PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED WOODHOUSE PHOTOVOLTAIC SOLAR ENERGY FACILITIES AND ASSOCIATED INFRASTRUCTURE ON THE REMAINING EXTENT OF FARM WOODHOUSE 729, NEAR VRYBURG, NORTH WEST PROVINCE

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EXECUTIVE SUMMARY

Genesis Eco-energy Developments proposes the development of two commercial photovoltaic (PV) solar energy facilities as well as associated infrastructure on the Remaining Extent of Farm Woodhouse 729, south east of Vryburg, Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality, North West Province. According to the National Heritage Resources Act (Act No 25 of 1999, section 38), a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development site.

The development site is underlain by Ghaap Group (Schmidtsdrif Subgroup and Vryburg Formation), and the Dwyka Group of the Karoo Supergroup. The geologically older Vryburg Formation (2.6 billion year-old) consists of fluvial and shallow marine quartzites, mudrocks and conglomerates, while the Dwyka Group [317 Million years (Ma)] consists of Permo-carboniferous glacial sediments. Small outcrops on the north-western and south-eastern borders consist of Permo-Carboniferous glacial rocks of the Dwyka Group (Karoo Supergroup). Although trace fossils and plants could be present in the Dwyka the likelihood of significant fossil heritage in the Vryburg area is considered to be low. The central area of the development area consists of the Vryburg Formation, while a small outcrop of the Schmidtsdrif Subgroup is present in the south western margin of the development area. Stromatolite assemblages are recorded within the Schmidtsdrif Subgroup and Vryburg Formation. The Boomplaas Formation stromatolites represent some of the oldest examples of these microbial fossils in South Africa. Detailed descriptions of these fossils have yet to be documented while their stratigraphic and geographical distributions are poorly understood. It is thus recommended that an EIA report must be conducted to assess the value and prominence of stromatolites in the development area and the effect of the proposed development on the palaeontological heritage.

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 solar photovoltaic (PV) 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 PV 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 (REZDs). The solar PV assessments domain was identified by the location of the majority of existing solar PV project applications and includes Northern Cape, Western Cape, Free State and North West, although solar PV 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.

Savannah Environmental (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioners (EAP) by Genesis Eco-energy Developments for the undertaking of the Environmental Impact Assessment process for the proposed Woodhouse Solar Facilities. The construction of two commercial photovoltaic (PV) solar energy facilities as well as associated infrastructure on the Remaining Extent of Farm Woodhouse 729, south east of Vryburg, Dr Ruth Segomotsi Mompati District Municipality is proposed (Figure 1).

The two projects are to be developed as stand-alone projects by Genesis Eco-energy Developments under two separate Special Purpose Vehicles namely Genesis Woodhouse Solar 1 (Pty) Ltd and Genesis Woodhouse Solar 2 (Pty) Ltd. **Site-specific studies will be undertaken to assess the localised impact of the proposed development in order to define areas of sensitivity within the farm. Once the limiting environmental factors have been identified, the layout for each proposed facility can be finalised, and will then be assessed in detail in the EIA Phase.**

Individually the PV facilities are proposed to include several arrays of photovoltaic solar panels with a contracted capacity of up to 100MW. The development footprint for each facility is expected to be approximately 300 hectares in total.

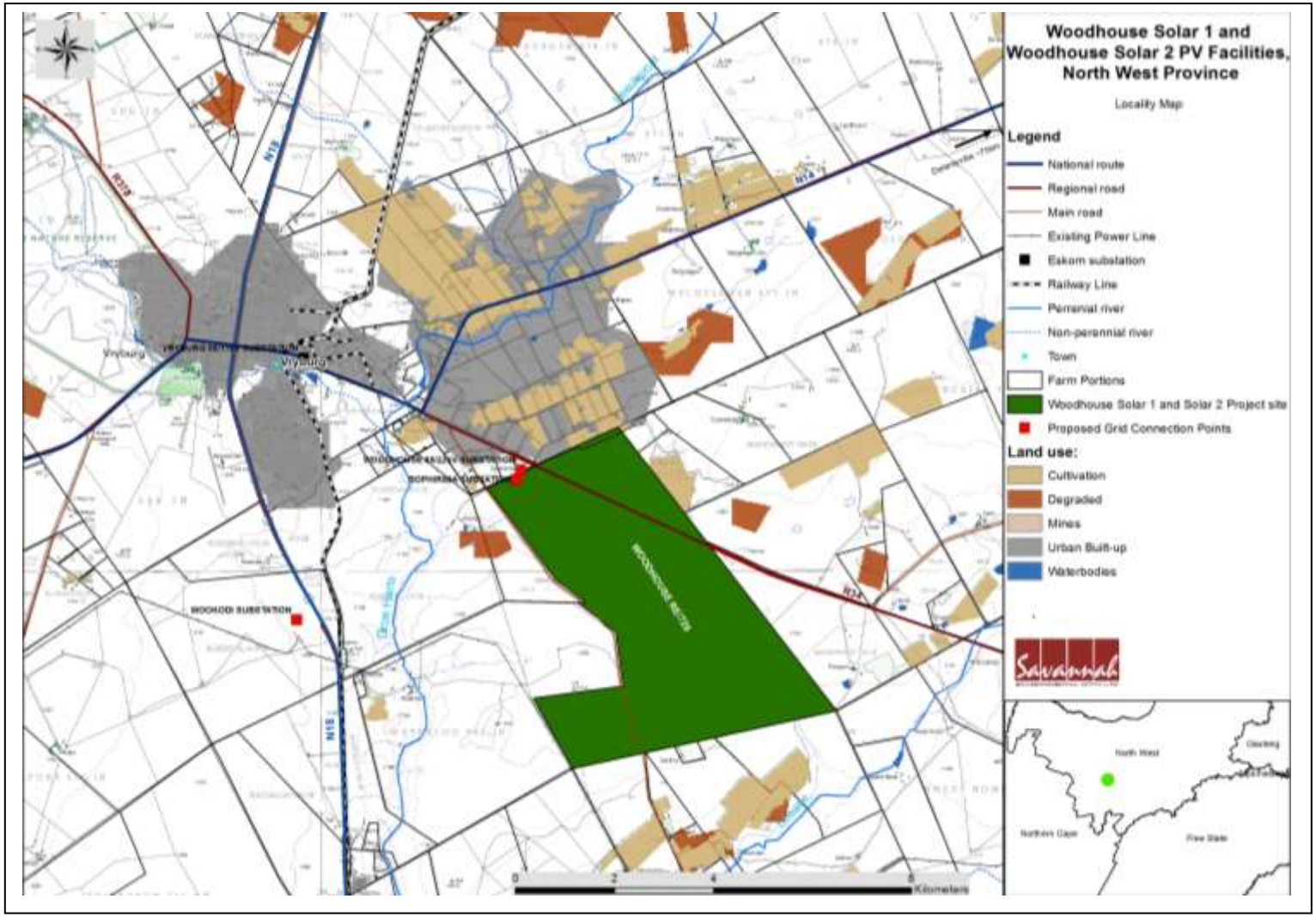

Figure 1. Location of the proposed Woodhouse Solar Facility (filled in green) on the remainder of Woodhouse 729, near Vryburg, Dr Ruth Segomotsi Mompati District Municipality, North West Province. Map provided by Savannah Environmental.

The infrastructure associated with each facility will include:

- Arrays of PV panels with a capacity of up to 100MW
- Mounting structures to support the PV panels
- On-site inverters to convert the power from a direct current to an alternating current and a substation to facilitate the connection between the solar energy facility and the Eskom electricity grid
- A new 132kV power line between the on-site substation and the Eskom grid connection point.
- Three alternatives are being considered for the grid connection:
    - A direct connection to the proposed Eskom Bophirima substation to be constructed on-site, or
    - A direct connection to the existing Mookodi 400/132KV substation located to the west of the site, or
    - A connection to the existing Woodhouse 88/22KV Substation located on the boundary of the site in the north
- Cabling between the project components, to be laid underground where practical
- Offices and workshop areas for maintenance and storage
- Temporary laydown areas
- Internal access roads and fencing around the development area

1.1 TECHNOLOGICAL BACKGROUND

Use of solar PV Technology as the renewable energy technology for the project (information provided by Savannah Environmental):

The PV panels are designed to operate continuously and unattended and with low maintenance for more than 20 years. Solar energy facilities, such as those using PV panels use the sun's energy to generate electricity through a process known as the **Photovoltaic Effect**. This entails light photons colliding with electrons, and consequently placing the electrons into a higher state of energy to create electricity. The Solar PV facilities will include the following components:

- **Photovoltaic Cell**

Individual PV cells (static or tracking) are linked and placed behind a protective glass sheet to form a photovoltaic panel.

- **Inverter**

The photovoltaic effect generates electricity in direct current (DC). Therefore an inverter is required to change it to an alternating current (AC).

- **Support Structure**

The PV panels will be attached to a support structure up to 6 m off the ground, set at an angle to receive the maximum amount of solar radiation (fixed technology), or

set to track the sun (tracking technology) in order to increase the total amount of energy produced.

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 impact on 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 development area near Vryburg is underlain by the Ghaap Group (Schmidtsdrif Subgroup, Vryburg Formation), and the Dwyka Group of the Karoo Supergroup. The geologically older Vryburg Formation (2.6 billion year-old) consists of fluvial and shallow marine quartzites, mudrocks and conglomerates, while the Dwyka Group [317 Million years (Ma)] consists of Permo-carboniferous glacial sediments (Fig. 2-3).

The proposed development site near Vryburg consists of characteristic flat-lying terrain of the Ghaap Plateau region. The climate is semi-arid and the vegetation cover of grassy thornveld is mapped as Ghaap Plateau Vaalbosveld. Small, low and scattered bedrock exposure may be present on the development site, but the literature states that the exposures are rare apart from along river banks and steeper hill slopes (Almond, 2013). Images from Google Earth show a flat relief and bedrock mantled by reddish-brown soils. These sandy soils contain abundant gravel clasts, primarily cherty material down wasted from the underlying Boomplaas Formation (Eriksson, *et al.,* 2006).

The Dwyka Group, present in the proposed study area in the north-eastern and south-western margins, represents the lowermost unit of the Karoo Supergroup. It consists almost throughout of gravelly sediments with subordinate vorved shale and mudstone containing scraped and facetted pebbles. These sediments are supposed to be of glacial origin and in places these materials have been deposited on typical glacier floors. In the Vryburg region this succession mainly comprises of glacial tillite or boulder mudstone and interglacial shale. Exposure levels are generally very poor, since the mudrock matrix easily weathers, and therefore the Dwyka outcrop area is represented at surface only by scattered erratic boulders (Keyser and Du Plessis 1993). The northern outcrops of the Dwyka Group may comprise of a low diversity non-marine trace fossil assemblages (fish and arthropod traces, *Rhizocorallium*) within interglacial mudrocks and dispersed vascular plant remains (*Glossopteris* leaves and petrified wood). Although these trace fossils and plants are considered to be a possibility, the likelihood of significant fossil heritage in the Vryburg area is considered to be low.

The south-western margin of the study area is underlain by ancient sedimentary rocks of the Schmidtsdrif Subgroup (Fig. 2) and consists of flat terrain. In the Griqualand West Basin, the Schmidtsdrif Subgroup is the basal subdivision of the Late Archaean to Early Proterozoic Ghaap Group (Transvaal Supergroup), Ghaap Plateau Sub-basin (Fig. 3).The Schmidtsdrif Subgroup can be divided into the geological older Boomplaas Formation and younger Clearwater Formation. The Ghaap Group represents 200 Ma of chemical sedimentation of which iron and manganese ores, cherts and carbonates with subordinate silicastic rocks are prominent within the Griqualand West Basin. The central and south-eastern (Fig. 2) portions of the study area are underlain by shallow marine or lagoon sediments as well as volcanic rocks of the Vryburg Formation. This Formation is roughly 140 m thick and overlies lavas of the Ventersdorp Supergroup. The lower portion

of the Vryburg succession consists of basal conglomerates followed by the 20 m thick Kobaga beds which show prominent weathering of cross-bedded feldspathic quartzites. The Kobaga beds are overlain by *c*. 20 m andesitic or basaltic lavas of the Rosendal Member and finally by the Waterloo Member which consists of c. 20-50 m of amydaloidal and non-amydaloidal basaltic or andesitic lavas and is overlain by 14 m of interbedded pyroclastic sediments and thin lenticular limestones. These sediments form the top of the Vryburg Formation and are followed by the overlying carbonate-rich Boomplaas Formation which is present in the study area. The Boomplaas Formation is known to contain well-preserved stromatolite (microbial dome) assemblages in the Vryburg region. It is very likely that comparable, scientifically important fossil stromatolites also occur on Woodhouse 729.

Microbial stromatolites in the upper Vryburg Formation were described by Smith (1991). The stromatolitic carbonates are interpreted to be intertidal (Altermann and Wotherspoon, 1995). Detailed descriptions of the Vryburg stromatolite occurrences are not present in the literature although South African Archaean stromatolites have been discussed in detail (Altermann, 2001; Buick, 2001; and Schopf, 2006). Columnar stromatolites from the Schmidtsdrif Subgroup of the Northern Cape have been described by Bertrand-Sarfarti and Eriksson (1977).

The Boomplaas beds are characterized by grey dolomites which weathers reddish-brown with subordinate interbeds of limestone (weathering blue-grey), quartzite, flaggy sandstone and shale. Oolitic and stromatolitic dolomite alternating with intervals of carbonaceous possible lagoonal mudrocks containing interbeds of calcareous sandstone and mudclast breccias is present. The Boomplaas beds are overlain by the grey- to khaki-hued mudrocks and interbedded dolomites, flagstones, tuffites and BIF-like cherts of the Clearwater Formation (= Lokamonna Formation), the topmost unit of the Schmidtsdrif Subgroup. Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Keyser and Du Plessis, 1993; Truswell and Eriksson, 1973; Eriksson and Altermann, 1998).

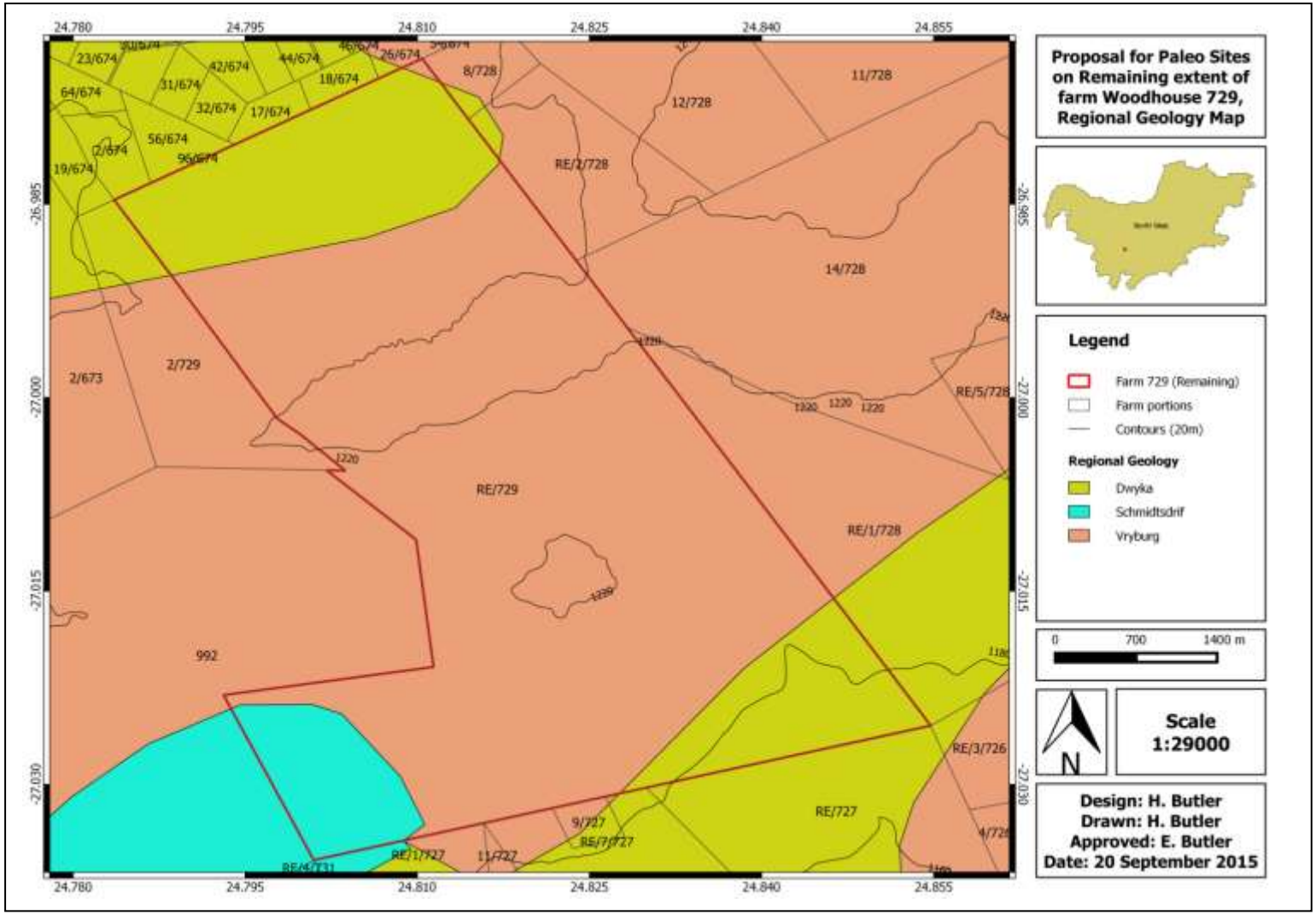

Figure 2**.** The surface geology of the proposed Woodhouse development area near Vryburg, Dr Ruth Segomotsi Mompat District Municipality. The development area is underlain by Dwyka Permo-Carboniferous glacial sediments and Schmidtsdrif Subgroup (Ghaap Group, Transvaal Supergroup of the Vryburg Formation). (Modified from the 1: 250 000 geological map 2724 Christiana (Council for Geoscience, Pretoria)

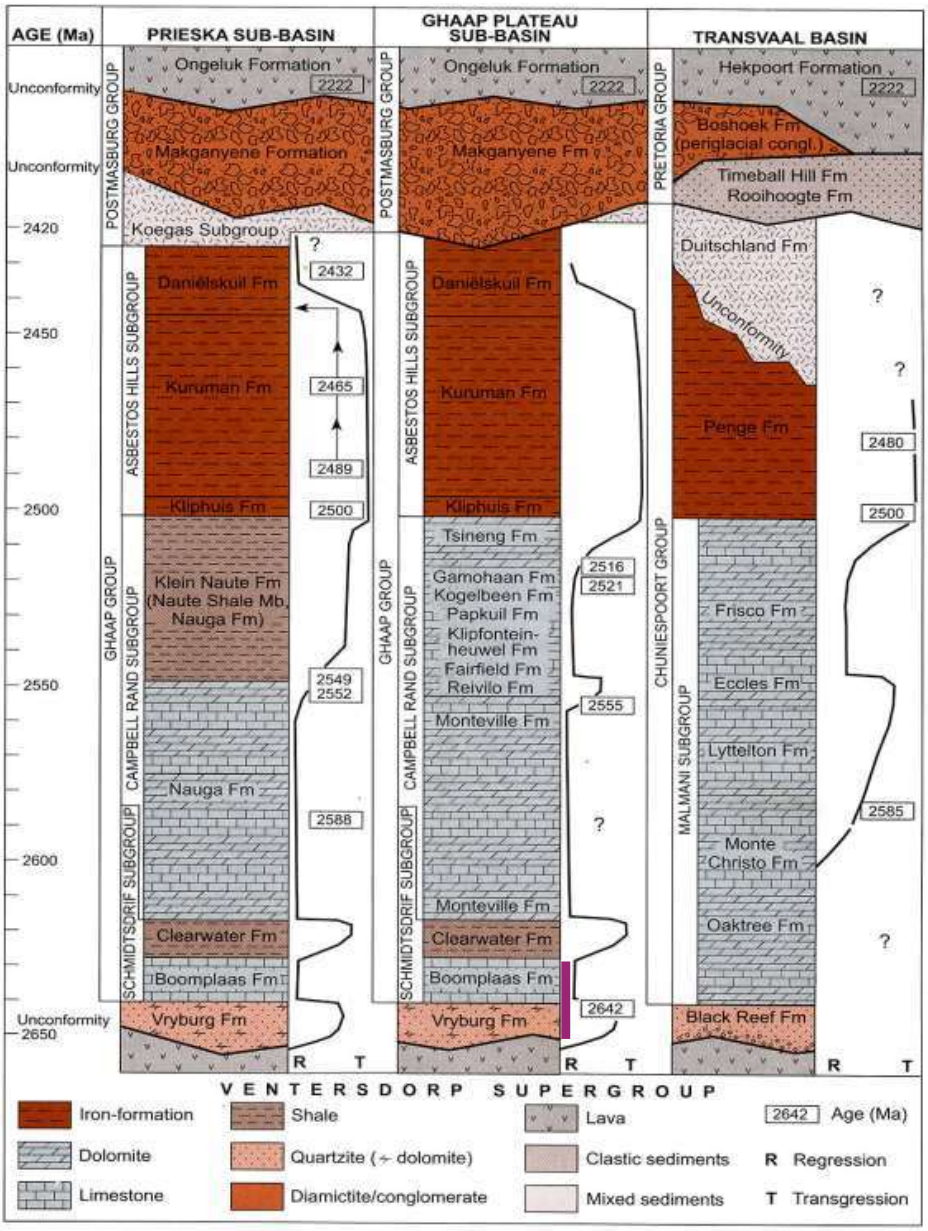

Figure3. Stratigraphy of the Transvaal Supergroup of the Ghaap Plateau Basin. The middle column shows the rock units represented in the proposed study area (purple line) (Eriksson, *et al.* 2006). The Vryburg Formation is incorporated within the base of the Schmidtsdrif Subgroup by some recent authors and is no longer correlated with the Black Reef Formation of the Transvaal Basin as shown here (*e.g.* Altermann and Wotherspoon, 1995, Sumner and Beukes, 2006).

5 GEOGRAPHICAL LOCATION OF THE SITE

The proposed development site is located approximately 10 km south east of Vryburg and falls under the jurisdiction of the Dr Ruth Segomotsi Mompati District Municipality, North West 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 photovoltaic solar facilities on local fossil heritage on the Remaining Extent of the farm Woodhouse 729 is presented here:

7.1 Nature of the impact

The PV Solar Facilities will include the following infrastructures:

Each facility will include the following infrastructure:

- Arrays of PV panels with a capacity of up to 100MW
- Mounting structures to support the PV panels.
- On-site inverters to convert the power from a direct current to an alternating current and a substation to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the Eskom grid connection point. Three alternatives are being considered for the grid connection:
    - A direct connection to the proposed Eskom Bophirima substation to be constructed on-site, or
    - A direct connection to the existing Mookodi 400/132KV substation located to the west of the site, or
    - A connection to the existing Woodhouse 88/22KV Substation located on the boundary of the site in the north.
- Cabling between the project components, to be laid underground where practical.
- Offices and workshop areas for maintenance and storage.
- Temporary laydown areas.
- Internal access roads and fencing around the development area

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 possibility of finding stromatolites (laminated microbial mounds).

7.2 Sensitive areas

The development area is underlain by Ghaap Group (Schmidtsdrif Subgroup, and Vryburg Formation), as well as the Dwyka Group of the Karoo Supergroup. Small outcrops of Permo-Carboniferous Dwyka Group, Vryburg Formation, (north-western and south-eastern borders) and Schmidtsdrif Subgroup (south-western margin) is present in

the development area. Although trace fossils and plants could be present in the Dwyka the likelihood of significant fossil heritage in the Vryburg area is considered to be low.

Stromatolite assemblages are recorded within the Schmidtsdrif Subgroup (south western margin of the development area) and Vryburg Formation (central area of the development area). The Boomplaas Formation (Schmidtsdrif Subgroup) stromatolites represent some of the oldest examples of these fossils in South Africa. Detailed descriptions of these fossils have yet to be documented while their stratigraphic and geographical distributions are poorly understood.

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 Vryburg Formation 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 facilities 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 concentrations of small to large stromatolites 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 Late Archaean stromatolites within the Schmidtsdrif Subgroup (including the Boomplaas Formation), is not documented in the literature. It is thus **not possible to accurately assess** the exceptional value of the stromatolite assemblages' present on Woodhouse 729. Better preserved specimens could be present on other areas in the Boomplaas Formation. By taking a precautionary approach, a significant loss of fossil resources is expected.

8.4 CUMULATIVE IMPACTS

Three proposed solar plant developments (excluding Woodhouse 792) are present in the surrounding areas. These include:

- A 19.5 MW solar plant on a northern portion of the farm Waterloo 992
- A 75 MW solar plant on a portion of the Remaining Extent of the farm Rosendal 673
- A 75 MW solar plant on the southern portion of the farm Waterloo 992

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

9 FINDINGS AND RECOMMENDATIONS

The development area located within the Remaining Extent of the farm Woodhouse 729 is underlain by Ghaap Group (Schmidtsdrif Subgroup and Vryburg Formation), and the Dwyka Group of the Karoo Supergroup. Small outcrops of Permo-Carboniferous Dwyka Group, Vryburg Formation, (north-western and south-eastern borders) and Schmidtsdrif Subgroup (south-western margin) is present in the development area. Although trace fossils and plants could be present in the Dwyka the likelihood of significant fossil heritage in the Vryburg area is considered to be low.

Stromatolite assemblages are recorded within the Schmidtsdrif Subgroup (south western margin of the development area) and Vryburg Formation (central area of the development area). The Boomplaas Formation (Schmidtsdrif Subgroup) stromatolites represent some of the oldest examples of these fossils in South Africa. Detailed descriptions of these fossils have yet to be documented while their stratigraphic and geographical distributions are poorly understood. It is thus recommended that a EIA report must be conducted to assess the effect of the proposed development on the palaeontological heritage.

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 concentrations of small to large stromatolites 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 Palaeontological Heritage: **stromatolites** (laminated microbial mounds)	Construction of the PV Facility 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. Any fossils occurring in the project area are potentially scientifically and culturally significant and any negative impact on them would be of high significance. There is a possibility that concentrations of small to large stromatolites will be recorded in the proposed study area namely the Schmidtsdrif Subgroup (south western margin of the development	Long term Local impact and limited to the construction phase	At this point in time no-go areas have not been identified although **palaeontological sensitive areas** are present namely the **Boomplaas and Vryburg Formations**. Microbial stromatolites in the upper Vryburg Formation has been described although **detailed occurrences of the Vryburg stromatolite has not been recorded in the literature**. The stromatolites of the Boomplaas Formation is important as they represent some of the oldest examples of these fossils in South Africa.

	area) and Vryburg Formation (central area of the development area). Small outcrops on the north-western and south-eastern borders consist of Permo-Carboniferous glacial rocks of the Dwyka Group). Although trace fossils and plants could be present tin the Dwyka the likelihood of significant fossil heritage in the Vryburg area is considered to be low. The destruction or inadvertent relocation of any affected fossils will be permanent and irreversible.		
Gaps in knowledge and recommendations for further study Stratigraphic and geographical distribution of Late Archaean stromatolites within the Schmidtsdrif Subgroup (including the Boomplaas Formation), is not documented in the literature. It is thus **not possible to accurately assess** the exceptional value of the stromatolite assemblages' present on Woodhouse 729 without an EIA.			

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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