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**Soil and Agricultural Potential Scoping Report for the
Proposed Harmony Target Solar PV**

Submitted by TerraAfrica Consult cc

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19 Augustus 2022

Declaration of the Specialist

Details of Specialist

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Declaration of Independence

I, Mariné Pienaar, hereby declare that TerraAfrica Consult, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

I further declare that I was responsible for collecting data and compiling this report. All assumptions, assessments and recommendations are made in good faith and are correct to the best of my knowledge and the information available at this stage.



TerraAfrica Consult cc represented by M Pienaar

19 August 2022

1. INTRODUCTION

Terra-Africa Consult cc was appointed by Savannah Environmental (Pty) Ltd to conduct the agricultural agro-ecosystem specialist assessment as part of the Scoping and Environmental Impact Assessment process for the proposed development of a solar energy facility.

The Harmony Target Solar PV is based approximately 500m south of the Harmony Target mining operations, located ~1km south of the town of Allanridge within the Matjhabeng Local Municipality, and within the Lejweleputswa District Municipality, Free State Province. The successful development of the renewable energy projects will enable Harmony Gold to make a valuable and meaningful contribution towards growing the green economy within the province and South Africa. This will assist the Free State in creating green jobs and reducing Green House Gas emissions, whilst reducing the energy demand on the National Grid.

The project entails the development of a photovoltaic (PV) solar energy facility and will include a grid connection solution and other associated infrastructure, with a capacity of up to 30MW over 72 ha of land and will be known as Harmony Target Solar PV Facility. The project will tie-in to the Avgold (6.6/44 kV) substation via an up to 2km overhead line with a capacity of up to 44 kV.

The onsite infrastructure will include:

- Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology. Once installed will stand up to 5m above ground level.
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components.
- Balance of Plant:
 - Existing spare switchgear panels upgraded switchgear circuit breakers or additional switchgear panels.
 - EK self-build works as defined in the CEL.
- On-site facility substation to facilitate the connection between the solar PV facility and Eskom electricity grid.
- An on-site medium voltage (MV) switching station and collector substation
- Temporary laydown areas.
- Access roads, internal roads and fencing around the development area.
- 132kV Overhead Power Lines (OHPL) – maximum of 30m height with a 30m servitude width
- Underground low voltage cabling will be used on the PV site

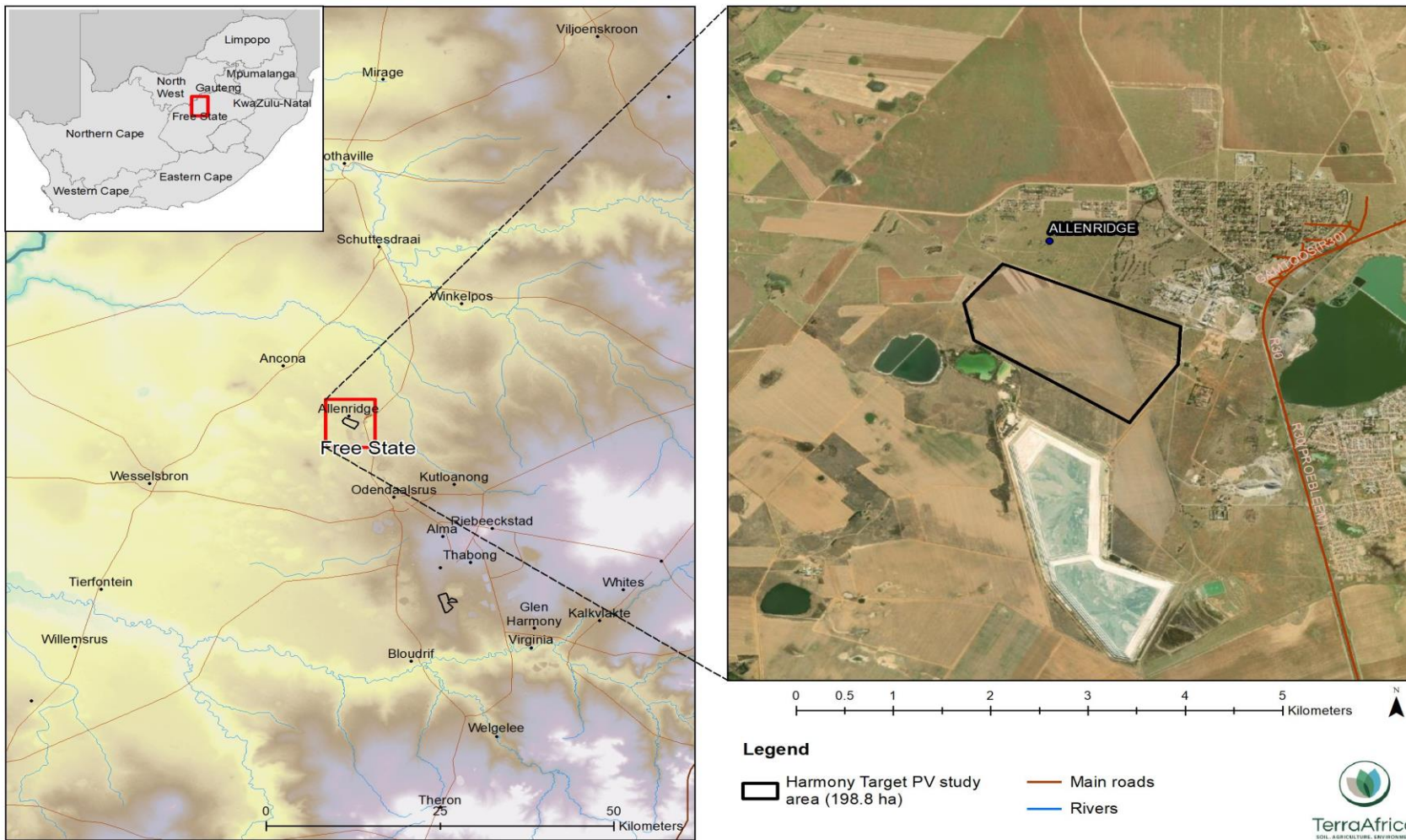


Figure 1 Locality of the proposed Harmony Target Solar PV Facility

2. TERMS OF REFERENCE

The terms of reference applicable to the soil and agricultural potential scoping assessment include the following:

- Conduct a desktop assessment of the baseline soil and agricultural properties for the proposed development area.
- Identify site sensitivities to the proposed project pertaining to the soil properties, associated land capabilities and the agricultural potential of the project area.
- Identify potential impacts that will be caused by the project and that will have to be assessed as part of the detail study phase.
- Identify a plan of study that will include the methodology to be followed during the detailed soil and agricultural potential impact assessment that will form part of the final EIA report that will be submitted.

3. METHODOLOGY

The proposed development area was superimposed on four data sets to determine the anticipated sensitivities of the properties to the development. The data sets are:

- The newly released National Land Capability Evaluation Raster Data Layer was obtained from the DAFF to determine the land capability classes of the development area assessment zone according to this system. The data was developed using a spatial evaluation modelling approach (DAFF, 2017).
- The long-term grazing capacity for South Africa 2018 was analysed for the area and surrounding area of the project assessment zone. This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), the Land Types of South Africa data set as well as the KZN Bioresource classification data. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The Free State Field Crop Boundaries (November 2019) was analysed to determine whether the proposed PV development area falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming.
- Land type data for the development area was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units.

4. BASELINE DESCRIPTION

4.1 Land capability

The Harmony Target Solar PV development area includes two different land capability classes according to the land capability data (DALRRD, 2017). **Figure 2** indicates the position of the different classes within the farm portions that form the proposed development area. The entire development area largely consists of land with Moderate (Class 8) to Moderate High (Class 9) land capability. Smaller patches in the northeast consist of land with Low- Moderate (Classes 06) land capability. Classes 08 and 09 have potential to produce specific crops under rainfed conditions while classes 06 and 07 are likely to be very marginal arable land that is more suitable for livestock grazing.

4.2 Field crop boundaries

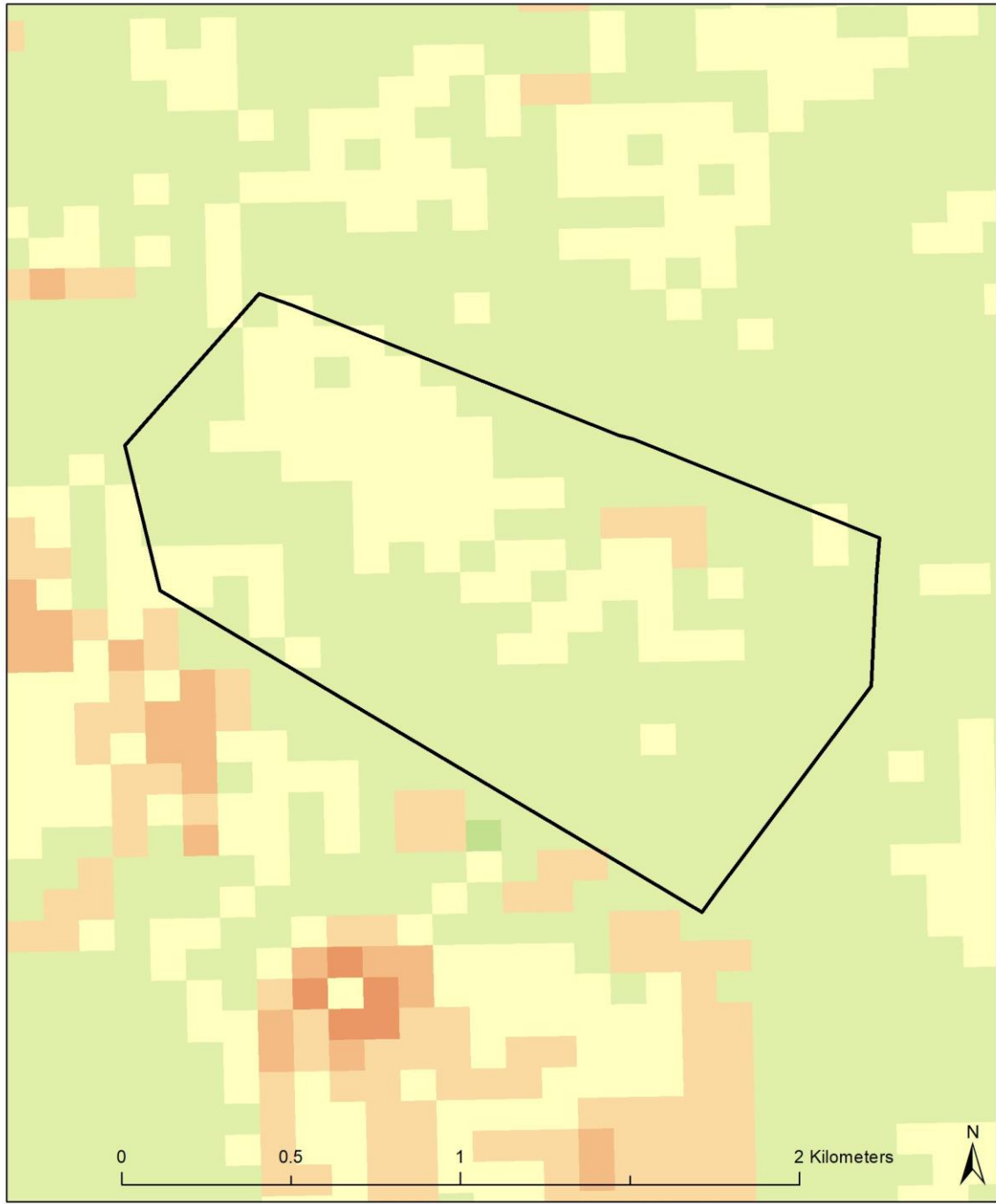
The Harmony Target Solar PV development area includes areas where rainfed field crops are produced. The DALRRD data layer indicates these areas as rainfed annual crops (or planted pastures) (see Figure 3). During the site visit, it was verified that these areas are still cultivated and some maize stalks that remained on the surface after the last harvest, was observed. A few pivot irrigation fields are located outside the development area, mostly north-west. Large fields with rainfed crops and/or planted pastures are located to the north, west and south of the development area with old fields to the north and west.

4.3 Grazing capacity

Although the largest part of the study area consists of crop fields, the eastern part of the site consists of grazing land. It is also assumed that the remains of harvest within the crop fields area, may be grazed by livestock.

The ideal grazing capacity is an indication of the long-term production potential of the vegetation layer growing in an area. More specifically, it relates to its ability to maintain an animal with an average weight of 450 kg (defined as 1 Large Stock Unit (LSU)) with an average feed intake of 10 kg dry mass per day over the period of approximately a year. This definition includes the condition that this feed consumption should also prevent the degradation of the soil and the vegetation. The grazing capacity is therefore expressed in number of hectares per LSU (ha/LSU) (South Africa, 2018). Following the metadata layer obtained from DAFF, the grazing capacity of the largest section of the development area, is 7 ha/LSU (**Figure 4**).

Since the proposed infrastructure within the development area will be fenced off, it will no longer be available for livestock grazing.



Legend








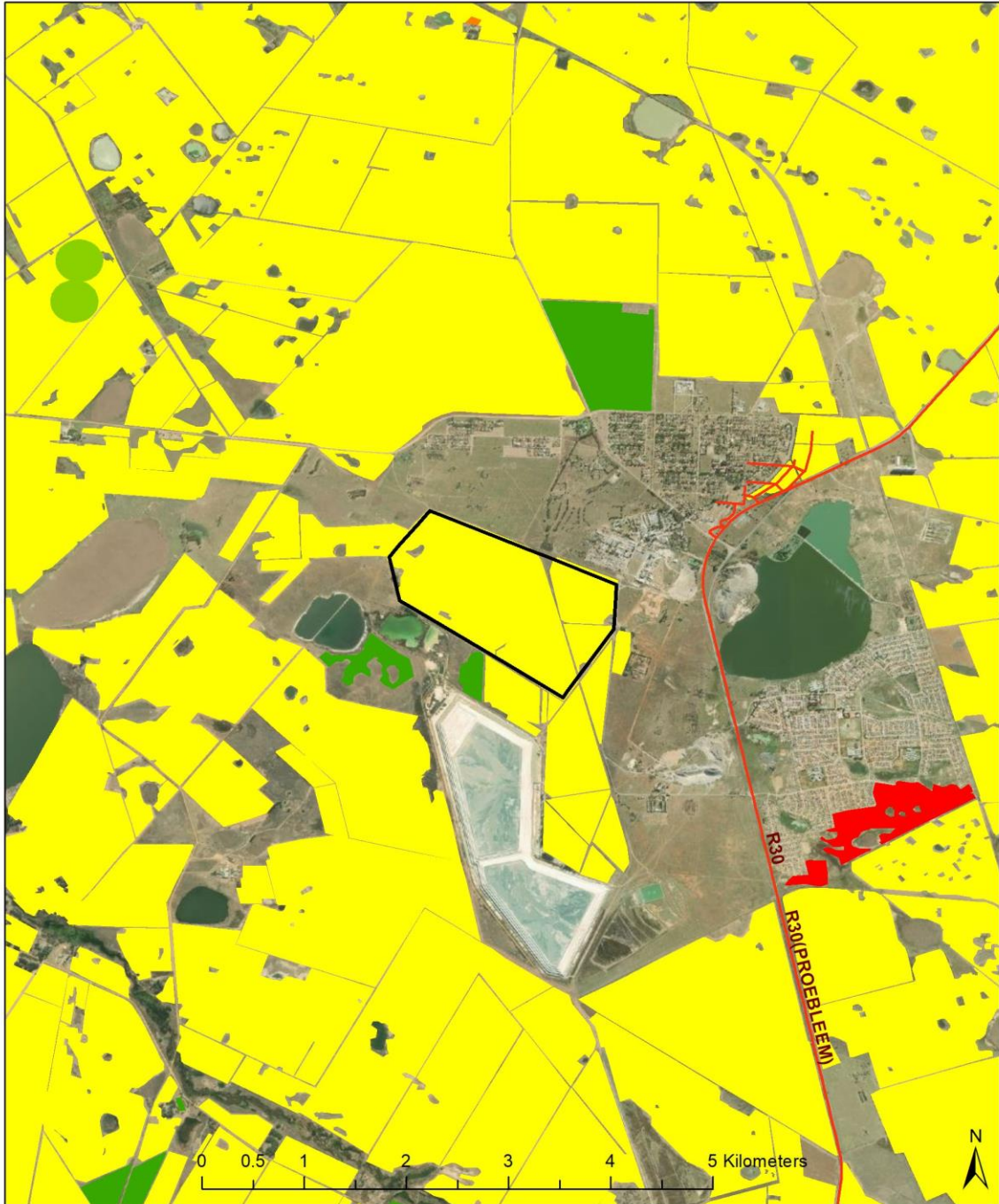
- | | | |
|--|---|---|
| Land capability (DAFF) |  08. Moderate |  Harmony Target PV study area (198.8 ha) |
|  05. Low |  09. Moderate-High | |
|  06. Low-Moderate |  10. Moderate-High | |
|  07. Low-Moderate | | |



Figure 2 Land capability classification of the proposed Harmony Target Solar PV



Legend

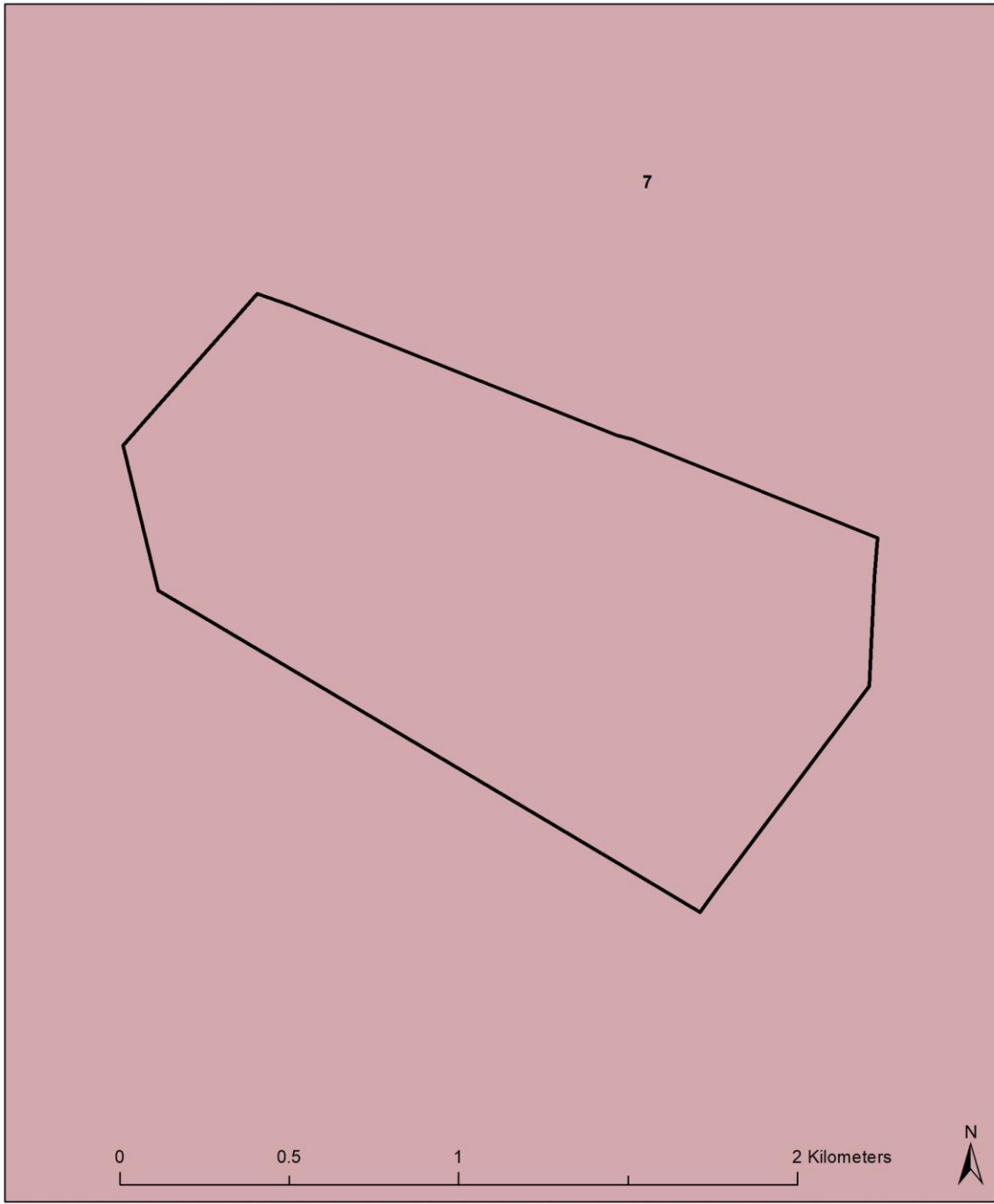
Field crops

- Old Fields
- Pivot Irrigation
- Rainfed Annual Crop Cultivation / Planted Pastures
- Shadenet
- Subsistence Farming 1

- Harmony Target PV study area (198.8 ha)
- Road



Figure 3 Locality of field crops within and around the development area of the Harmony Target Solar PV (source: DAFF 2019)



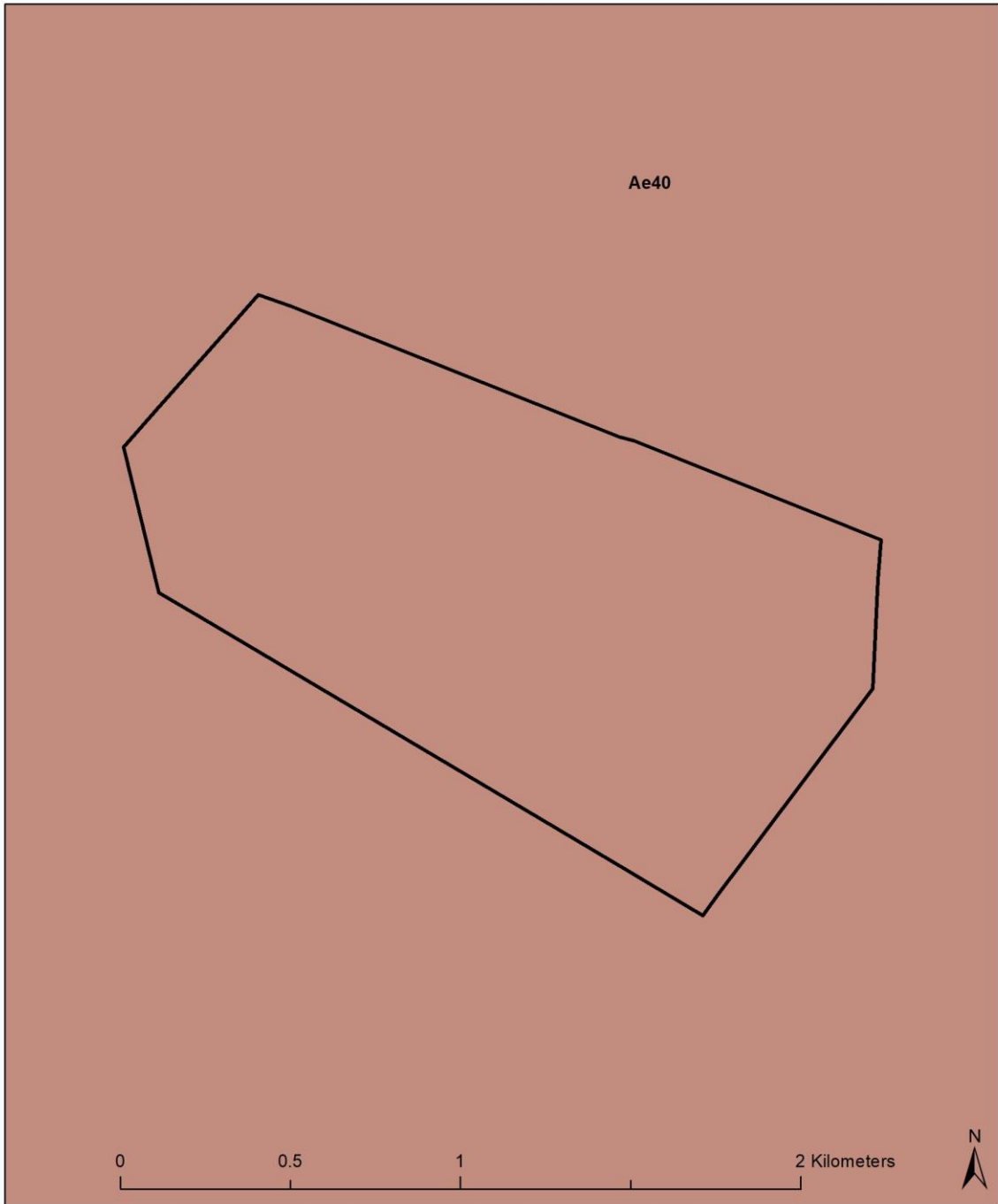
Legend

Grazing capacity (ha/LSU) Harmony Target PV study area (198.8 ha)

7



Figure 4 Long-term grazing capacity of the proposed development area of the Harmony Target Solar PV Facility



Legend

- Land type**
-  Ae40
 -  Harmony Target PV study area (198.8 ha)



Figure 5 Land type classification of the proposed development area of the Harmony Target Solar PV Facility

4.4 Land type classification

The development area consists of Land Type Ae40 (**Figure 5**). Land Type Ae40 consists of three terrain units and the landscape can be described as slightly undulating with slopes ranging between 1 and 2%. The soil formed from sandstone, mudstone and shale. The toe-slope (Terrain unit 4) is dominated by deep Clovelly and Hutton soil forms (>1.2m). Terrain unit 4 (toe-slopes) forms 92% of land type Ae40. The valley bottom consists of deep Katspruit and Rensburg soil forms (0.5-0.9m).

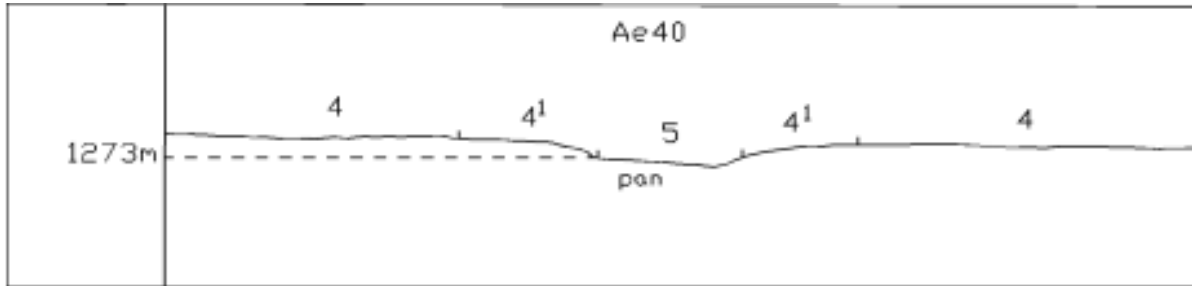


Figure 6 Terrain form sketch of Land Type Ae40

5. POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

5.1 Project description

The project entails the development of a photovoltaic (PV) solar energy facility and will include a grid connection solution and other associated infrastructure, with a capacity of up to 30MW over 72 ha of land and will be known as Harmony Target Solar PV Facility.

5.2 Potential impacts on soil

The anticipated impacts of the proposed project on soil are soil compaction, erosion, soil pollution and the loss of soil fertility from the topsoil horizons to be stripped and stockpiled during the construction phase. Below follows a description of the impacts anticipated:

The most significant impact will most likely be caused by the traversing of vehicles over the terrain during the construction phase. This will result in soil compaction. Soil compaction affects the infiltration of rain into the soil and will increase the risk of erosion because of this. Deep level soil compaction (as caused by heavy vehicle traffic) is difficult to alleviate.

Impact: Soil compaction			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Soil compaction reduces the water infiltration rate of soil that increase the risk of run-off	Negative	Local	None
Description of expected significance of impact			

Wherever the impact occurs (where heavy vehicles traverse) the impact is expected to be of moderate significance.

Gaps in knowledge & recommendations for further study

- Soil samples that will be taken during the site visit will be analysed to determine whether the soil physical properties of the site are particularly sensitive to soil compaction.

Soil erosion is considered another possible impact, especially where vegetation will be removed during the construction phase of the project.

Impact: Soil erosion			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Bare soil surfaces are prone to loss of soil particles as a result of wind and water movement	Negative	Local	None
Description of expected significance of impact The impact is expected to be of moderate significance.			
Gaps in knowledge & recommendations for further study			
<ul style="list-style-type: none"> • Soil samples that will be taken during the site visit will be analysed to determine the erodibility risk of the soil in the development area. 			

In any area where topsoil will be stripped for construction purposes, the inherent soil fertility and in situ soil horizon organisation will be compromised.

Impact: Loss of soil fertility through disturbance of in situ horizon organisation			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Earthworks as part of construction of the Solar Energy Facility will result in disturbance of in situ soil profiles	Negative	Local	None
Description of expected significance of impact Low to moderately low significance			
Gaps in knowledge & recommendations for further study			
<ul style="list-style-type: none"> • The results of the soil survey that will be conducted will be used to determine the sensitivity of the in situ profiles to this impact. 			

Chemical soil pollution may occur as a result of oil and fuel spills from construction vehicles as well as any other waste products that may be generated on site and not properly handled.

Impact: Soil chemical pollution			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Oil and fuel spillages as well as waste generation during the project cycle will result in soil chemical pollution.	Negative	Local	None
Description of expected significance of impact The significance of this impact is moderate to high.			

Gaps in knowledge & recommendations for further study

- The only knowledge gap is the full project description that includes detail of activities and materials that may result in soil pollution during the different project phases.

5.3 Potential impacts on agriculture

The proposed Harmony Target Solar PV project will result in changing the current land use from agriculture (both crop production and livestock farming) to renewable energy generation. The cumulative impact on land use is that portions of land that were previously used for agriculture in the region are converted into alternative land uses.

Impact: Reduction or loss of agricultural productivity			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
The proposed project will change reduce the areas where crops and livestock are produced.	Negative	Local	None / Will be determined during the detail assessment
Description of expected significance of impact			
The proposed project may have a low to high impact on the agricultural production of the development area.			
Gaps in knowledge & recommendations for further study			
The economic viability of rainfed annual crop production and livestock farming within the development area, will be calculated during the detail study phase.			

Impact: Change in numbers of employment opportunities			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
The proposed project will result in the possible loss of agricultural employment opportunities.	Negative to Positive	Local	None / Will be determined during the detail assessment
Description of expected significance of impact			
Although the change in land use may result in a loss of agricultural jobs, it may be substituted or improved by the number of employment opportunities that will be created by the proposed project.			
Gaps in knowledge & recommendations for further study			
It is not currently known how many agricultural jobs are made possible by the agricultural activities within the proposed Harmony Target Solar PV development area. This will be investigated through informal discussions with the current landowner (or person/entity leasing the land for agricultural production)			

5.4 Potential impacts on land capability

The land capability of the area where the proposed project will be located will not be affected by the proposed project.

Impact Change in the land capability of the site			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
Where in situ soil profiles are disturbed by construction activities, the land capability may be altered	Negative	Local	None
Description of expected significance of impact The site has low-moderate to moderate-high land capability and the proposed project will reduce the land capability of the surface infrastructure footprint. The significance of this impact ranges from low to moderate-high, depending on the specific land capabilities of the soil within the development area.			
Gaps in knowledge & recommendations for further study The final land capability will be determined during the detail study phase.			

6. PLAN OF STUDY

A site visit will be conducted to determine the soil properties and associated agricultural potential of the proposed Harmony Target Solar PV. The area to be surveyed is the development area of 198.8 ha. This area includes for the proposed surface footprint as well as a 50m buffered area around it.

The soil will be classified according to the most recent Soil Classification System for South Africa (Soil Classification Working Group, 2018). The following data will be recorded during the site visit:

- Soil forms present within the development area
- Soil depth
- Topsoil and subsoil clay percentages
- Terrain units and slope of the development area

The data points of the spatial data that will be generated during the site visit, will be interpreted for the soil and land capability mapping of the final Soil and Agricultural EIA-level report to be submitted for the proposed Harmony Target Solar PV Facility. The productivity and employment data will be gathered through discussion sessions with the landowners of the farm portions or otherwise the main users.

Following the results of the survey and data analysis, the final proposed project infrastructure layout will be used to calculate whether the proposed Harmony Target Solar PV will be within the allowable development limits for renewable energy developments or where it exceeds it.

The report will be prepared in alignment with all the relevant NEMA regulations as well as General Notice 320 of 2020 that specifically address Agricultural Compliance reporting for the renewable energy sector.

7. CONCLUSION

Following the desktop analysis of available data, it is concluded that the proposed development of the Harmony Target Solar PV and supporting infrastructure, will affect land with moderate to moderate-high land capability. Soil in the area include oxidic yellow-brown and red apedal forms, with soft plinthic underlying it. The soil and agricultural sensitivity of the site therefore varies between moderate to high, depending on the soil properties, topography and other landscape features of the development area.

No no-go areas have been identified for the proposed project from the perspective of soil and agricultural resource conservation. It is anticipated that the proposed project will have moderate to moderate-high impact on the soil properties and land capability. Further investigation of the site sensitivities will be conducted during the EIA phase to confirm the sensitivities as well as the anticipated impacts of the proposed Harmony Target Solar PV.

8. LIST OF REFERENCES

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