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Agricultural Assessment for the Proposed Harmony Joel Solar PV Facility Project

Submitted by TerraAfrica Consult cc

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1. Introduction

Terra-Africa Consult cc was appointed by Savannah Environmental (Pty) Ltd to conduct the agricultural assessment as part of the Scoping and Environmental Impact Assessment process for the proposed development of a solar energy facility. The development of a solar photovoltaic (PV) facility with a generating capacity of up to 18MW is proposed 900m north east of the Harmony Joel operations, approximately ~20km north east of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province. The PV facility is located on Portion 0 of the Farm Leeuwbult 580. The solar PV development will be known as Harmony Joel Solar PV Facility. Freegold Harmony (Pty) Ltd (a subsidiary of Harmony Gold Mining Company Ltd) is the applicant.

2. Project description

A project site considered to be technically suitable for the development of the solar PV facility, with an extent of approximately 1000ha, was identified. A development area of ~220ha was demarcated within this project site and allows an adequate footprint (~47ha) for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities. The preferred site for the project is on a property which is privately owned by the Mine and are available for the proposed project and is therefore deemed technically feasible by the project developer for such development to take place.

The infrastructure associated with the 18MW solar PV facility will include:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Grid connection solution including an on-site facility substation, switching station, to be connected to the Shafts 1 & 2 HJ Joel Mining Substation via an overhead power line (located ~830m south west of the development footprint).

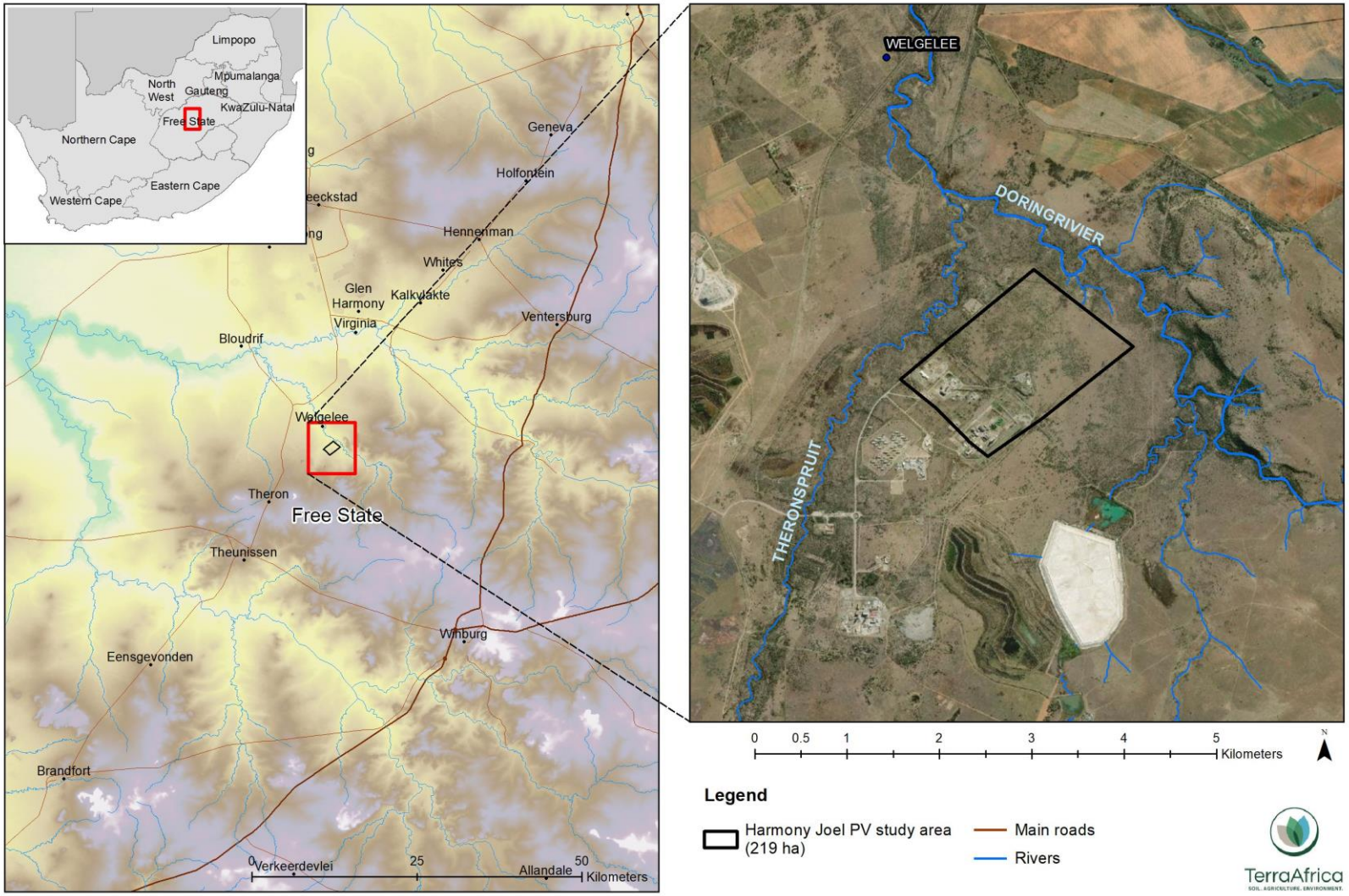

Figure 1 Locality of the proposed Joel PV Facility project area

3. Details of the specialist

The report is prepared by Mariné Pienaar of TerraAfrica Consult CC. Mariné is a scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialised in the fields of Agricultural Science and Soil Science. Her SACNASP Registration Number is 400274/10 (see Appendix 2). Mariné holds a BSc. degree in Agricultural Science (with specialisation in Plant Production) from the University of Pretoria and a MSc. Degree in Environmental Science from the University of the Witwatersrand.

Jan-Dirk is a candidate scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialized in the field of Soil Science. His SACNASP registration number is 400274/13. Jan-Dirk holds a BSc. Degree in Agricultural Science (with specialization in Soil Science) from the University of the Free State and a MSc. Degree in Soil Science from the University of the Free State.

The full details and contact details of the specialist is attached as Appendix 1 – Specialist Declaration of Independence.

4. Purpose and objectives of the compliance statement

The purpose of the Agricultural Compliance Statement, is to ensure that the sensitivity of the site from the perspective of agricultural production to the proposed development, is sufficiently considered. To meet this objective, site sensitivity verification must be conducted, of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool.
- It must contain proof in the form of photographs of the current land use and environmental sensitivity pertaining to the study field.
- All data and conclusions are submitted together with the Environmental Impact Assessment Report (prepared in accordance with the NEMA regulations) for the proposed project.

According to GNR 320, the agricultural compliance statement that is submitted must meet the following requirements, it must:

- be applicable to the preferred site and the proposed development footprint;
- confirm that the site is of “low” or “medium” sensitivity for agriculture; and
- indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site.

The following checklist is supplied as per the requirements of GNR 320, detailing where in the report the various requirements have been addressed:

Table 1 GNR 320 requirements of an Agricultural Compliance Statement (Low to Medium Sensitivity)

Requirement	**Report reference**
3.1. The compliance statement must be prepared by a soil scientist or agricultural specialist registered with the SACNASP.	Page 4 & Appendix 2
3.2. The compliance statement must: 3.2.1. be applicable to the preferred site and proposed development footprint;	Section 10
3.2.2. confirm that the site is of "low" or "medium" sensitivity for agriculture; and	Section 10.4
3.2.3. indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site.	Section 10.4 and Section 13
3.3. The compliance statement must contain, as a minimum, the following information: 3.3.1. contact details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vitae;	Appendices 1, 2 and 3
3.3.2. a signed statement of independence;	Appendix 1
3.3.3. a map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	Figure 2
3.3.4. confirmation from the specialist that all reasonable measures have been taken through micro- siting to avoid or minimise fragmentation and disturbance of agricultural activities;	Section 12
3.3.5. a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development;	Section 12
3.3.6. any conditions to which the statement is subjected;	Section 12
3.3.7. in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;	Not applicable
3.3.8. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and	Section 11
3.3.9. a description of the assumptions made as well as any uncertainties or gaps in knowledge or data.	Section 9
3.4. A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	Submitted as part of final report

5. Terms of Reference

In addition to the requirements stipulated in GNR 320, the following Terms of Reference, as stipulated by Savannah, apply to the Agricultural Compliance Statement:

- to ensure a thorough assessment, that includes both the desktop assessment of databases and aerial photography; a description of the on-site verification of the agricultural potential of the area; and the soil forms present in the development area.
- identify and assess potential impacts on both agricultural potential and soil resulting from the proposed project.
- identify and describe potential cumulative soil, agricultural potential and land capability impacts resulting from the proposed project in relation to proposed and existing developments in the surrounding area; and
- recommend mitigation, management and monitoring measures, to minimise impacts and/or optimise benefits associated with the proposed project.

6. Legislative framework of the assessment

The report follows the protocols as stipulated for agricultural assessment in Government Notice 320 of 2020 (GNR 320). This Notice provides the procedures and minimum criteria for reporting in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (No. 107 of 1998) (NEMA). It replaces the previous requirements of Appendix 6 of the Environmental Impact Assessment Regulations of NEMA.

In addition to the specific requirements of GN320 for this study, the following South African legislation is also considered applicable to the interpretation of the data and conclusions made with regards to environmental sensitivity and the conservation of soil resources of the project area:

- the Conservation of Agricultural Resources Act (No 43 of 1983) (CARA) states that the degradation of the agricultural potential of soil is illegal. CARA requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilization of marshes, water sponges and watercourses are also addressed; and
- the National Water Act (No 36 of 1998) (NWA) deals with the protection of water resources (i.e. wetlands and rivers). Hydric soils with wetland land capability are not part of the proposed development area and the NWA is therefore not applicable.

7. Agricultural Sensitivity

The combined Agricultural Sensitivity of the proposed project area was determined by using the National Environmental Screening Tool (www.screening.environment.gov.za). The screening report was generated by Savannah Environmental on 6 June 2022. The requirements of GNR 320 stipulate that a 50m buffered development envelope must be assessed with the screening tool. The map depicted in Figure 2 shows the agricultural sensitivity of the 220ha development area, although only 47ha (development footprint) will be used for the proposed development. Additionally, a buffered area of at least 1km around the proposed development area is included.

The results provided by the screening tool indicate that the largest part of the development area consists of land with Medium agricultural sensitivity (refer to Figure 2). Small areas with Low agricultural sensitivity are found in the center, southern and northern boundaries. The development footprint area consists mainly of land with Medium agricultural sensitivity.

The screening tool showed that Low sensitivity areas are allocated to land with Very low (Class 01 and 02), Low-Very low (Class 03 and 04) and Low (Class 05) land capabilities, whereas Medium sensitive areas had Low-Moderate (Class 06 and 07) and Moderate (Class 08) land capabilities.

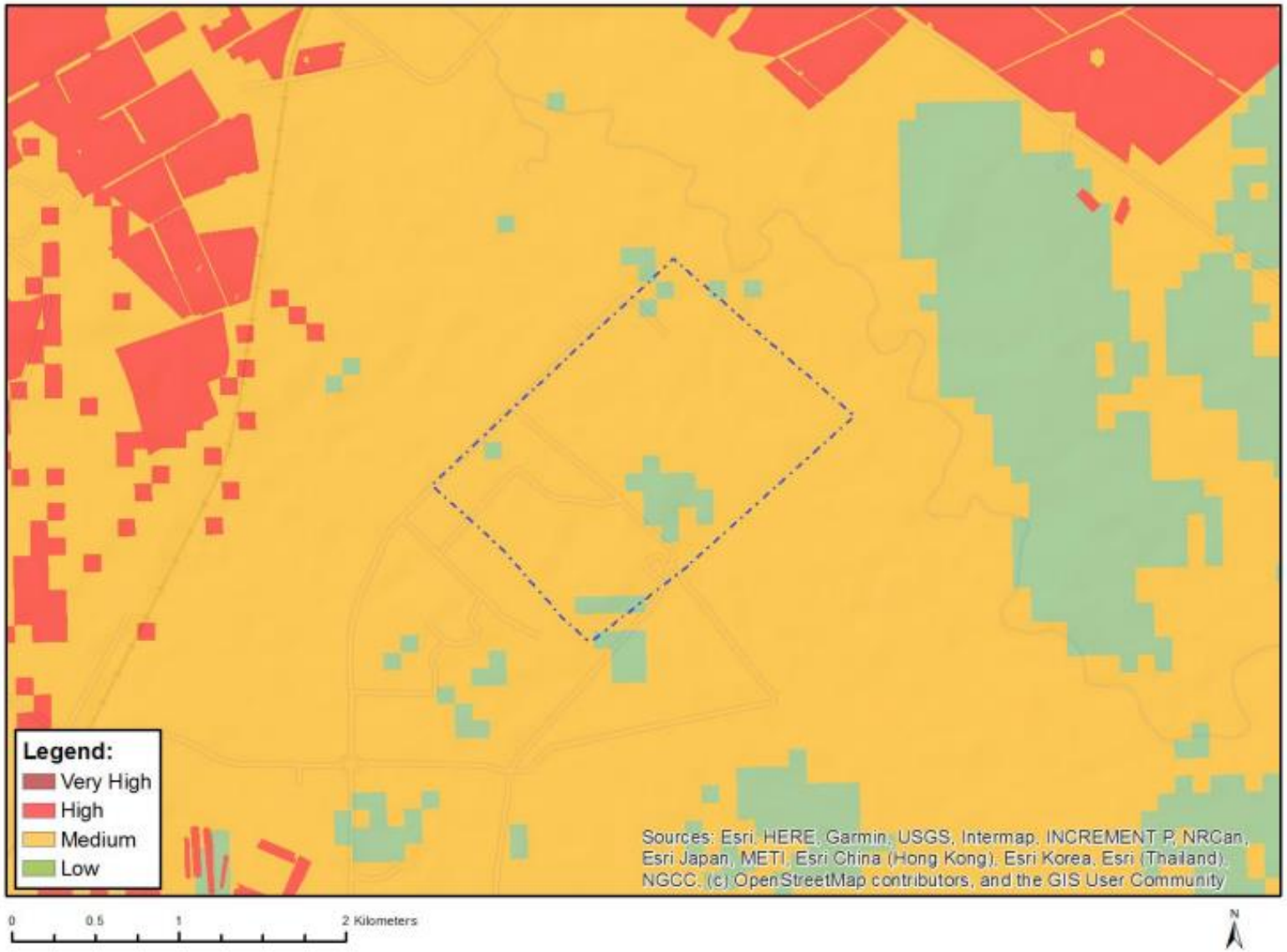

Figure 2 Agricultural Combined Sensitivity of the Joel PV Facility development area (generated by Savannah Environmental, 2022)

8. Methodology

The different steps that were followed to gather the information used for the compilation of this report is outlined below. The methodology is in alignment with the requirements of GNR 320.

8.1 Assessment of available data

The most recent aerial photography of the area available from Google Earth was obtained. The satellite imagery was used to analyse the terrain of the proposed project area and the surrounding area. The analysis considered the typical terrain units and landscape features, such as existing roads, farm infrastructure and areas where land degradation may be present. The proposed development area was also superimposed on three different raster data sets obtained from the National Department of Agriculture, Land Reform and Rural Development (DALRRD). The data sets are:

- The Refined Land Capability Evaluation Raster Data for South Africa that was developed using a spatial evaluation modelling approach (DALRRD, 2016).
- The long-term grazing capacity for South Africa 2018 that present the long-term grazing capacity of an area with the understanding that the veld is in a relatively good condition (South Africa, 2018).

8.2 Site assessment

The site visit was conducted on the 6th to the 8th of June 2022. The soil profiles were examined to a maximum depth of 1.2m using a hand-held auger. Observations on site were made regarding soil texture, structure, colour and soil depth at each survey point. The locality of each survey point is shown in . A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. Qfield was used to the log the coordinates of each of the survey points. The soils are described using Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018). It should be noted that development will only be taken place in the development footprint and thus not the entire development area. Figures below focus on the development footprint and grid connection corridor.

Other observations made during the site visit include recording the presence of farm buildings, cattle handling facilities and water troughs. The larger area around the study area was also assessed by driving through the area to gain an understanding of the agro ecosystem within which the study area functions. Photographic evidence of soil properties, current land uses and farm infrastructure were taken with a digital camera and presented in Section 9 of the report.

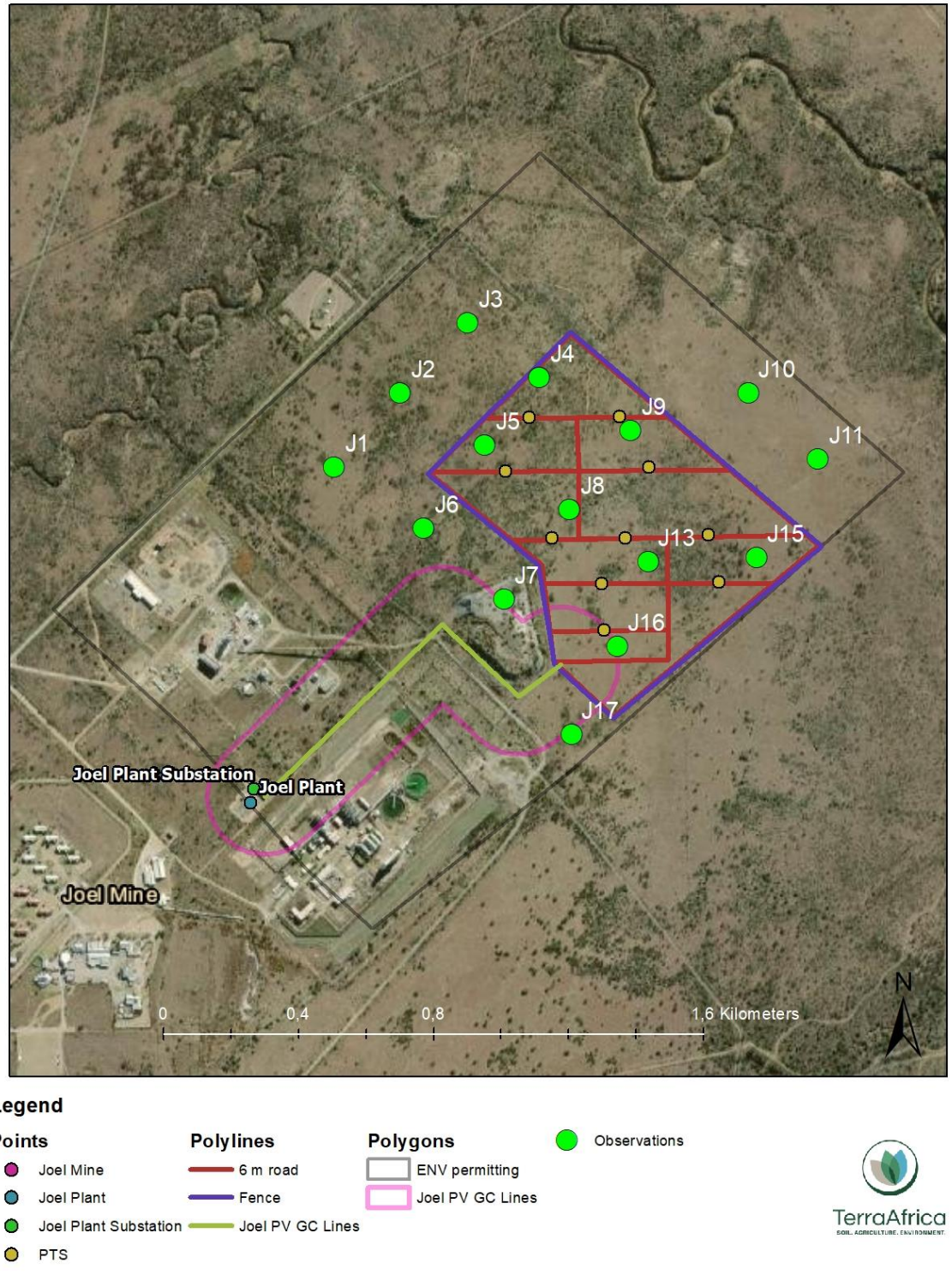

Figure 3 Locality of on-site soil classification and observation points within the Joel PV Facility project area

8.3 Impact assessment methodology

Following the methodology prescribed by Savannah Environmental (Pty) Ltd., the direct, indirect and cumulative impacts associated with the project have been 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

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).

9. Study gaps, limitations and assumptions

All assumptions made with the interpretation of the baseline results and anticipated impacts, are listed below:

- It is assumed that the development footprint will be within the project area of 220 ha that was assessed in this report.
- It is assumed that the development footprint will be fenced off and the 220 ha of land will be excluded as land available for any future farming activities; and
- It is further assumed that the activities for the construction and operation of the infrastructure are limited to that typical for the construction and operation of a solar PV facility, inclusive of the infrastructure listed in Section 11.1.

The following limitations is part of the assessment:

- The anticipation and rating of impacts are based on the report author's knowledge and experience on the nature of construction and operation of PV facilities and grid infrastructure. Therefore, it is done as accurately as possible but must not be considered as absolute measures.

No other information gaps, limitations and assumptions have been identified.

10. Baseline description

10.1 Soil properties

The soil profiles classified within the Joel PV Facility development area consist of the Glen, Glenrosa, Swartland, Sepane, and Technosols soil forms. The positions of the soil forms are depicted in Figure 4 and a description of each soil form is provided following Figure 4.

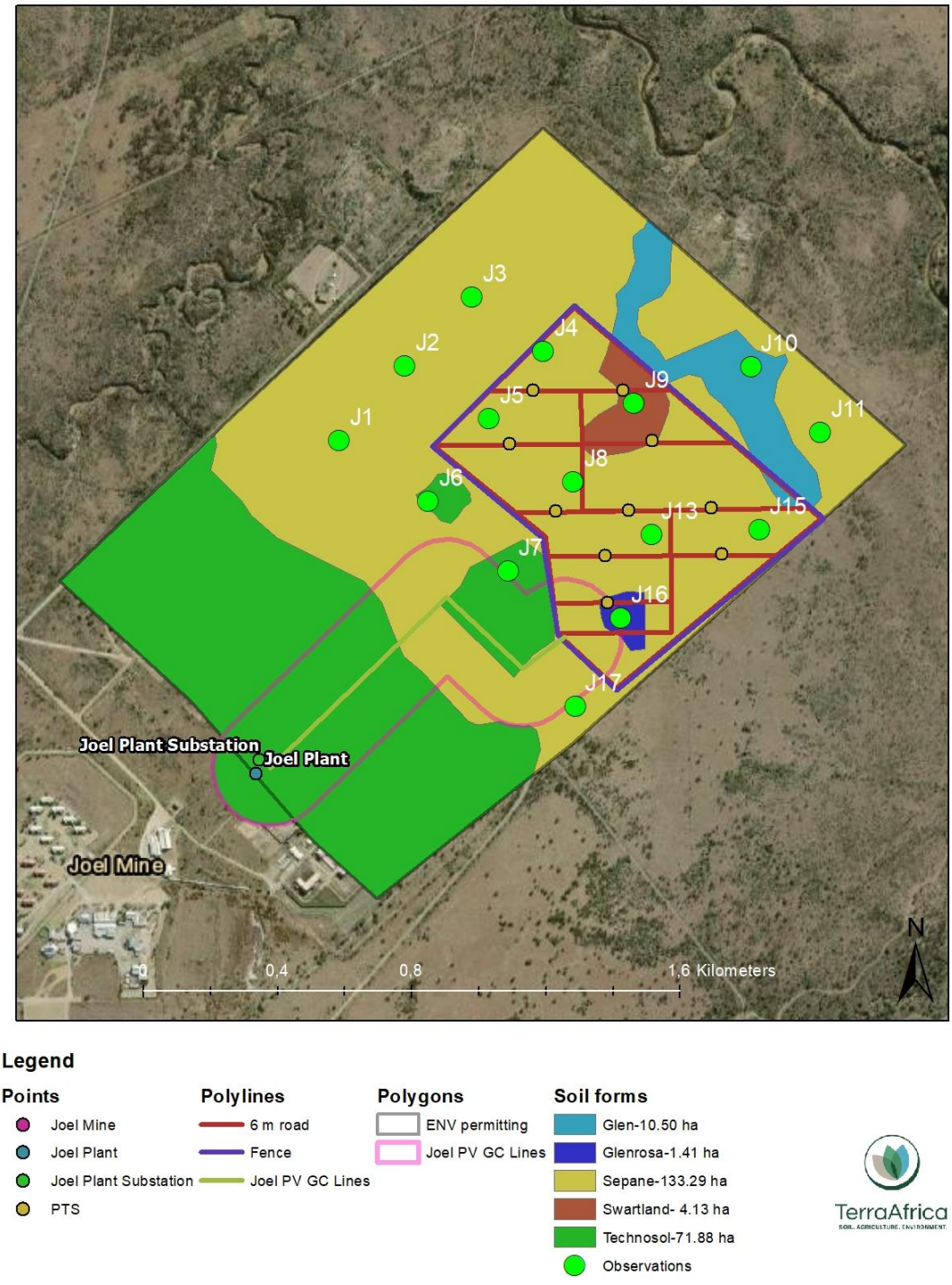

Figure 4 Soil classification map of the Joel PV Facility project area

Glen soils

The Glen horizon (Figure 5) was found in the center of the study areas and covered approximately 10.50 ha. The Glen consists of a vertic horizon overlying a pedocutanic horizon. The vertuc horizon had clear slickensides and had a strong structure. Additionally, 10 mm vertical cracks are present as defined for the vertic horizon.

Figure 5 Glen soil form

Glenrosa

The Glenrosa soil form (Figure 6) was only found in a small area and covered approximately 1.41 ha. The Glenrosa consists of an orthic A overlying a lithic horizon. The lithic is defined as saprlithic ((weathered in place from igneous or metamorphic rock and usually overlain by soil and exhibiting some properties of rock.) The Glenrosa had shallow soil depths which only reached 0.2m. The Glenrosa soil form is not ideal for cultivation as the freely drainable depth of the soil is to shallow.

Figure 6 Glenrosa soil form

Swartland

The Swartland soil (Figure 7) is found in the northeastern side of the study area and covered approximately 4.13 ha. The Swartland soil consist of an orthic horizon overlying a pedocutanic horizon with a lithic underneath. The pedocutanic is dry and had a moderate structure, with cutans present. The Lithic of the Swartland is saprolithic as defined for the Glenrosa soil form. The depth of the Swartland was moderate with the pedocutanic having a depth of 0.6m whereafter the lithic was found. The Swartland is not an optimal agricultural soil as the clay content of the pedocutanic would be too high, with infiltration being the main concern.

Figure 7 Swartland soil form showing pedocutanic characteristics

Sepane

The Sepane soil form (**Error! Reference source not found.**) is found throughout the study area and is the soil form most found in the development area (133.29 ha). The Sepane soil consists of an orthic horizon, overlying a pedocutanic horizon with a gleyic underneath. The peducutanic had a moderate structure with cutans present. The gleyic horizon was found between 0.7 and 1 m and had a moderate structure with grey colours on the external surfaces. The gleyic horizon is an indication of low-moderate water saturation. Thus, the soil is not recommended for agricultural use as water logging could be a risk as the gleyic was found between 0.7 and 1 m.

Figure 8 Example of the Sepane soil form

Technosol

Technosol covers the second largest area (71.88 ha) and was found in the southern parts of the development area. The Technosol/Johannesburg (Figure 9) are urban technosols consisting of material present in an urban environment where significant areas are disturbed or covered by means of constructions including but not limited to, roads, buildings, sport fields and waste dumps. Technosols are not recommended for agricultural use. The Technosols found in the development area is highly disturbed with stockpiles.

Figure 9 Technosol soil form

10.2 Land capability

The position of the different land capability classes within the development area are depicted in Figure 10.

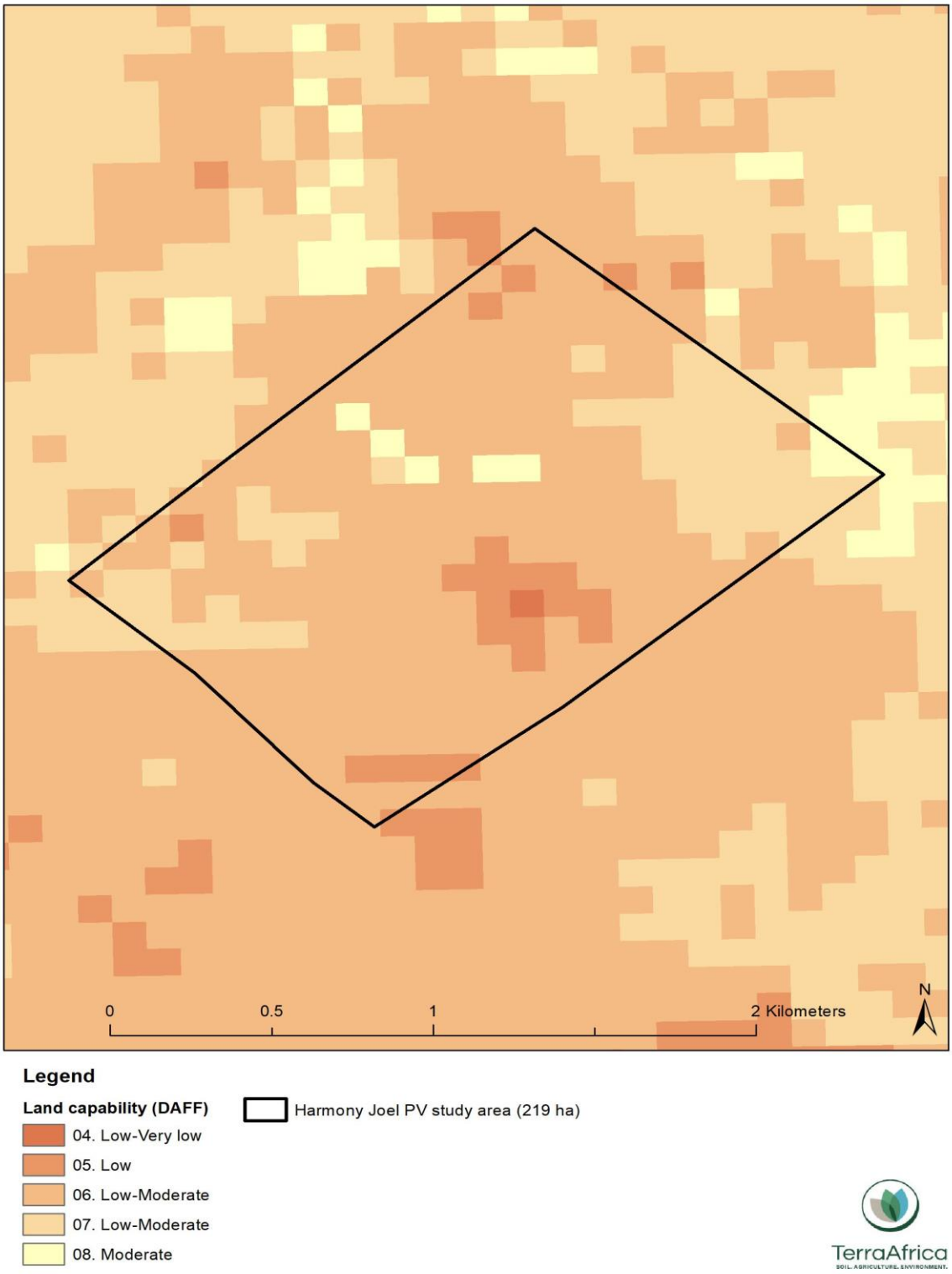

Figure 10 Land capability classification of the Joel PV Facility development area (data source: DALRRD, 2016)

The largest part of the Joel PV Facility development area consists of land with Low-Moderate (Class 06 and 07) land capability. This land capability class is present within the entire center boundary of the development area while the eastern and northwestern section of the boundary consists of land with Moderate (Class 08) land capability. Low (Class 05) land capability is found in the center of the development area.

10.3 Verified land capability

Following the classification of the soil and the consideration of the soil properties and limiting factors to rainfed crop production, the land capability within the development area was determined. The calculated land capability of the area is depicted in Figure 11 and was calculated using Terrain, Soil and Climate capabilities. The low land capabilities are mainly contributed to the Low-Moderate (Class 04) climate capability.

The largest part of the total area assessed, has Low-Moderate land capability (143.79ha). Low-Moderate land capability has been assigned to the Sepane and Glen soil form. Low (05) land capability (5.54ha) was assigned to the Glenrosa and Swartland soil forms as these soils had a shallow depth and a lithic horizon restricting infiltration. Low-very low (04) land capability was assigned to the Technosol/Johannesburg soils as these soils are not recommend for agricultural use due to the disturbance.

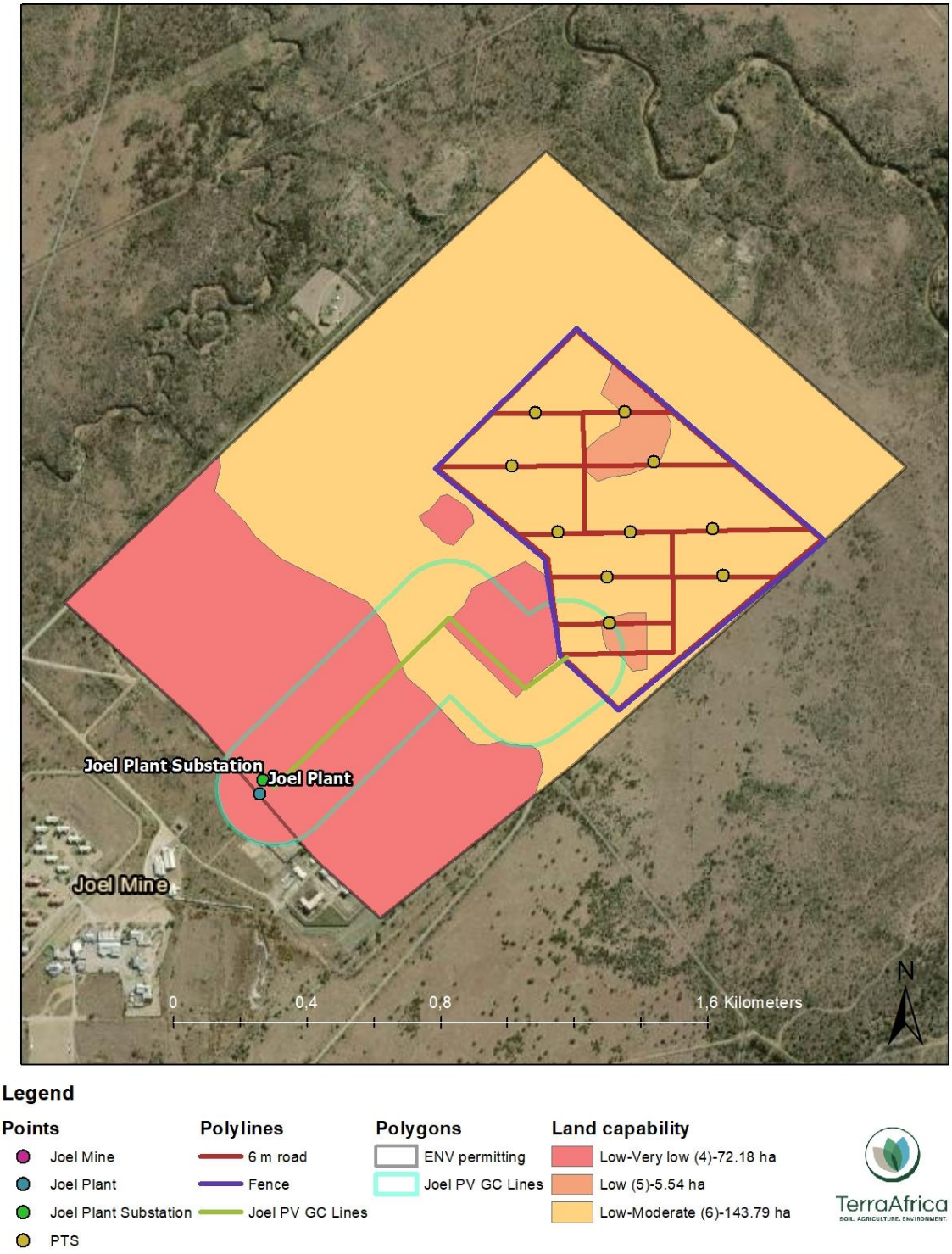

Figure 11 Land capability for the Proposed Joel PV Facility Project

Following the metadata layer obtained from DALRRD, the long-term grazing capacity of the entire project area is 6 ha/LSU (see Figure 13). 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 several hectares per LSU (ha/LSU) (DALRRD, 2018).

Using the long-term grazing capacity of 6ha/LSU, the Joel PV Facility development footprint and connection corridor of 220 ha can provide forage to 36 head of cattle. The grazing capacity is moderate in comparison to the grazing capacity of the rest of the country. The grass cover shows no signs of regular grazing and most of the area was dominated by shrubs and trees (Figure 12).

Figure 12 Grass cover of the development area.

The Low and Low-Moderate land capability of the soils within the development area is confirmed by the field crop boundaries area data of DALRRD (2019). No rainfed crops or old fields are found within the development area (Figure 14). During the site verification visit, it was confirmed that the area consists of grassland, shrubs, and trees and that there is no crop cultivation in the area.

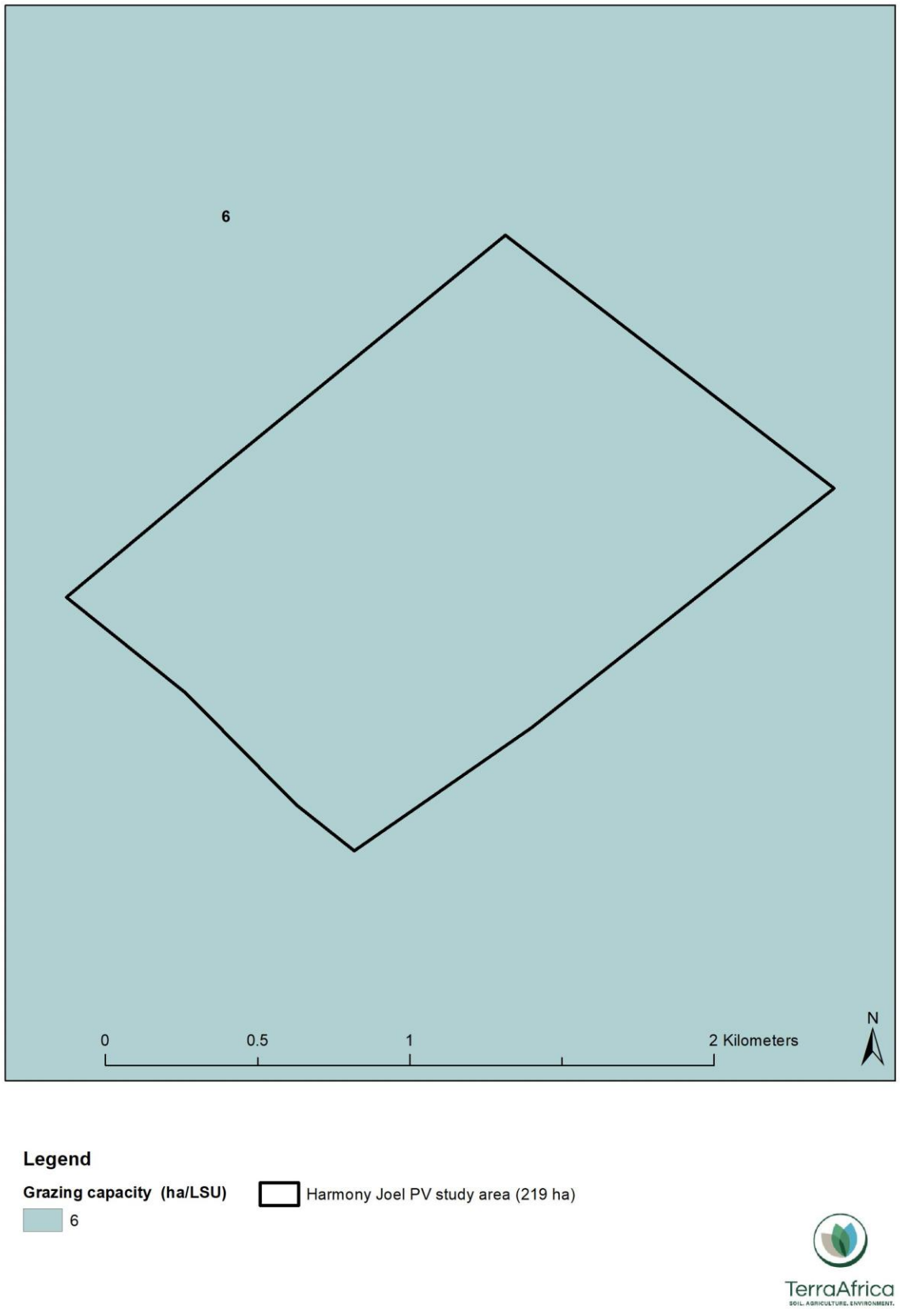

Figure 13 Grazing capacity of the proposed Joel PV Facility project area (data source: DALRRD, 2018).

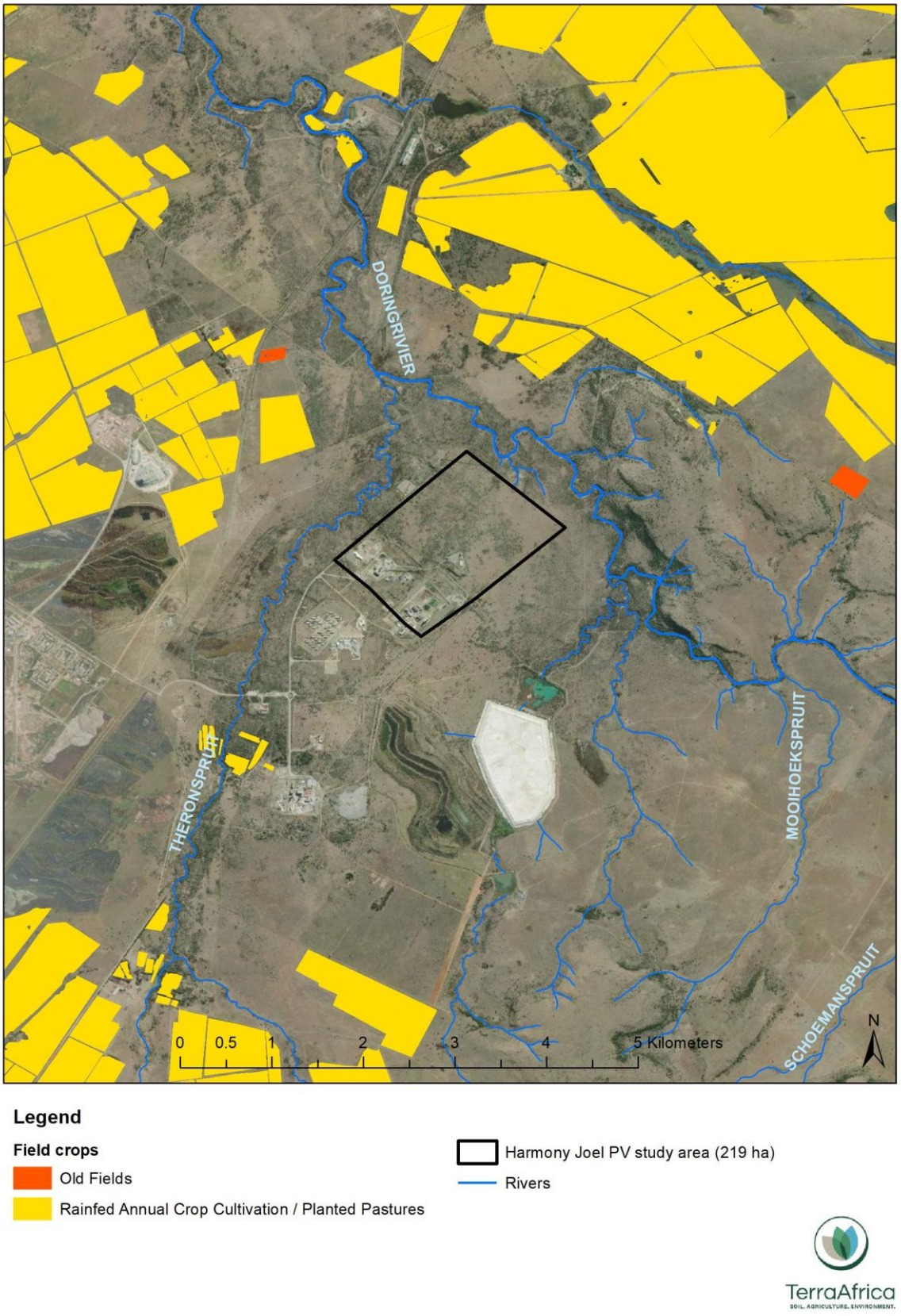

Figure 14 Location of field crop boundaries around the proposed Harmony Joel PV facility project area (data source: DALRRD, 2019)

10.4 Sensitivity analysis

Following the consideration of all the desktop and gathered baseline data above, the findings of the report are not the same as the Environmental Screening Tool. The soil forms present within the project area are mainly of the Sepane and Technosol/Johannesburg soil forms, which has a Low-Moderate (06) and Low-Very low (04) land capability respectively. The area has historically not been used for crop production recently, as confirmed by the data of DALRRD (2019) (see Figure 14). No irrigation infrastructure, such as centre pivots or drip irrigation, are present within the project area and irrigated agricultural is currently not practiced in the area.

The area is not currently used for livestock farming although the Proposed Joel PV Facility project area can support 36 head of cattle at the long-term grazing capacity of 6ha/LSU (DALRRD, 2018). Considering the soil properties, land capability and Calculated land capability of the development area, the area is defined as having a **Low Agricultural Sensitivity** (see Figure 15**)**. Soil in the project area will have Low sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction, and pollution. The significance of the impacts and mitigation measures proposed are discussed in **Section 11**.

Following the sensitivity delineation of the development area, the allowable development limit for the development footprint of 47ha, was calculated. The allowable development limit for areas outside crop field boundaries were used. The results of the calculations are provided in Table 2 below.

Table 2 Calculated allowable development limits of the development footprint

Sensitivity class	Area that will be affected by development footprint (ha)	Allowable limit (ha/MW)	Area allowed for a 18MW development (ha)	Area that exceeds allowable limit (ha)
Medium	0	0.35	0	0
Low	47	2.50	45	2

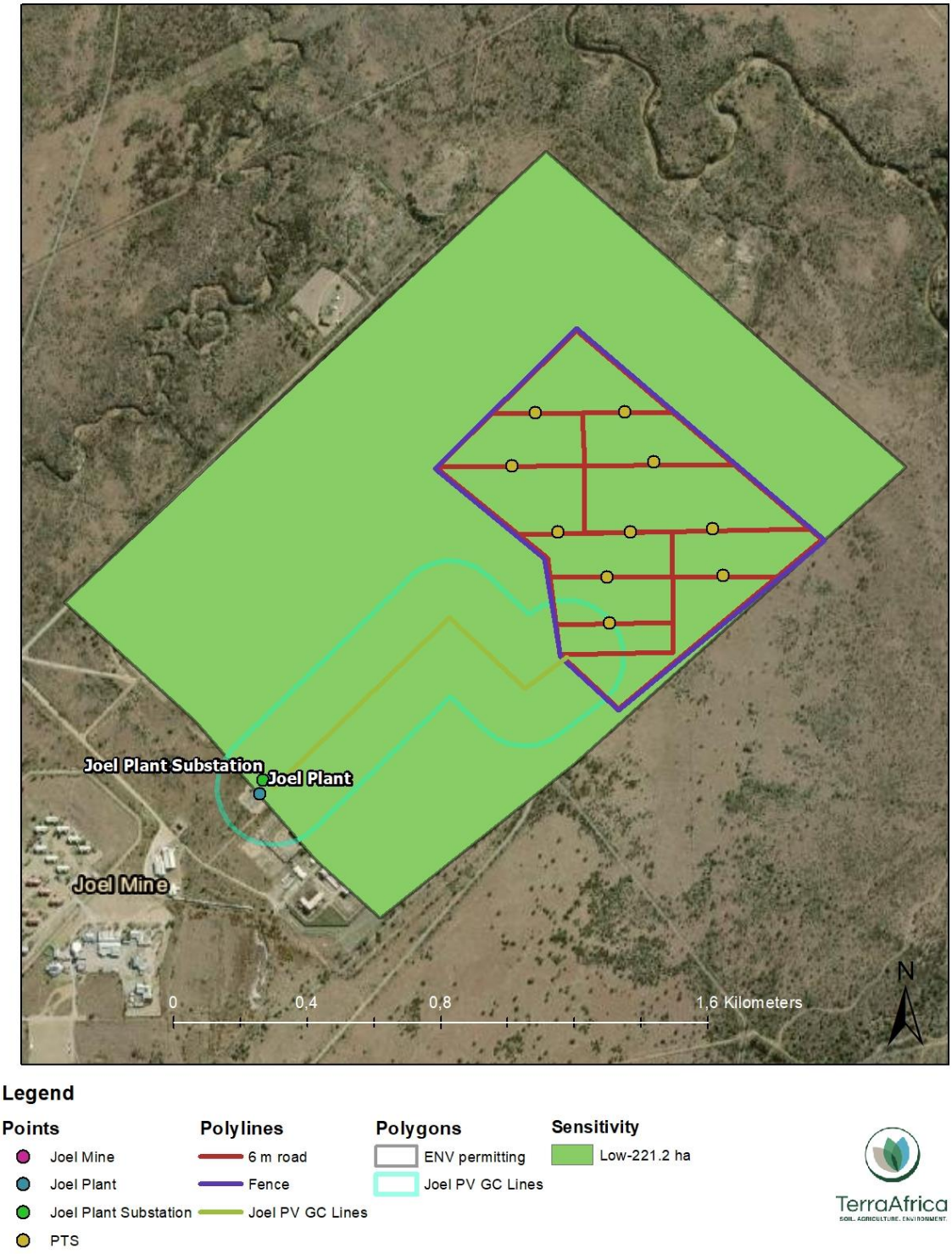

Figure 15 Agricultural sensitivity rating of the proposed Joel PV Facility project area

11. Impact assessment

11.1 Project description

A project site considered to be technically suitable for the development of the solar PV facility, with an extent of approximately 1000ha, was identified. A development area of ~220ha was demarcated within this project site and allows an adequate footprint (~47ha) for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities.

The infrastructure associated with the 18MW solar PV facility will include:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Grid connection solution including an on-site facility substation, switching station, to be connected to the Shafts 1 & 2 HJ Joel Mining Substation via an overhead power line (located ~830m south west of the development footprint).

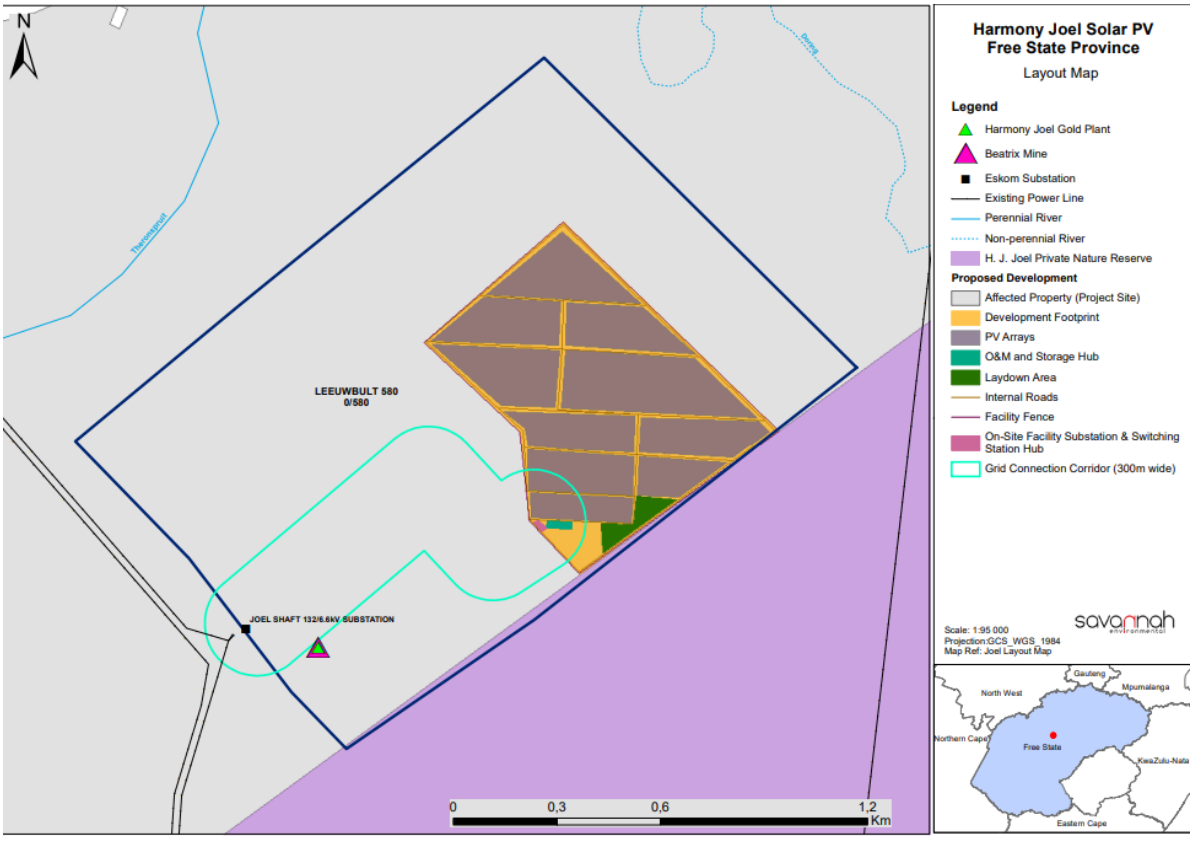

Figure 16 Layout of the Joel PV Facility's infrastructure

11.2 Impact significance rating

The most significant impacts of the proposed project on soil and agricultural productivity will occur during the construction phase when the vegetation is removed, and the soil surface is

prepared for the delivery of materials and assembly of the infrastructure. During the operational phase, the risk remains that soil will be polluted by the waste generated or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface.

Below follows the rating of the significance of each of the impacts for each of the project phases.

11.2.1 Construction phase

Impact: Change in land use from livestock grazing to energy generation

Nature: Prior to construction of the project infrastructure, the PV development area will be fenced off and livestock farming will be excluded from the development footprint area.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium duration (3)	Medium duration (3)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (4)	Definite (4)
Significance	**Medium (40)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	N/A
Mitigation: • Vegetation clearance must be restricted to areas where infrastructure is constructed. • No materials removed from development area must be allowed to be dumped in nearby livestock farming areas. • All left-over construction material must be removed from site once construction on a land portion is completed. • No open fires made by the construction teams are allowable during the construction phase.		
Residual Impacts: The residual impact from the construction of the Joel PV Facility and Associated Infrastructure is considered medium.		
Cumulative Impacts: Any additional infrastructure development in support of the Joel PV Facility, will result in additional areas where grazing veld will be disturbed.		

Impact: Soil erosion

Nature: All areas where vegetation is removed from the soil surface in preparation for the infrastructure construction will result in exposed soil surfaces that will be prone to erosion. Both wind and water erosion are a risk, as the area falls within a region that experiences thunderstorms in the summer months and sometimes strong winds during the dry winter months, especially August and September.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low

Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A
Mitigation: • Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint; • Unnecessary land clearance must be avoided; • Level any remaining soil removed from excavation pits (where the PV modules will be mounted) that remained on the surface, instead of allowing small stockpiles of soil to remain on the surface; • Where possible, conduct the construction activities outside of the rainy season; and • Stormwater channels must be designed to minimise soil erosion risk resulting from surface water runoff.		
Residual Impacts: The residual impact from the construction and operation of the project on the susceptibility to erosion is considered low.		
Cumulative Impacts: Any additional infrastructure development in support of the project will result in additional areas exposed to soil erosion through wind and water movement.		

Impact: Soil compaction

Nature: The clearing and levelling of land for construction of the infrastructure will result in soil compaction. In the area where the access roads and substation will be constructed, topsoil will be removed, and the remaining soil material will be deliberately compacted to ensure a stable surface prior to construction.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A
Mitigation: • Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint; • Unnecessary land clearance must be avoided; • Materials must be off-loaded and stored in designated laydown areas; • Where possible, conduct the construction activities outside of the rainy season; and • Vehicles and equipment must park in designated parking areas.		
Residual Impacts: The residual impact from the construction and operation of the project on soil compaction is considered low.		
Cumulative Impacts: Any additional infrastructure development in support of the project, will result in additional areas exposed to soil compaction.		

Impact: Soil pollution

During the construction phase, construction workers will access the land for the preparation of the terrain and the construction of the thermal plant and access road. Potential spills and leaks from construction vehicles and equipment and waste generation on site can result in soil pollution.

Nature: The following construction activities can result in the chemical pollution of the soil:

1. Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation;
2. Spills from vehicles transporting workers, equipment, and construction material to and from the construction site;
3. The accidental spills from temporary chemical toilets used by construction workers;
4. The generation of domestic waste by construction workers;
5. Spills from fuel storage tanks during construction;
6. Pollution from concrete mixing;
7. Pollution from road-building materials; and
8. Any construction material remaining within the construction area once construction is completed.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Any waste generated during construction must be stored into designated containers and removed from the site by the construction teams;
- Any left-over construction materials must be removed from site;
- The construction site must be monitored by the Environmental Control Officer (ECO) to detect any early signs of fuel and oil spills and waste dumping;
- Ensure battery transport and installation by accredited staff / contractors; and
- Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.

Residual Impacts:

The residual impact from the construction and operation of the proposed project will be low to negligible.

Cumulative Impacts:

Any additional infrastructure that will be constructed to strengthen and support the operation of the Joel PV facility and waste not removed to designated waste sites will increase the cumulative impacts associated with soil pollution in the area.

11.2.2 Operational phase

Impact: Soil erosion

During the operational phase, staff and maintenance personnel will access the project area daily. The following impacts on soil are expected for this phase:

Nature: The areas where vegetation was cleared will remain at risk of soil erosion, especially during a rainfall event when runoff from the cleared surfaces will increase the risk of soil erosion in the areas directly surrounding the project area.

	Without mitigation	**With mitigation**

Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A
Mitigation: • The area around the project, including the internal access roads, must regularly be monitored to detect early signs of soil erosion on-set; and • If soil erosion is detected, the area must be stabilised using geo-textiles and facilitated re-vegetation.		
Residual Impacts: The residual impact from the operation of the project on the susceptibility to erosion is considered low.		
Cumulative Impacts: Any additional infrastructure that will be constructed to strengthen and support the operation of the project will result in additional areas exposed to soil erosion through wind and water movement.		

Impact: Soil pollution

Nature: During the operational phase, potential spills and leaks from maintenance vehicles and equipment and waste generation on site can result in soil pollution. Also, any spillages around the workshop area or damaged infrastructure, such as inverters and transformers, can be a source of soil pollution.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A
Mitigation: • Maintenance must be undertaken regularly on all vehicles and maintenance machinery to prevent hydrocarbon spills; • No domestic and other waste must be left at the site and must be transported with the maintenance vehicles to an authorised waste dumping area; and • Regularly monitor areas alongside the roads, parking area and workshop for any signs of oil, grease and fuel spillage or the presence of waste.		
Residual Impacts: The residual impact from the operation of the proposed project will be low to negligible.		
Cumulative Impacts: The operation of any additional infrastructure to strengthen and support the operation of the Joel PV facility and waste not removed to designated waste sites will increase the cumulative impacts associated with soil pollution in the area.		

11.2.3 Decommissioning phase

The decommissioning phase will have the same impacts as the construction phase i.e. soil erosion, soil compaction and soil pollution. It is anticipated that the risk of soil erosion will

especially remain until the vegetation growth has re-established in the area where the project infrastructure was decommissioned.

11.3 Cumulative impact assessment and rating

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[1].

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section should address whether the construction of the proposed project will result in:

- unacceptable risk;
- unacceptable loss;
- complete or whole-scale changes to the environment or sense of place; and
- unacceptable increase in impact.

The proposed project will be located within a 50km radius of three PV facilities and Co-Generation Facility that already have been granted Environmental Authorisation (see Figure 17). These PV facilities are:

- Beatrix Mine Shaft 4 PV Facility
- Beatrix Mine Shaft 2 PV Facility
- Sonvanger PV Facility
- Beatrix Mine Shaft 4 Co-Generation Facility

The cumulative impacts of the proposed project in addition to the authorised solar developments are rated and discussed below.

Table 3 Assessment of cumulative impact of decrease in areas available for livestock farming

Nature: Decrease in areas with suitable land capability for cattle farming.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Short duration - 2-5 years (2)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly likely (4)	Highly likely (4)
Significance	**Low (28)**	**Medium (40)**
Status (positive/negative)	Negative	Negative

[1] Unless otherwise stated, all definitions are from the EIA Regulations 2014 (GNR 326).

Reversibility	High	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Confidence in findings: High.		
Mitigation: The only mitigation measure for this impact is to keep the footprints of all renewable energy facilities as small as possible and to manage the soil quality by avoiding far-reaching soil degradation such as erosion.		

Table 4 Assessment of cumulative impact of areas susceptible to soil erosion

Nature: Increase in areas susceptible to soil erosion		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (33)**
Status (positive/negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Confidence in findings: High.		
Mitigation: Each of the projects should adhere to the highest standards for soil erosion prevention and management, as defined in Sections 11.2.1 and 11.2.2. above.		

Table 5 Assessment of cumulative impact of areas susceptible to soil compaction

Nature: Increase in areas susceptible to soil erosion		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive/negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Confidence in findings: High.		
Mitigation: Each of the projects should adhere to the highest standards for soil compaction prevention and management, as defined in Sections 11.2.1 and 11.2.2 above.		

Table 6 Assessment of cumulative impact of increased risk of soil pollution

Nature: Increase in areas susceptible to soil pollution

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (30)**
Status (positive/negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Confidence in findings: High.		
Mitigation: Each of the projects should adhere to the highest standards for soil pollution prevention and management, as defined in Sections 11.2.1 and 11.2.2. above.		

12. Mitigation and management measures

The objective of the mitigation and management measures presented below is to reduce the risk of soil degradation that will in turn affect the ability of soils within the project site to support the natural vegetation and provide ecosystem services.

Prevention and management of soil erosion:

Project component/s	• Construction of infrastructure • Construction of the access road
Potential Impact	Soil particles can be removed from the area through wind and water erosion
Activity/risk source	The removal of vegetation in areas where infrastructure will be constructed.
Mitigation: Target/Objective	To avoid the onset of soil erosion that can spread into other areas

Mitigation: Action/control	**Responsibility**	**Timeframe**
• Limit vegetation clearance to only the areas where the surface infrastructure will be constructed. • Avoid parking of vehicles and equipment outside of designated parking areas. • Plan vegetation clearance activities for dry seasons (late autumn, winter and early spring). • Design and implement a Stormwater Management System where run-off from surfaced areas is expected.	Environmental Officer / SHEQ division	During the entire construction, operational and decommissioning phases

• Re-establish vegetation along the access road to reduce the impact of run-off from the road surface.		

Performance Indicator	No visible signs of soil erosion around the project infrastructure
Monitoring	• Regular inspections around the constructed infrastructure to detect early signs of soil erosion developing. • When signs of erosion are detected, the areas must be rehabilitated, using a combination of geo-textiles and re-vegetation to prevent the eroded area(s) from expanding.

Prevention and management of soil pollution:

Project component/s	• Construction of infrastructure • Daily activities and maintenance during the operational phase
Potential Impact	Potential fuel and oil spills from vehicles and waste generation can cause soil pollution.
Activity/risk source	• Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation. • Spills from vehicles transporting workers, equipment, and construction material to and from the construction site. • The accidental spills from temporary chemical toilets used by construction workers. • The generation of domestic waste by construction workers. • Spills from fuel storage tanks during construction. • Pollution from concrete mixing. • Pollution from road-building materials. • Any construction material remaining within the construction area once construction is completed. • Containment breaches related to the battery units and any inadvertent chemical exposure therefrom.
Mitigation: Target/Objective	To avoid soil pollution that can harm the surrounding environment and human health.

Mitigation: Action/control	**Responsibility**	**Timeframe**
• Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills. • Any waste generated during construction must be stored in designated containers and removed from the site by the construction teams. • Any left-over construction materials must be removed from site. • Ensure battery transport and installation by accredited staff / contractors.	Environmental Officer / SHEQ division	During the entire construction, operational and decommissioning phases

• Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.		

Performance Indicator	• No visible signs of waste and spills within the project site. • No accumulation of contaminants in the soils of the project site.
Monitoring	• Regular inspections of vehicles and equipment that enter the project site. • Analysis of soil samples around high-risk areas to determine whether soil contaminants are present. • In the case that soil pollution is detected, immediate remediation must be done.

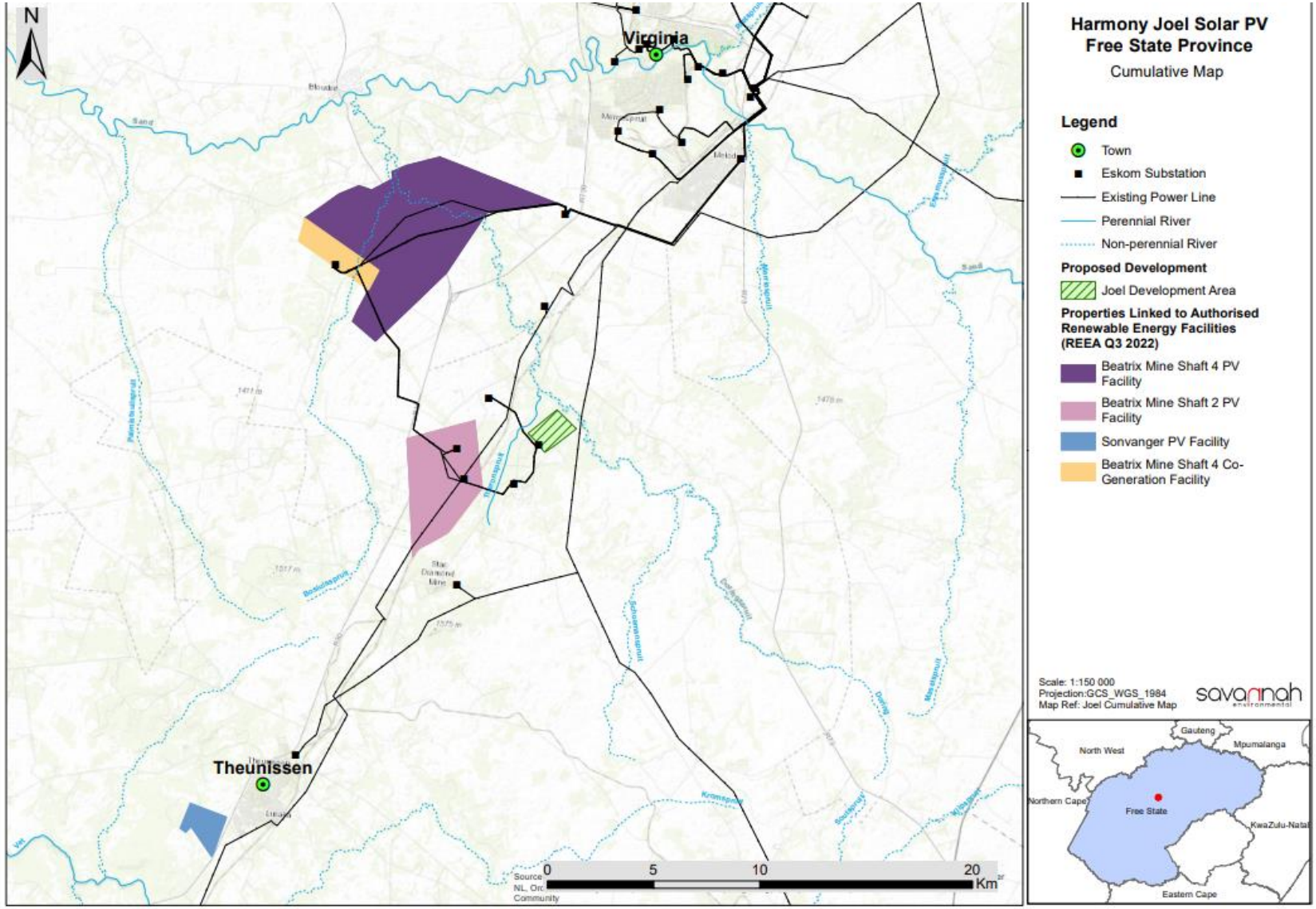

Figure 17 Renewable energy projects within a 50km radius around the proposed Joel PV Facility (source: Savannah Environmental, 2022)

13. Acceptability statement

Following the data analysis and impact assessment above, the proposed Joel PV Facility and Associated Infrastructure is considered an acceptable development within the development footprint area that was assessed for the purpose of compiling the Agricultural Assessment Report.

The soil forms present within the development footprint consist mostly of Sepane soil form which has a Low-Moderate (06) land capability. All soils are assigned Low sensitivity to the proposed development due to absence pf any no rainfed or irrigated crop production within the development footprint. There is also no irrigation infrastructure, such as centre pivots or drip irrigation, present within the project area. The grazing capacity (according to DALRRD, 2018), is 6ha/LSU, indicating that the proposed development area of 220ha has forage to feed 36 head of cattle.

I confirm that all reasonable measures have been taken to avoid or minimize fragmentation and disturbance of agricultural activities, provided that the mitigation measures provided in this report are implemented.

It is my professional opinion that this application be considered favorably, permitting that the mitigation measures are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The project infrastructure should also remain within the proposed project area that will be fenced off. It is also my recommendation that the project be authorised, even though the allowable development limit is exceeded with 2ha. The 2ha exceedance is located on land with Low agricultural sensitivity and no crop production will be affected by it.

14. Reference list

Crop Estimates Consortium, 2019. *Field crop boundary data layer (FS province)*, 2019. Pretoria. Department of Agriculture, Land Reform and Rural Development.

Department of Agriculture, Land Reform and Rural Development, 2019. *High potential agricultural areas 2019 – Spatial data layer*, *Free State Province*, 2021. Pretoria.

Department of Agriculture, Land Reform and Rural Development, 2018. *Long-term grazing capacity for South Africa*: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.

Department of Agriculture, Land Reform and Rural Development, 2016. *National land capability evaluation raster data: Land capability data layer*, 2016. Pretoria.

Land Type Survey Staff, 1972 – 2006. *Land Types of South Africa data set*. ARC – Institute for Soil, Climate and Water. Pretoria.

The Soil Classification Working Group, 2018. *Soil Classification – Taxonomic System for South Africa.* Dept. of Agric., Pretoria.

APPENDIX 1 – DECLARATION OF INDEPENDENCE AND SPECIALIST DETAILS

To be inserted by Savannah

APPENDIX 2 - CURRICULUM VITAE OF SPECIALIST

MARINÉ PIENAAR

Specialist Scientist

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Wolmaransstad,
South Africa

EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
Environmental Science
University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution

Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment

Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

MARINÉ PIENAAR
Specialist Scientist

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

♦

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

♦

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

MARINÉ PIENAAR

Specialist Scientist

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101 Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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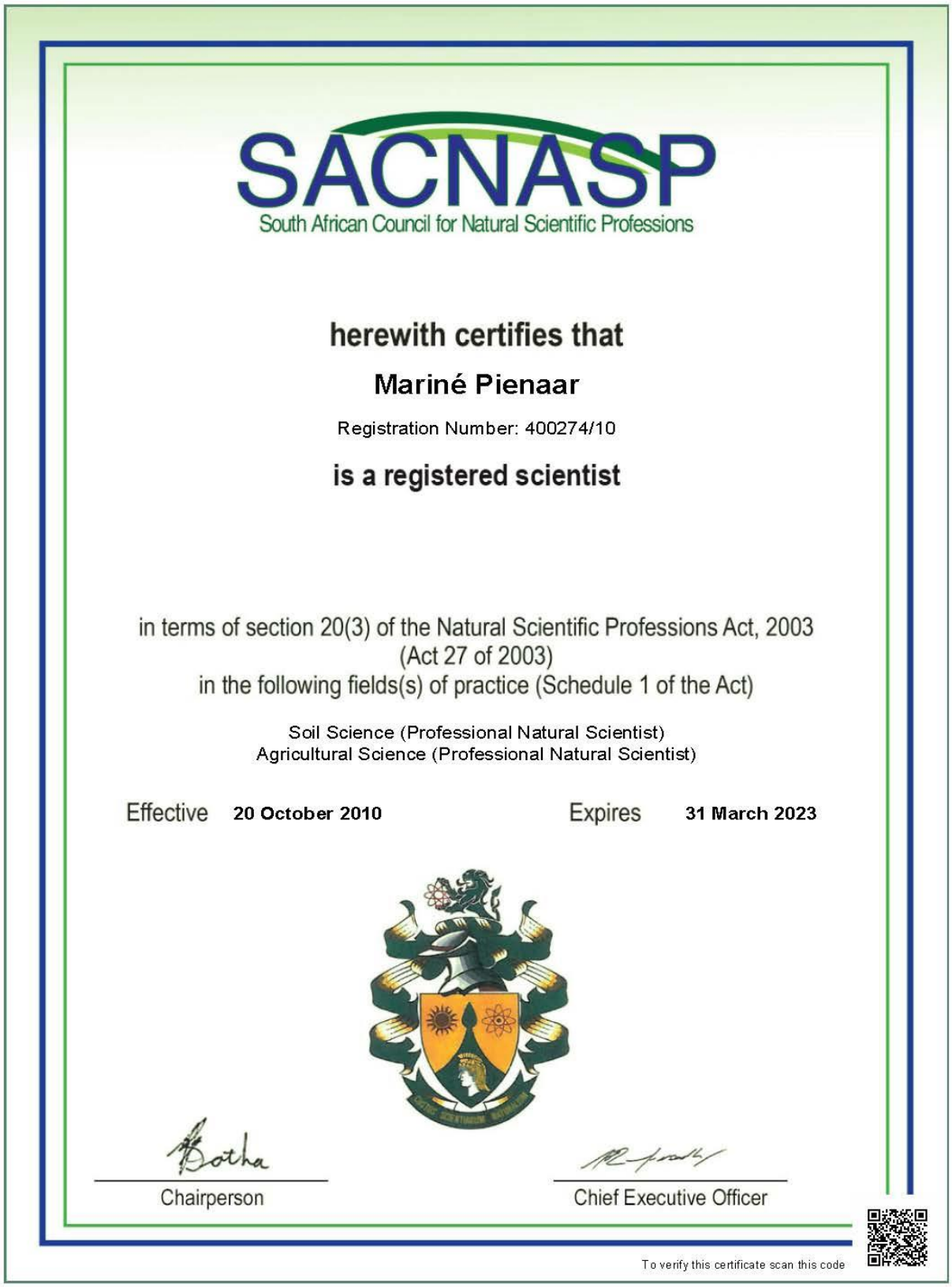
APPENDIX 3 – PROOF OF SACNASP REGISTRATION OF SPECIALIST



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Mariné Pienaar

Registration Number: 400274/10

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Soil Science (Professional Natural Scientist)
Agricultural Science (Professional Natural Scientist)

Effective **20 October 2010** Expires **31 March 2023**

Chairperson

Chief Executive Officer

To verify this certificate scan this code