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Soil, Land Use and Land Capability Scoping Report for the Proposed Hyperion 2 Solar Project

Submitted by TerraAfrica Consult cc
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Declaration of EAP

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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 considered to be correct to the best of my knowledge and the information available at this stage.

TerraAfrica Consult cc represented by M Pienaar

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1. INTRODUCTION

Terra-Africa Consult cc was appointed by Savannah Environmental (Pty) Ltd to conduct the soil, land use, land capability and agricultural potential study for the proposed Hyperion Solar Development 2 (photovoltaic (PV) solar energy facility (SEF)) project. The proposed project will be located on the Remaining Extent of the Farm Lyndoch 432 (from this point onwards referred to as the project site), approximately 13 kilometres north of Kathu in the Northern Cape. In relation to other towns, the project site is located approximately 35km west of Kuruman, 21km east of Dibeng and 40km south of Hotazel.

Three additional SEFs are also proposed on the project site (Hyperion Solar Development 1, Hyperion Solar Development 3 and Hyperion Solar Development 4). Each facility is proposed to include multiple arrays (static and tracking) of PV solar panels with a contracted capacity of up to 75MW. The development footprint for each facility is anticipated to be approximately 180ha in extent.

Infrastructure associated with each solar energy facility will include:

- Arrays of PV panels (static or tracking PV system) with a contracted capacity of up to 75MW.
- Mounting structures to support the PV panels.
- Cabling between the project components, to be laid underground where practical.
- On-site inverters to convert the power from a direct current to an alternating current.
- An on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV overhead power line (OPHL) between the on-site substation and the existing Ferrum Substation[1].
- Battery storage mechanism with a storage capacity of up to 300MWh.
- Water purification plant.
- Site Offices and Maintenance Buildings, including workshop areas for maintenance and storage.
- Batching plant.
- Temporary laydown areas.
- Internal access roads and fencing around the development area.

For each facility, the applicant is also proposing to upgrade an existing gravel road to which links the project site to the N14. Two alternatives will be assessed:

- Upgrade approximately 3,6km of the T26 (Alternative 1) gravel road between the project site and the N14; and
- Alternative 2 - The construction of a new access road and the formalisation of an informal access road (consisting a two tyre track serving as a fire break in some places) between the project site and the T25, approximately 5km in length.

2. TERMS OF REFERENCE

The terms of reference applicable to the soils, land capability, land use and agricultural potential study include the following:

- Conduct a desktop study for the proposed site to assess the soil and land use of the site and receiving environment by interrogating relevant spatial data and maps available.
- Identify site sensitivities to the proposed project pertaining to the soil properties, associated land capabilities and the agricultural potential of the project site.
- Identify potential impacts that will be caused by the project, and that will have to be asssessed as part of the detail EIA study phase (if applicable).
- Identify a Plan of Study (PoS) that will include the methodology to be followed during the detailed soil, land capability, land use and agricultural potential impact assessment.

3. METHODOLOGY

The following data was obtained and interrogated for the scoping phase report of the proposed project:

- Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and consists of 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 in the cross section. The soil data is classified according to the Binomial System (MacVicar et al., 1977). The soil data was interpreted and re-classified according to the Taxonomic System (MacVicar, C.N., et al. 1991);
- Broad geological, soil depth and soil description classes were obtained from the Department of Environmental Affairs (DEAT) and studied. This data forms part of the Environmental Potential Atlas (ENPAT) of South Africa that was released in 2001.
- The spatial files for the newest land capability classification system were obtained from the Department of Agriculture, Forestry and Fisheries (DAFF). The new system includes fifteen land capability classes as opposed to the previous system developed by Schoeman (2002) that only included eight classes. DAFF launched this new classification data in 2017.

For the impact assessment, the methodology described by Savannah Environmental (Pty) Ltd. was used. The methodology is described below.

Direct, indirect and cumulative impacts associated with the projects must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;
- The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which will be described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

S=(E+D+M)P where

- S = Significance weighting
- E = Extent
- D = Duration
- M = Magnitude
- P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

4. RESULTS OF THE SCOPING PHASE STUDY

4.1 Land types present

Following the Land Type classification data, the project site consists of only one land type, Land Type Ah 9 (209.5 ha) (Figure 1).

4.1.1 Land Type Ah9

Land Type Ah9 consists of only two terrain units where Terrain Unit 4 are the vast flat areas that dominates the landscape and Terrain Unit 5 are the areas of slight depression where endorheic pans can develop. The landscape can therefore be described as flat to very slightly undulating with slopes ranging from between 0 and 3%. The soil formed from Aeolian sand of Recent age and the riverbeds in the larger area around the project site formed on outcrops of Tertiary Kalahari beds (in most cases limestone layers can be seen where it has been exposed through sediment transported by water and wind). The texture of soil in this land type is dominated by sand with the clay fraction estimated as always less than 10%. Deep Hutton and Clovelly soil forms (deeper than 120cm) constitutes the largest portion of this land type with very limited possibility for finding shallow, rocky soils of the Mispah and Glenrosa forms over the entire land type area (an estimated 3.5%).

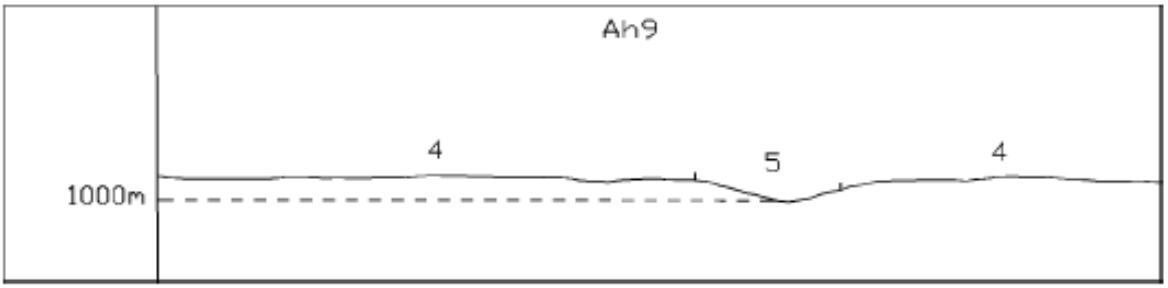

Figure 1 Depiction of the terrain forms of Land Type Ah9

4.1.2 Land Type Ag110

Similar to Land Type Ah9, Land Type Ag110 also consists of only two terrain units where Terrain Unit 4 represent flat areas that dominates the landscape and Terrain Unit 5 are the areas of slight depression at a variety of elevations where endorheic pans can develop. The landscape can is also flat to very slightly undulating with slopes ranging from between 0 and 2%. However, the underlying geology differs from that of Land Type Ah9. The soil in this land type overlies surface limestone, alluvium and red wind-blown sand of Tertiary to Recent age with a few occurrences of amygdaloidal andesitic lava of the Ongeluk Formation.

The texture of soil in this land type is dominated by sand and sandy loam with the clay fraction estimated as always less than 15%. This land type mainly consists of shallow soil profiles of

the Hutton and Mispah forms with an estimated 18.5% of areas in this land type consisting of deeper soil profiles of the Hutton form.

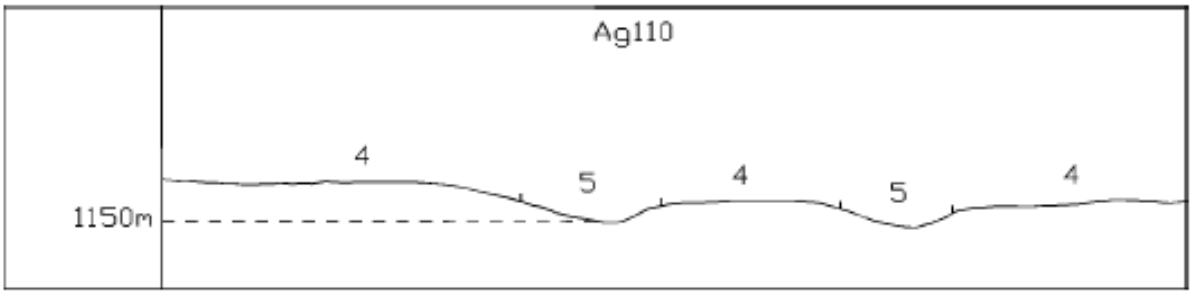

Figure 2 Depiction of the terrain forms of Land Type Ag110

4.2 Soil depth

Following the soil depth data (illustrated in Figure 3), the entire project site consists of soil profiles with an effective soil depth that is deeper than 750 mm. The southern portion of the proposed second access road traverses an area with shallow soil depth where the majority of soil profiles are shallower than 450mm. Soil depth is considered a key factor in determining the dryland agricultural potential of soil. Soil depths shallower than 500mm are considered unsuitable for dryland crop production. However, even with deep soil depths, the low rainfall and recurring drought periods makes this area unsuitable for dryland crop production.

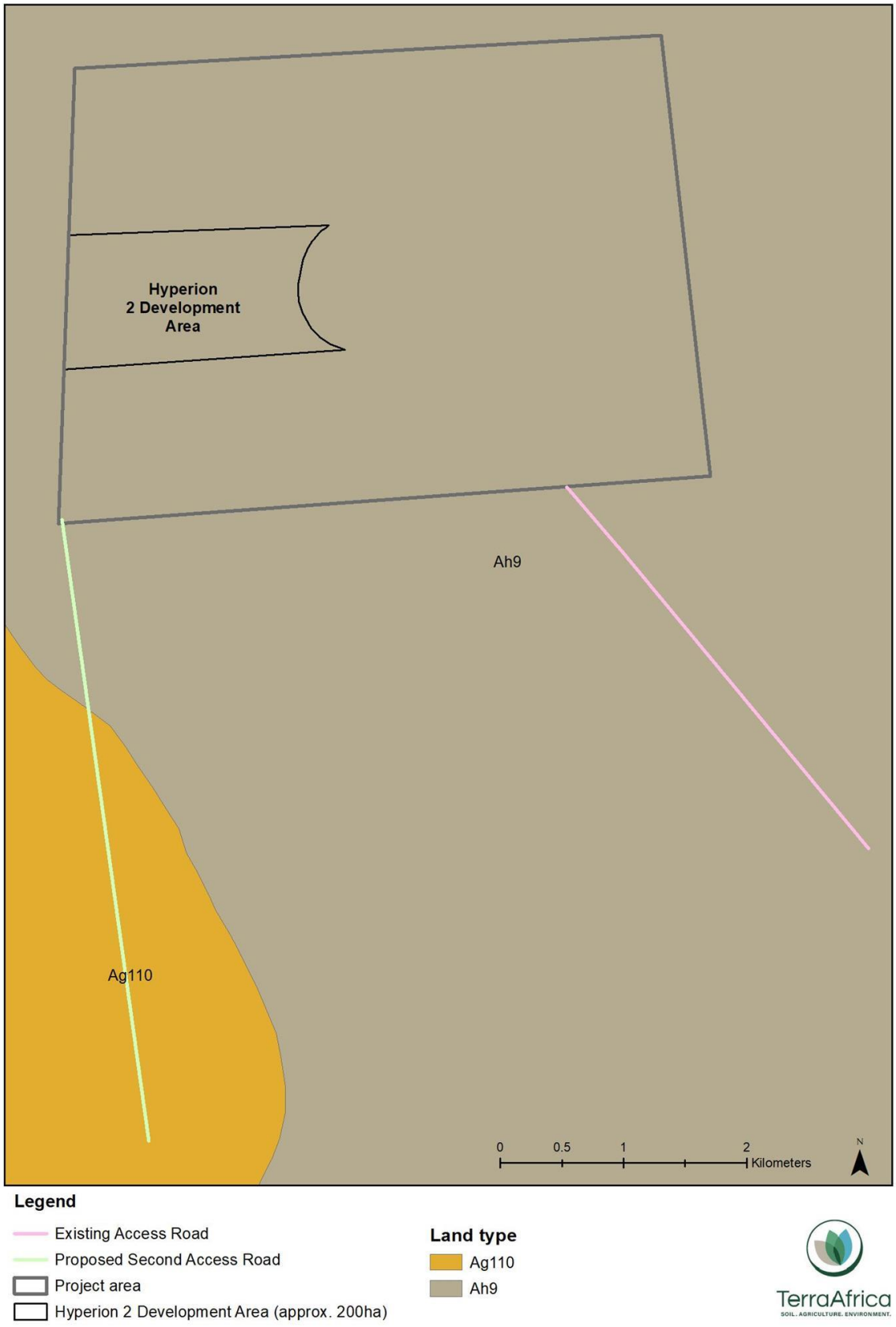

Figure 3: Land Type map of the proposed Hyperion Solar Development 2, including alternative access roads

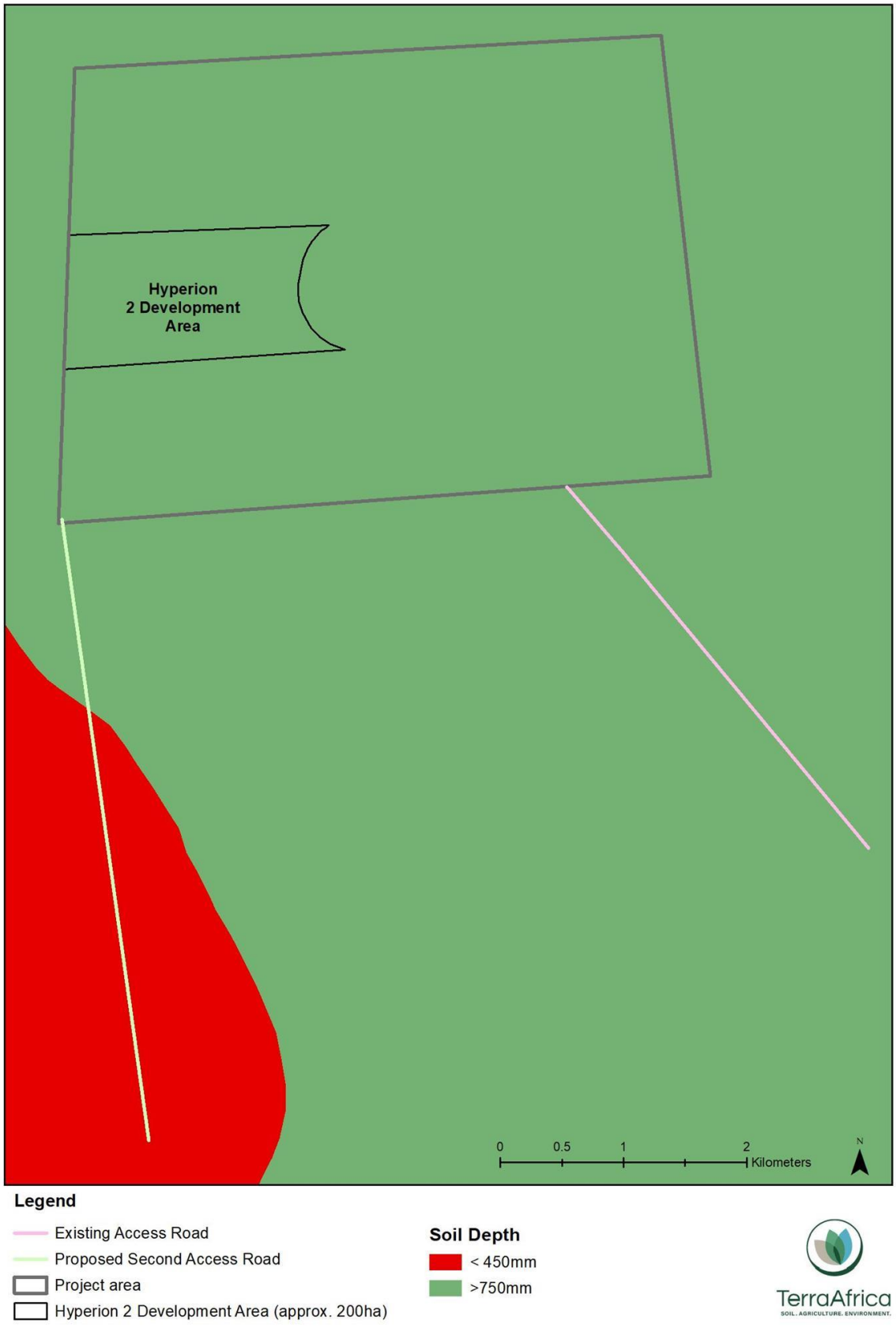

Figure 4 Soil depth map of the proposed Hyperion Solar Development 2, including alternative access roads

4.3 Land capability

Following the land capability classification data obtained from the DAFF (depicted in Figure 5), the project site has low to low-moderate land capability. This range is not considered suitable for crop production and the most suitable land use is livestock grazing with management measures in place. These management measures include controlled grazing to prevent overgrazing, which in turn results into land degradation.

4.4 Agricultural potential

Similarly, the soil potential data indicates that soils in the area are poorly suited for arable agriculture (Figure 6). Even though the soil forms present here are suitable for arable agriculture in other areas of the country, the proposed site has a dry, semi-arid climate with erratic rainfall patterns which are not suitable for dryland crop production.

The recommended grazing capacity for veld where the project site is located, is 21 – 30 hectares per Large Stock Unit (ha/LSU) (Morgenthal et al., 2005). These large stock units can be further converted to include small grazers and browsers such as Boer goats or sheep although the area is most suitable for cattle production. The entire project site (1600ha) therefore has the capacity to provide grazing 53 to 76 head of cattle. When considering the development area of 200 ha, it has the capacity to feed 7 to 9 head of cattle. On its own, the development area is not considered a viable unit for livestock farming but in combination with the rest of the project site, it is large enough to function as a sustainable cattle farm.

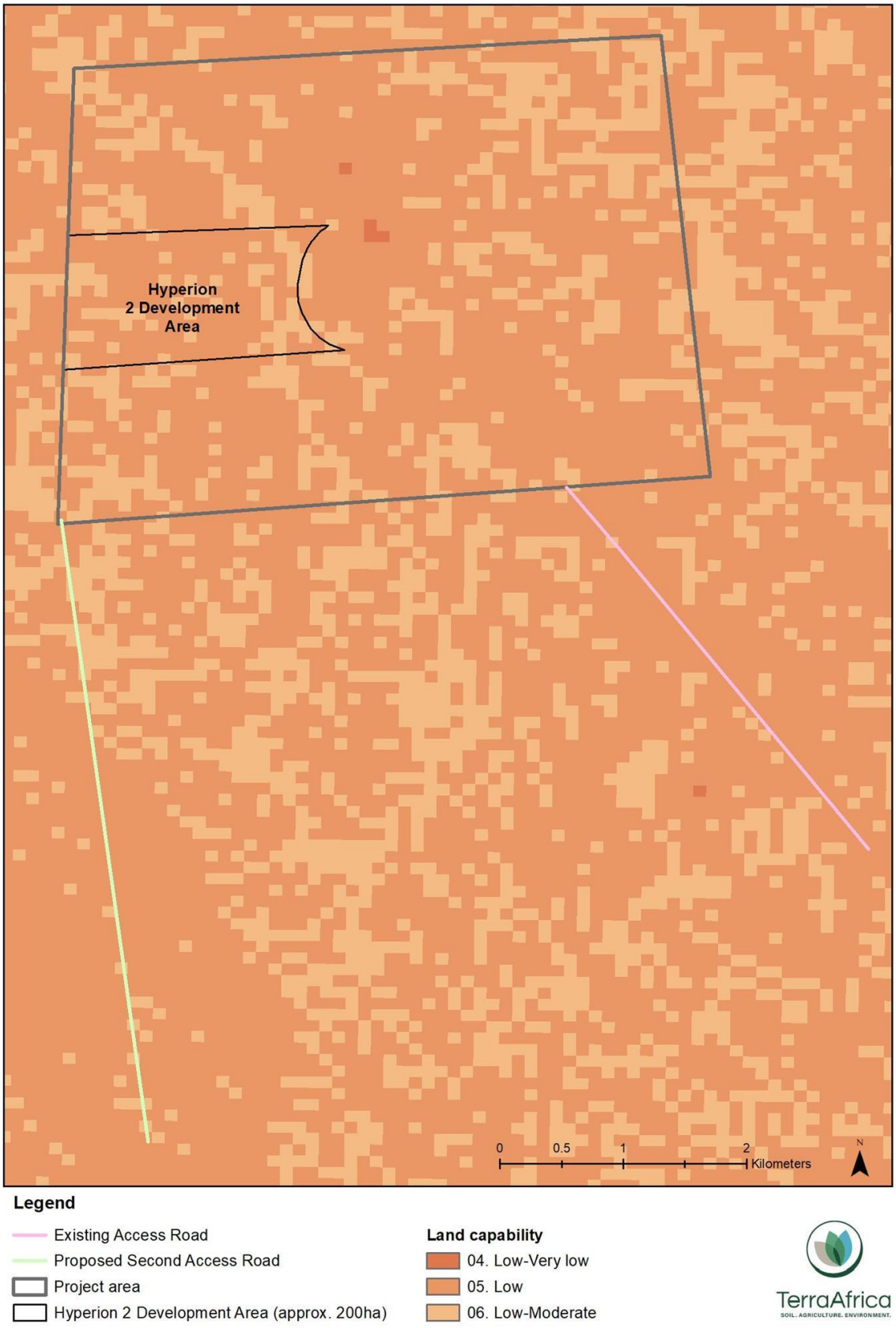

Figure 5: Land capability map of the proposed Hyperion Solar Development 2, including alternative access roads

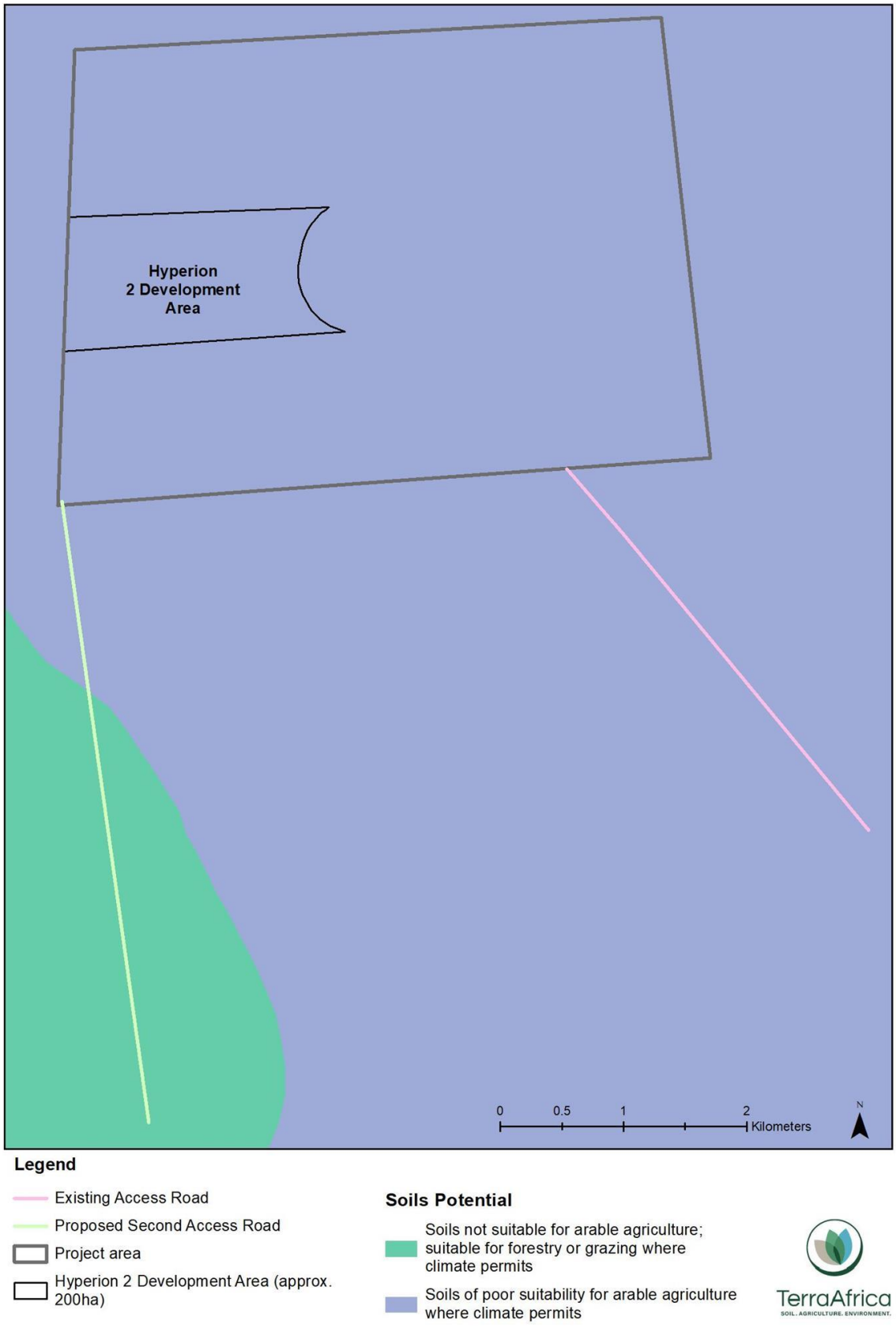

Figure 6 Soil potential map of the proposed Hyperion Solar Development 2, including alternative access roads

5. POTENTIAL IMPACTS OF THE PROPOSED HYPERION SOLAR DEVELOPMENT 2 PROJECT

5.1 Potential impacts on soil

The anticipated impacts of the proposed project on soil are very limited. The impacts below are for both the project site and the access roads. 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. Vehicles will use designated roads and the impact will only be restricted to certain areas. This will result in soil compaction. Soil compaction affects the infiltration of rain into the soil and will increase the risk of erosion as a result of this. Deep level soil compaction (as caused by heavy vehicle traffic) is difficult to alleviate.

Impact: Soil compaction			
Desktop Sensitivity Analysis of the Site » Low to moderate sensitivity			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Soil Compaction	Negative - Soil compaction reduces the water infiltration rate of soil that increase the risk of run-off	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. Even though mitigation measures will be implemented (keep the traffic footprint as small as possible), deep soil compaction is difficult to alleviate and the impact is considered to remain of moderate significance.			
Gaps in knowledge & recommendations for further study » The site survey will indicate whether the physical soil 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			
Desktop Sensitivity Analysis of the Site » Moderate sensitivity to erosion			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Soil erosion	Negative - Bare soil surfaces are prone to loss of soil particles as a result of wind and water movement	Local	None
Description of expected significance of impact The impact is expected to be of moderate significance. With the correct mitigation measures,			

the impact is expected to be of low significance.
Gaps in knowledge & recommendations for further study » The textural analysis of soil samples will indicate the sensitivity to soil erosion.

- 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			
Desktop Sensitivity Analysis of the Site » Low to moderately low sensitivity			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Loss of soil fertility through disturbance of in situ horizon organisation	Negative - Earthworks as part of construction of the PV plant will result in disturbance of *in situ* soil profiles	Local	None
Description of expected significance of impact Low to moderately low significance. It is expected that management and mitigation measures will keep the expected significance low.			
Gaps in knowledge & recommendations for further study » The soil survey 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. Chemical soil pollution may also occur during the operational phase when maintenance will be done on the infrastructure.

Impact: Soil chemical pollution			
Desktop Sensitivity Analysis of the Site » Low to moderate sensitivity			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Soil chemical pollution	Negative - Oil and fuel spillages as well as waste generation during the project cycle will result in soil chemical pollution.	Local	None
Description of expected significance of impact The significance of this impact is moderate to high. It is expected that with the correct mitigation measures such as proper waste management and spill checks for vehicles, the impact will be of low significance.			
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. A more detailed layout and details on the associated infrastructure will be available in the EIA phase for consideration.			

5.2 Potential impacts on land use

The only impact on land use will be the change of land use from livestock farming to that of 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. A number of other renewable projects are also planned for the project site. Should all of these projects be authorised, it will impact on change in land use in the same manner.

Impact: Change in land use			
Desktop Sensitivity Analysis of the Site » Very low to low.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Change in land use	Neutral- The proposed project will change the current land use from agriculture to energy generation	Local	None
Description of expected significance of impact The proposed project may have a moderate to major positive impact on the current land use and in the worst case, have a neutral impact. No mitigation measures are recommended and the expected significance of the impact will still be moderately to majorly positive.			
Gaps in knowledge & recommendations for further study » The economic viability of livestock farming vs renewable energy generation will be calculated during the detailed EIA study phase.			

5.3 Potential impacts on agricultural potential

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

Impact Change in the agricultural potential of the site			
Desktop Sensitivity Analysis of the Site » The site has very low sensitivity to the impact on the agricultural potential			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Change in the land capability of the site	Neutral - The land capability of areas where the solar panels are constructed may be altered as a result of the disturbance to the soil profiles.	Local	None
Description of expected significance of impact The site has low to low-moderate land capability and although the proposed project footprint will cover a surface area of 180 ha, it is not anticipated that the inherent land capability of the site will be changed permanently by the project. With mitigation measures in place, the impact is expected to remain neutral.			
Gaps in knowledge & recommendations for further study » The final land capability will be determined using the data gathered with the site survey. Soil forms will be grouped into land capability classes.			

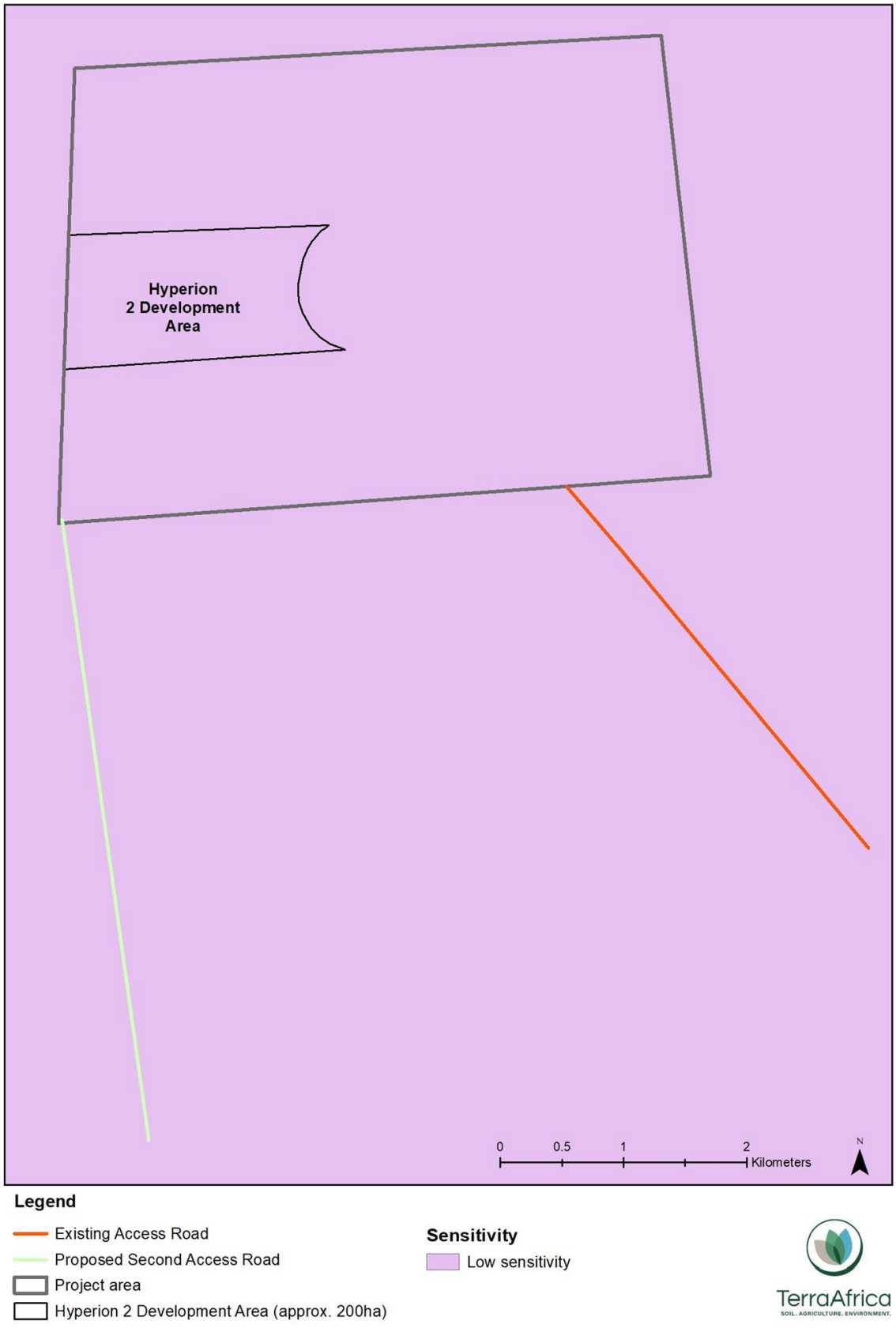

Figure 7 Soil sensitivity map of the proposed Hyperion Solar Development 2, including alternative access roads

6 PLAN OF STUDY

Once the detail assessment phase (EIA phase) commences, a detailed soil survey (150 m x 150 m) will be conducted in the proposed development area (approximately 200ha in extent) and the routes for the two access road alternatives. Observations will be made regarding soil texture, depth of soil, soil structure, organic matter content and slope of the area. A cold 10% hydrochloric acid solution will be used on site to test for the presence of carbonates in the soil.

Soil profiles will be classified using a hand-held soil auger and drilling soil profiles to a depth of 1500mm or refuse. The soil characteristics of each sample point will be noted and logged with a global positioning system. Soil samples for chemical analysis will be taken at certain sampling points and at each point both topsoil (0-300mm) and subsoil (300-600mm) will be sampled. The soils will be described using the S.A. Soil Classification A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018). Soils will be grouped into classes with relatively similar soil properties and pedogenesis.

The capability and use of the land will be defined using the information obtained during the soil investigation. The results from the soil survey will be used in conjunction with the DAFF classification system. During the assessment of the land, the economic and ecological implications of the proposed project will be described as well as the steps that need to be followed for rehabilitation of any soil profiles that were temporarily disturbed. The land users will be interviewed and any additional data on land use economics will be obtained. In addition, observations of the project site and surrounding areas will be undertaken to determine their land use practices, and how they derive income and other ecosystem services from the land.

The result of this study will be a report that describes all the pre-project baseline features in detail, and an impact assessment that will use the method prescribed by Savannah Environmental (Pty) Ltd. In addition, a Soil and Land Management Plan will be included which describes all mitigation, management and monitoring measures to be implemented. The report will fulfill all requirements for specialist studies as indicated in the NEMA regulations (Appendix 6 of GNR 326 of 2014, as amended).

7 CONCLUSION

The development area identified for the proposed Hyperion Solar Development 2 project has low sensitivity in terms to the proposed development as the land capability of the area has low to moderately low potential for dryland arable agriculture. Further to this, there are no hydromorphic soil forms present that underlies wetland ecosystems within the development area and the proposed development will therefore not negatively affect the water storage function of the soil present. The change in land use from livestock farming to renewable energy generation will have a minor to negligible impact on the food production potential of the region

as the site has the grazing potential for 7 to 9 head of cattle. However, the large numbers of livestock are already produced in the area and the project impact is not considered as a threat to food security. The detailed assessment and subsequent reporting will provide in-depth detail on all these aspects.

8 LIST OF REFERENCES

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