DESKTOP PALAEONTOLOGICAL SPECIALIST STUDY

In terms of Section 38(8) of the NHRA for a

Proposed development of Allepad PV One, / Allepad PV Two, / Allepad PV Three, / Allepad PV Four, a solar PV facility and associated infrastructure on a site near Upington, in the Northern Cape Province.

Prepared by

CTS HERITAGE

In Association with

Savannah

And

Natura Viva cc

March 2019

CTS HERITAGE

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I Jenna Lavin, as the appointed independent specialist hereby declare that I:

• act/ed as the independent specialist in this application;

• regard the information contained in this report as it relates to my specialist input/study to be true and correct, and

• do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;

• have and will not have no vested interest in the proposed activity proceeding;

• have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;

• am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;

• have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;

• have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;

• have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;

• have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and

• am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Jenna Lavin
Signature of the specialist

CTS Heritage
Name of company

March 2019
Date

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EXECUTIVE SUMMARY

Allepad Solar 1, Allepad Solar 2, Allepad Solar 3 and Allepad Solar 4, a commercial solar PV energy generation facility and associated infrastructure, is proposed on a site near Upington, in the Northern Cape Province. Photovoltaic (PV) technology is proposed for the generation of electricity. The solar energy facility will have a contracted capacity of up to 100MW, and will make use of either fixed-tilt, single-axis tracking, or double axis tracking PV technology. Electricity generated by the project will feed into Eskom's national electricity grid via a new 132kV power line which will connect the on-site substation to the upgraded 132kV double circuit power line running between the new Upington Main Transmission Substation (MTS) (currently under construction approximately 15km south of the project site), and the Gardonia Distribution Substation (located in Upington town).

The geology of the study area near Upington is shown on the 1: 250 000 geology map 2820 Upington (Council for Geoscience, Pretoria). A comprehensive sheet explanation for this map has been published by Moen (2007). The study area is underlain at depth by a range of ancient Precambrian basement rocks – largely high grade metamorphic rocks (*e.g.* gneisses, metapelites) and intrusive granitoids – that belong to the **Namaqua-Natal Province** of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007). The bedrock units concerned include granites of the **Keimoes Suite** as well as various high grade metasediments (Schists, migmatites, amphibolites) of the **Areachap Group** (*e.g.* Bethesda and Jannelsepan Formations). These basement rocks are approximately two to one billion years old and entirely unfossiliferous (Almond & Pether 2008). They only crop out regionally as small, isolated patches of basement rocks or low *Inselberge*. A large portion of the study area is covered by fine-grained aeolian (wind-blown) sands of the **Gordonia Formation** (**Qg**, pale yellow in Fig. 1), the youngest, Pleistocene to Recent, subunit of the **Kalahari Group** (Almond 2008, Almond & Pether 2008).

The overall palaeontological sensitivity of the development area is considered to be low as most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity. In addition, extensive, deep excavations are unlikely to be involved in this sort of project. Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed development and in the author's (Almond, 2018) opinion no further specialist palaeontological studies for this project are necessary.

Recommendations

1. A Chance Fossil Finds Procedure must be implemented during the construction phase.
2. The above recommendations must be included in the Environmental Management Plan (EMP) for the project.

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1. INTRODUCTION

1.1 Background Information on Project

Allepad Solar 1, Allepad Solar 2, Allepad Solar 3 and Allepad Solar 4, a commercial solar PV energy generation facility and associated infrastructure, is proposed on a site near Upington, in the Northern Cape Province. The project is intended to be bid into the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating power generated by the project into the Eskom national electricity grid. The project is proposed on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington. The area under investigation is approximately 3 889ha in extent and comprises a single agricultural property. The project site can be accessed directly via the N10 national road which borders the southern boundary of the site.

Photovoltaic (PV) technology is proposed for the generation of electricity. The solar energy facility will have a contracted capacity of up to 100MW, and will make use of either fixed-tilt, single-axis tracking, or double axis tracking PV technology. The solar energy facility will comprise the following key infrastructure components:

- Arrays of PV panels with a generation capacity of up to 100MW.
- Mounting structures to support the PV panels.
- Combiner boxes, on-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and power transformers.
- An on-site substation up to 0.5ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line approximately 5km in length, between the on-site substation and Eskom grid connection point.
- Cabling between the project's components (to be laid underground where practical).
- Meteorological measurement station.
- Energy storage area of up to 2ha in extent.
- Access road and internal access road network.
- On-site buildings and structures, including a control building and office, ablutions and guard house.
- Perimeter security fencing, access gates and lighting.
- Temporary construction equipment camp up to 1ha in extent, including temporary site offices, parking and chemical ablution facilities.
- Temporary laydown area up to 1ha in extent, for the storage of materials during the construction.

Electricity generated by the project will feed into Eskom's national electricity grid via a new 132kV power line which will connect the on-site substation to the upgraded 132kV double circuit power line running between the new Upington Main Transmission Substation (MTS) (currently under construction approximately 15km south of the project site), and the Gardonia Distribution Substation (located in Upington town). The point of connection is located approximately 5km east of the project site, and will make use of a loop-in and loop-out configuration. The proposed power line required for the project will be constructed within a 300m wide power line corridor which has been identified immediately north of, and

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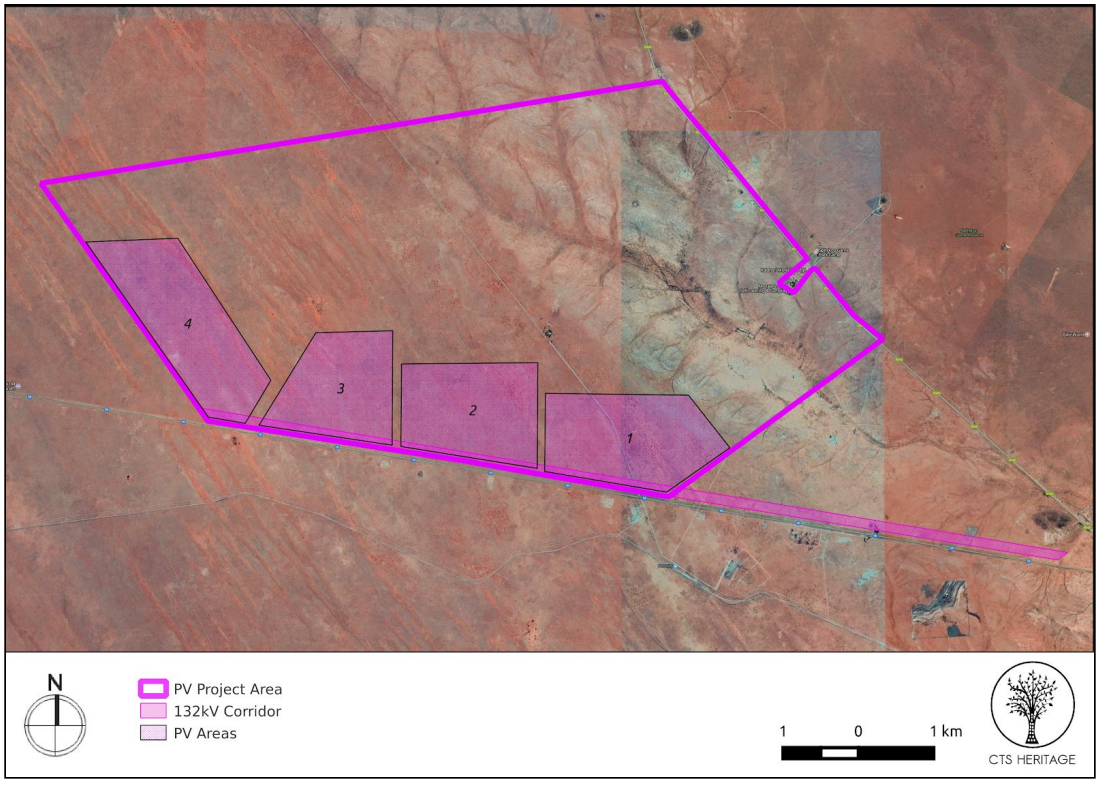
which runs parallel to, the N10 national road. The full extent of the project site (i.e. 3 889ha) is being assessed as part of the EIA process, of which an area of approximately 250ha (equivalent to 6.4% of the total project area) would be required for the development of the solar energy facility and associated infrastructure.

1.2 Description of Property and Affected Environment (from AIA - J. Kaplan)

The study site is located in the Kalahari Duneveld region of the Northern Cape.

The eastern sector is characterised by numerous drainage channels (Figure 1.1), on a substrate of compact red sands covered in extensive scatters of quartz pebbles, gravels and surface outcroppings of larger quartz boulders and some basaltic type rock. No significant rocky kopjes occur in the eastern sector.

The western sector of the study area comprises a generally flat, undulating landscape interspersed with occasional dunes. The plains are covered in deep red Kalahari sands, dense swathes of Driedoring vegetation, and patches of tall Bushman grass in places (alongside the N10). A few sporadic Shephard Trees and Acacias occur in places. There is very little surface stone covering this portion of the farm. There, are no seasonal or permanent sources of water such as streams, springs or pans. A few outcroppings of granitic/basaltic rock occur in places. There are numerous twee-spoor tracks criss crossing the site. Existing infrastructure includes twee spoor sandy farm tracks, farm fencing, farm gates, cattle pens, and 2 small concrete dams. Current land use comprises grazing (cattle) where many of the wind deflated areas have been heavily trampled. Surrounding land use is vast tracts of vacant agricultural land, accommodation (Kalahari Monate Lodge), roads (N10 & R330), informal animal husbandry camps, informal housing alongside the N10.



Map 1: Close up satellite image indicating proposed location of development

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2. METHODOLOGY

2.1 Purpose of Palaeontological Study

The purpose of this desktop palaeontological study is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999) in terms of impacts to palaeontological resources.

2.2 Summary of steps followed

- A palaeontologist conducted a desktop assessment of the site and its environs using available literature to determine what palaeontological resources are likely to be impacted by the proposed development.
- The identified resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999).
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner.

2.3 Constraints & Limitations

The experience of the heritage practitioner, and observations made during the study, allow us to predict with some accuracy the palaeontological sensitivity of the receiving environment.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Palaeontological sensitivity

According to the SAHRIS Palaeosensitivity Map (Figure 4), the extract from the CGS Sheet 2820 Figure 5.1 and 5.2) , this area is underlain by the Gordonia Formation (Quaternary coversands of moderate palaeontological sensitivity), the Bethesda Formation, the Jannelsepan Formation, the Keimoes Formation and the Straussburg Granite, of zero palaeontological sensitivity. The primary risk associated with impacts to palaeontological heritage is related to impacting fossils preserved within the Quaternary coversands of the Gordonia Formation (wind-blown alluvial sands).

According to Almond's assessment for similar infrastructure development in this area (2011 SAHRIS NID 174335), "overall impact significance of the proposed solar park development is likely to be LOW because: Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity; Extensive, deep excavations are unlikely to be involved in this sort of solar park project. Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary."

3.2 Geomorphology, climate, vegetation

The eastern sector is characterised by numerous drainage channels (Figure 1.1), on a substrate of compact red sands covered in extensive scatters of quartz pebbles, gravels and surface outcroppings of larger quartz boulders and some basaltic type rock. No significant rocky kopjes occur in the eastern sector.

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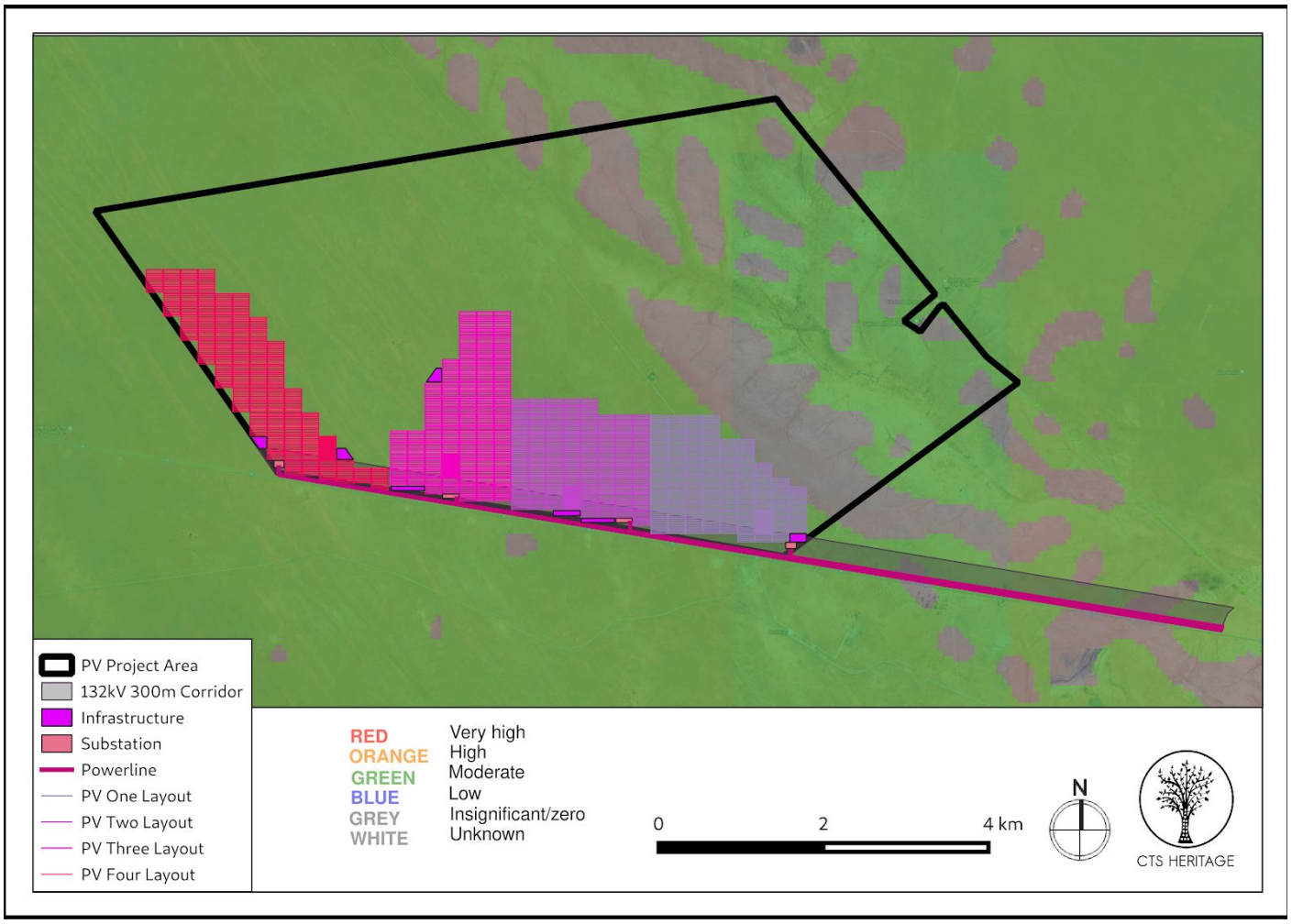

Map 2: Palaeontological sensitivity of the proposed development area

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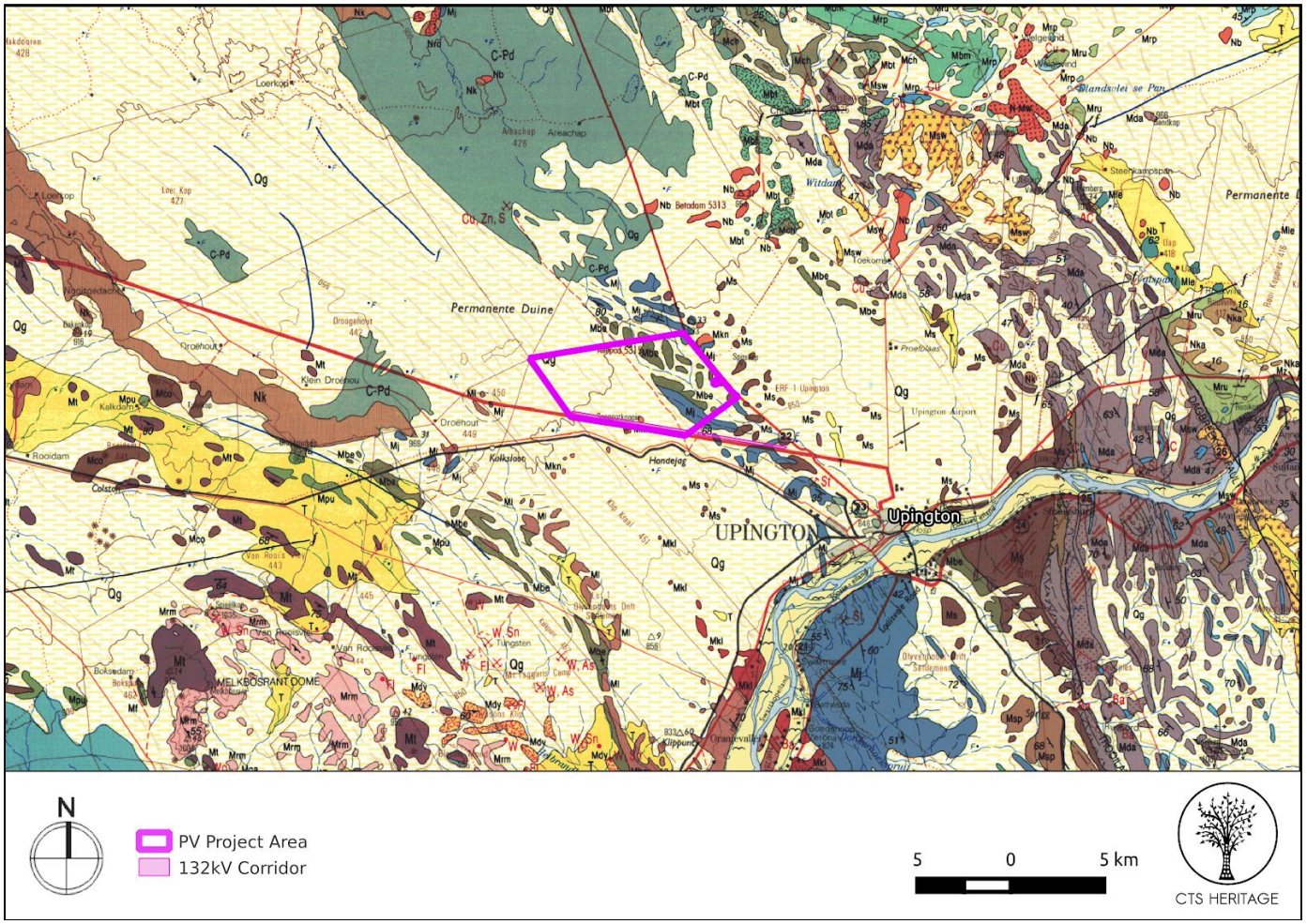

Map 3: Geology underlying the proposed development area extracted from the Council of Geoscience Map (1:250 000) 2820 Upington

Table 2: Explanation of symbols for the geological map and approximate ages

Symbol	Group/Formation	Lithology	Approximate Age
Qg	Gordonia Formation	Red brown wind blown sand and dunes	Pleistocene to Recent
Mkn	Keimoes Suite	Mesocratic, fine-grained and weakly foliated granites	Mid Proterozoic (Mokolian)
Mj	Jannelspan Formation	Amphibolite, amphibole gneiss, biotite gneiss, pelitic gneisses, lenses of calc-silicate rocks	~2 to 1 billion years old
Mbe	Bethesda Formation	Migmatitic biotite-rich and aluminous gneisses	~2 to 1 billion years old

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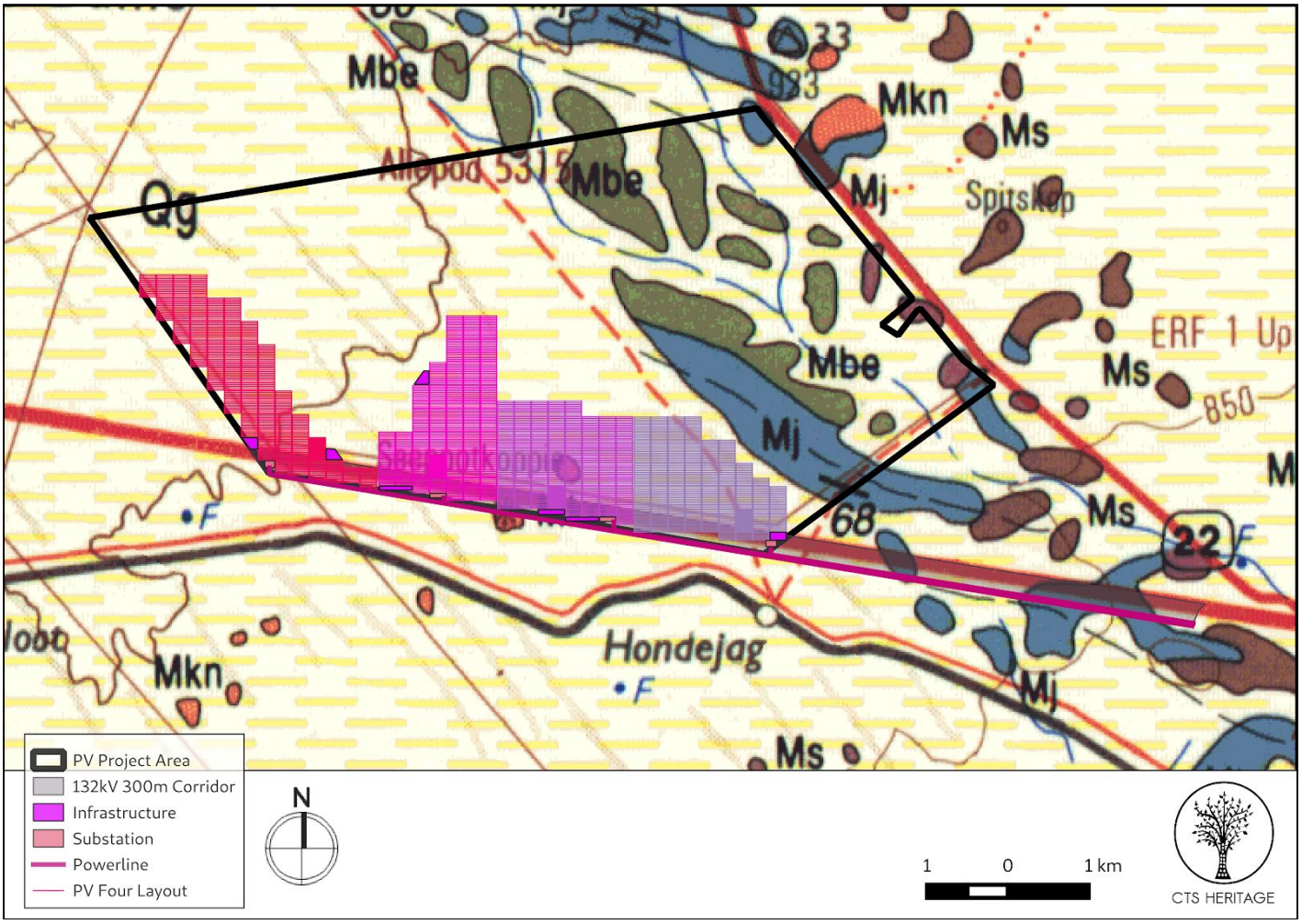

Map 3a: Geology underlying the proposed development area extracted from the Council of Geoscience Map (1:250 000) 2820 Upington

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Results of Desktop Assessment

The geology of the study area near Upington is shown on the 1: 250 000 geology map 2820 Upington (Council for Geoscience, Pretoria). A comprehensive sheet explanation for this map has been published by Moen (2007). The study area is underlain at depth by a range of ancient Precambrian basement rocks – largely high grade metamorphic rocks (*e.g.* gneisses, metapelites) and intrusive granitoids – that belong to the **Namaqua-Natal Province** of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007). The bedrock units concerned include granites of the **Keimoes Suite** as well as various high grade metasediments (Schists, migmatites, amphibolites) of the **Areachap Group** (*e.g.* Bethesda and Jannelsepan Formations). These basement rocks are approximately two to one billion years old and entirely unfossiliferous (Almond & Pether 2008). They only crop out regionally as small, isolated patches of basement rocks or low *Inselberge*. A large portion of the study area is covered by fine-grained aeolian (wind-blown) sands of the **Gordonia Formation** (**Qg**, pale yellow in Fig. 1), the youngest, Pleistocene to Recent, subunit of the **Kalahari Group** (Almond 2008, Almond & Pether 2008).

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Figure 4.1: Contextual Images - PV Areas 1 and 2 facing north east (from AIA - J. Kaplan)

Figure 4.2: Contextual Images - PV Areas 2 and 3 facing north east (from AIA - J. Kaplan)

Figure 4.3: Contextual Images - PV Area 4 along the N10 (from AIA - J. Kaplan)

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Figure 4.4: Contextual Images - PV Area 4 along the N10 (from AIA - J. Kaplan)

Figure 4.5: Contextual Images - PV Area 4 along the N10 (from AIA - J. Kaplan)

Figure 4.6: Contextual Images - Powerline Route (from AIA - J. Kaplan)

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Figure 4.7: Contextual Images - Powerline Route (from AIA - J. Kaplan)

Figure 4.8: Contextual Images - Powerline Route (from AIA - J. Kaplan)

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Palaeontological Resources

The overall impact significance of the proposed development is likely to be LOW because:

- Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity;
- Extensive, deep excavations are unlikely to be involved in this sort of project. Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed development and in the author's (Almond, 2018) opinion no further specialist palaeontological studies for this project are necessary.

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Table 2: Impacts of the PV facilities and powerline corridor to heritage resources

NATURE: No palaeontological resources of significance were identified during the desktop assessment for palaeontology within the development footprint for each facility		
		Palaeontology
MAGNITUDE	**L (2)**	Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity; Extensive, deep excavations are unlikely to be involved in this sort of project. Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed development and in the author's opinion no further specialist palaeontological studies for this project are necessary.
DURATION	**H (5)**	Where manifest, the impact will be permanent.
EXTENT	**L (1)**	Localised within the site boundary.
PROBABILITY	**L (1)**	It is extremely unlikely that any fossils would be impacted
SIGNIFICANCE	**L**	(2+5+1)x1=8
STATUS		Neutral
REVERSIBILITY	**L**	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	**L**	Unlikely
CAN IMPACTS BE MITIGATED		NA
MITIGATION: No impacts are anticipated however it is recommended that a Fossil Chance Finds Procedure be implemented during teh construction phase.		
RESIDUAL RISK: Should any significant resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources		

6. CONCLUSION AND RECOMMENDATIONS

The overall palaeontological sensitivity of the development area is considered to be low as most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity. In addition, extensive, deep excavations are unlikely to be involved in this sort of project. Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed development and in the author's (Almond, 2018) opinion no further specialist palaeontological studies for this project are necessary.

Recommendations

3. A Chance Fossil Finds Procedure must be implemented during the construction phase.
4. The above recommendations must be included in the Environmental Management Plan (EMP) for the project.

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Appendix 1: Opinion from J. Almond (2018)

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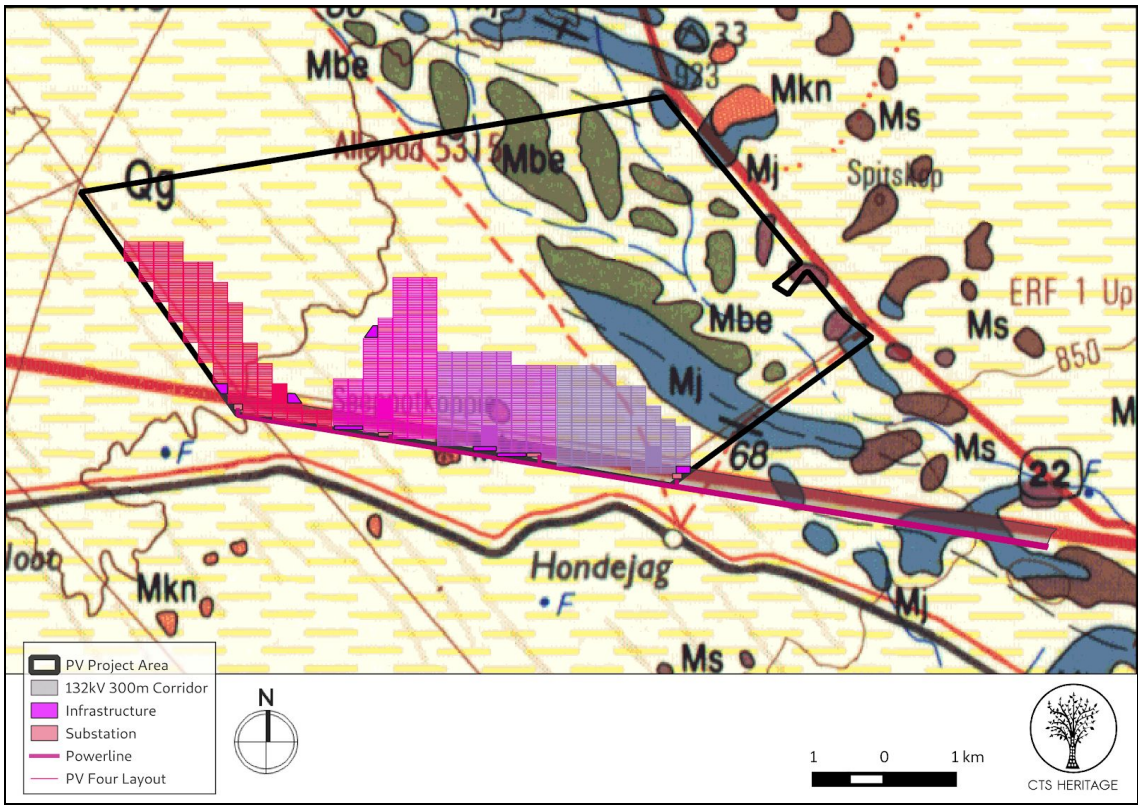

Map 3a: Geology underlying the proposed development area extracted from the Council of Geoscience Map (1:250 000) 2820 Upington

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Mj	Jannelspan Formation	Amphibolite, amphibole gneiss, biotite gneiss, pelitic gneisses, lenses of calc-silicate rocks	~2 to 1 billion years old
Mbe	Bethesda Formation	Migmatitic biotite-rich and aluminous gneisses	~2 to 1 billion years old

Comments on Palaeontology

The geology of the study area near Upington is shown on the 1: 250 000 geology map 2820 Upington (Council for Geoscience, Pretoria). A comprehensive sheet explanation for this map has been published by Moen (2007). The study area is underlain at depth by a range of ancient Precambrian basement rocks – largely high grade metamorphic rocks (e.g. gneisses, metapelites) and intrusive granitoids – that belong to the Namaqua-Natal Province of Mid Proterozoic (Mokolian) age (Cornell et al. 2006, Moen 2007). The bedrock units concerned include granites of the Keimoes Suite as well as various high grade metasediments (Schists, migmatites, amphibolites) of the Areachap Group (e.g. Bethesda and Jannelsepan Formations). These basement rocks are approximately two to one billion years old and entirely unfossiliferous (Almond & Pether 2008). They only crop out regionally as small, isolated patches of basement rocks or low Inselberge. A large portion of the study area is covered by fine-grained aeolian (wind-blown) sands of the Gordonia Formation (Qg, pale yellow in Fig. 1), the youngest, Pleistocene to Recent, subunit of the Kalahari Group (Almond 2008, Almond & Pether 2008)

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