EIA REPORT

On contract research for

SiVEST

SOIL INFORMATION FOR GRID CONNECTIONS FOR SITE 2 OF THE PROPOSED TLISITSENG SOLAR ENERGY PLANT, NEAR LICHTENBURG, NORTH WEST PROVINCE

By

D.G. Paterson (Pr. Sci. Nat. 400463/04)

Report No. GW/A/2016/xx

March 2017

ARC • LNR

ARC-Institute for Soil, Climate and Water,
Private Bag X79, Pretoria 0001, South Africa

Tel (012) 310 2500 Fax (012) 323 1157

DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

D G Paterson
February 2016

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1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by SiVEST to undertake a soil investigation near Lichtenburg, in the North West Province, where a solar power (PV) project is proposed. The objectives of the study are;

- To obtain all existing soil information and to produce a soil map of the specified area as well as

- To assess broad agricultural potential and the impacts thereon.

2. SITE CHARACTERISTICS

2.1 Location

An area was investigated lying approximately 10 km to the north of the town of Lichtenburg. The area lies between 26° 03′ and 26° 06′ S and between 26° 05′ and 26° 09′ E. Within this area, two separate possible sites for the establishment of the solar power project have been identified. For each of the possible sites, a proposed grid connection, consisting of a substation within the site and power lines to connect the PV plant to the existing Watershed substation to the south-east, have been identified.

This report deals with the proposed grid connection corridor for ***Site 2***, which is identified in blue on the locality map (Figure 1). The two proposed substation sites are shown in black. The PV sites themselves are is also shown, but not coloured in.

2.2 Terrain

The area lies at a height of approximately 1 500 metres above sea level. The area slopes very gently (<2%) to the south-west). No permanent drainageways are present in the vicinity.

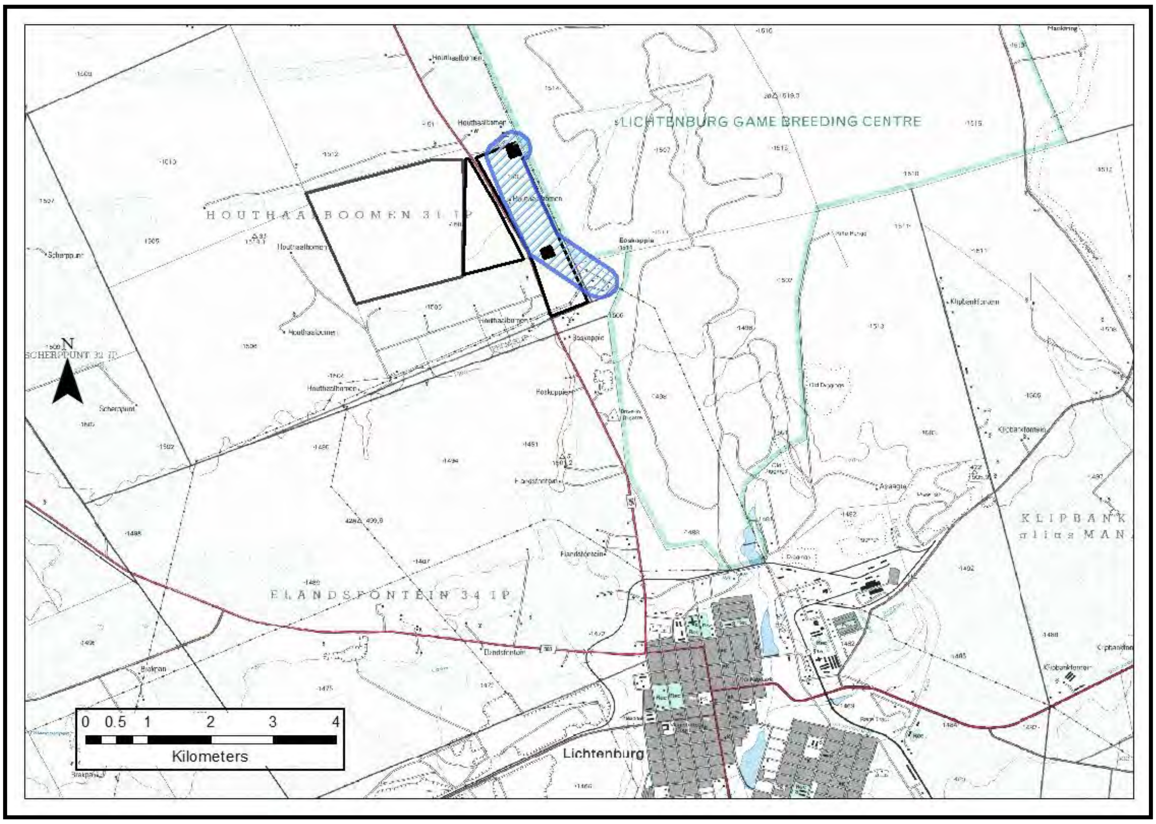

Figure 1 Locality map

2.3 Climate

The climate of the study area (Kotze & Lonergan, 1984) can be regarded as warm to hot with moist summers and dry winters. The long-term average annual rainfall is 545 mm, of which 452 mm, or 83%, falls from October to March. The average evaporation over the same period is 2 335 mm. Temperatures vary from an average monthly maximum and minimum of 31.1°C and 16.2°C for January to 17.6°C and 2.0°C for July respectively. The extreme high temperature that has been recorded is 36.0°C and the extreme low −4.1°C.

2.4 Parent Material

The geology of the area comprises dolomite of the Malmani Formation (Geological Survey, 1984).

The distribution of the geological units in the area is shown in Figure 2.

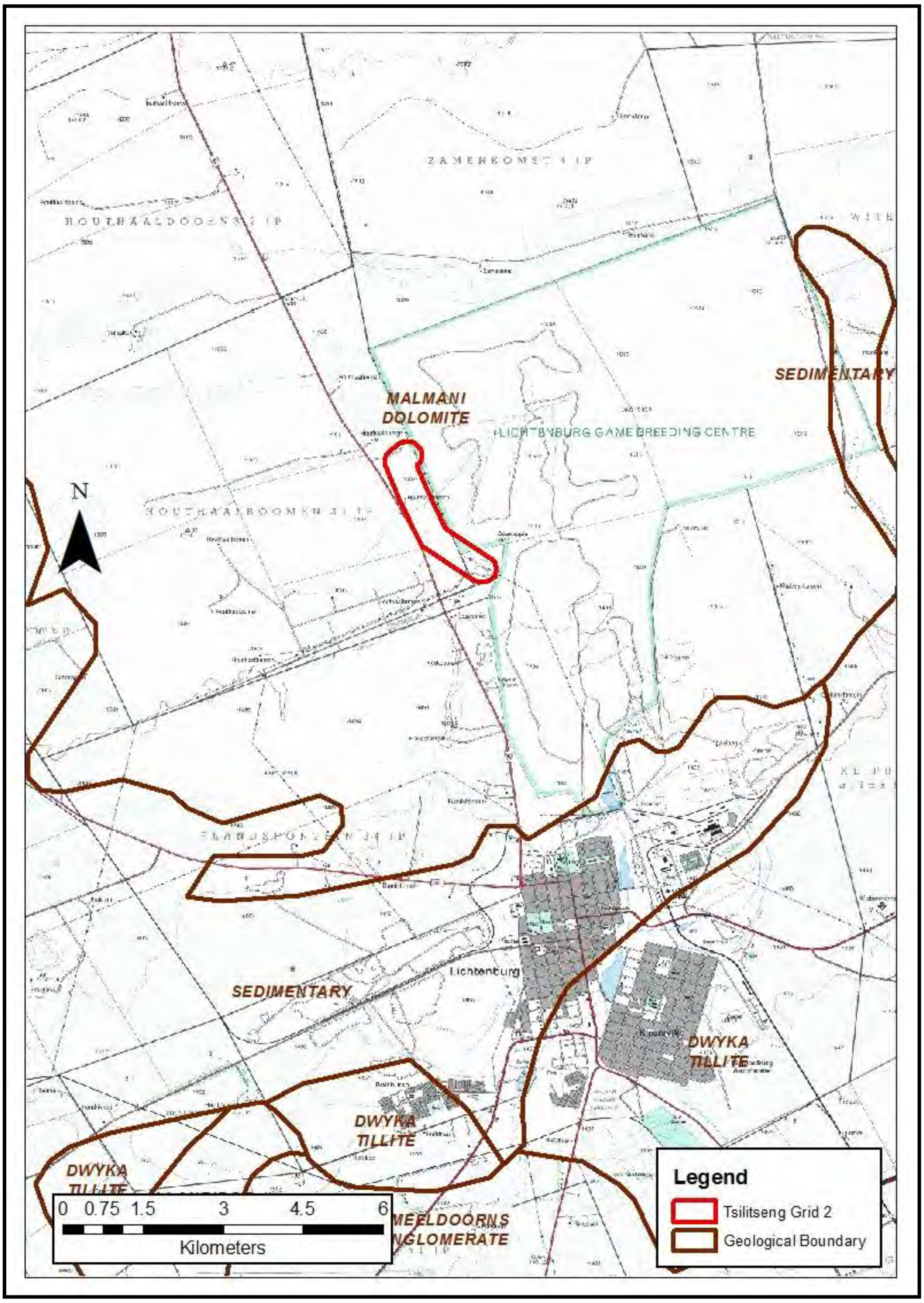

Figure 2 Geology

3. METHODOLOGY - SOILS

Existing soil information was obtained from the map sheet 2626 West Rand (Bruce & Schoeman, 1978) from the national Land Type Survey, published at 1:250 000 scale.

For this second (EIA) phase of the study, a field trip (in conjunction with other specialists) was carried out whereby the soils at various localities within the area were investigated using a hand-held soil auger, in order to carry out a ground-truthing exercise. A reference grid of 250 x 250 m was established, using a GPS to locate points in the field, and selected points were visited to carry out a soil observation. This involved describing the main soil characteristics at each point, as well as classifying the soil according to the South African soil classification system (Soil Classification Working Group, 1991).

4. SOIL PATTERN

The desk-top study indicated that the soils in the vicinity of the project were generally shallow to very shallow (<500 mm), usually sandy loam and calcareous, overlying either rock or cemented hardpan calcrete. Some rock outcrops occur in places in the landscape. However, some areas of deeper red soils, which will have a higher agricultural potential, can also occur.

The soil investigation confirmed this, with virtually all of the soils observed being less than 450 mm onto hard or weathering rock. The soils are reddish-brown to brown, structureless to weakly structured and belong to the Mispah, Glenrosa and Hutton soil forms (Soil Classification Working Group, 1991).

The location of the points in the vicinity of the proposed grid connection corridor for Tsilitseng PV 1 that were visited during the field trip is shown in Figure 3. The PV site is shown in blue, with the grid corridor in orange and the proposed substation sites in black.

Within the grid corridor, a variation in soil depth was recorded. At point L130, the soil was deep (>1 m), and at points L64, L65 and L47, the soil was moderately deep (600-850 mm), with the other soils being shallow.

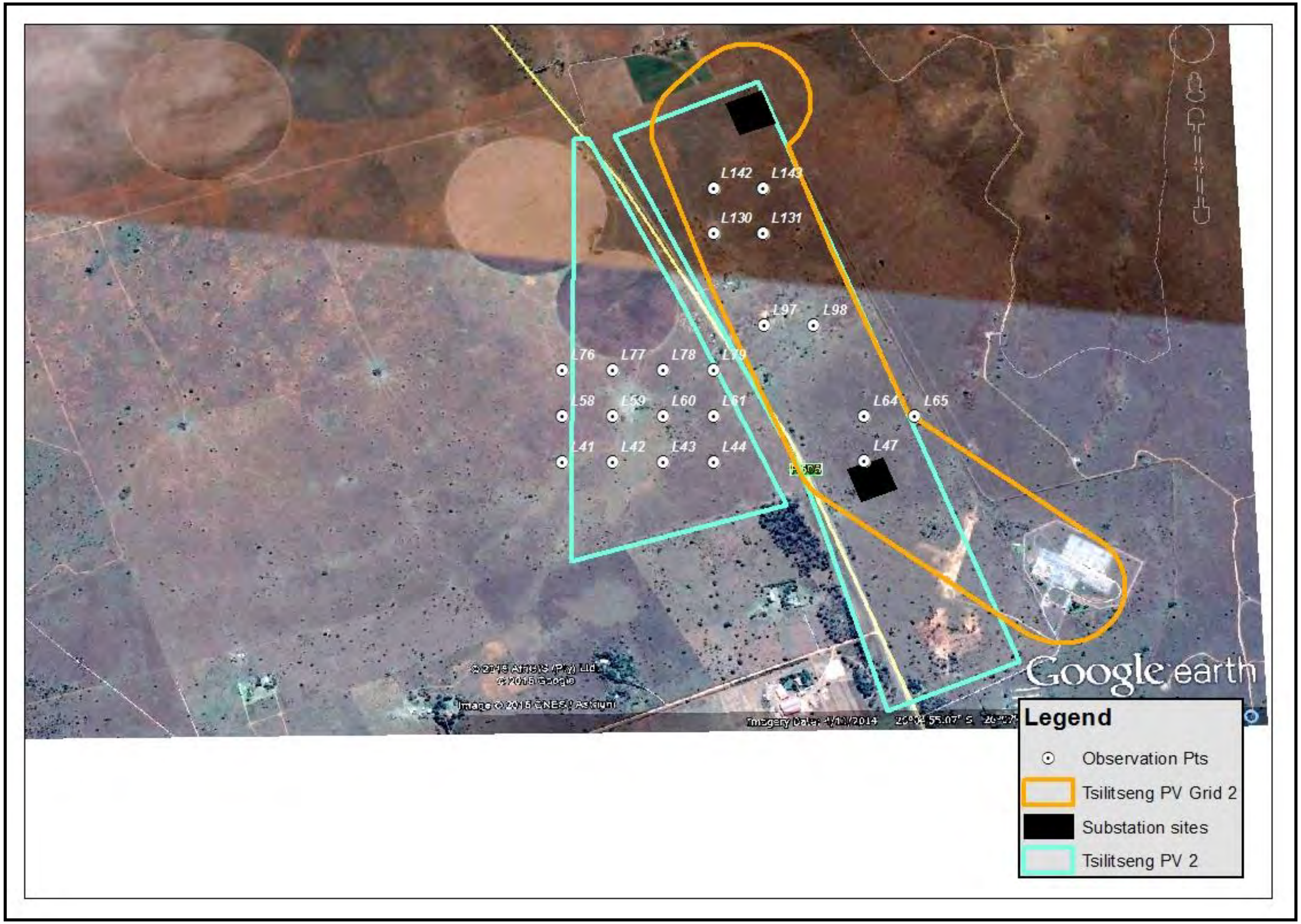

Figure 3 Soil observation points

5. AGRICULTURAL POTENTIAL

Although there are deeper soils that were observed in places, there is no evidence of cultivation along the rest of the corridor, suggesting that the deeper soils occur in patches and not as a large homogeneous unit. This type of depth variation is typical of many areas underlain by dolomite. Due to time and other organizational constraints, it was not possible to investigate all of the soils along the corridor as well as across the proposed PV site.

The climatic parameters (Section 2.3) mean that this part of North West is well suited for grazing but here the grazing capacity is relatively low, around 12 ha/large stock unit (ARC-ISCW, 2004).

5.1 Land Use

The land use in the area is dominantly grazing, but with limited areas of cultivation, some under irrigation as classified by the National Land Cover (Thompson, 1999).

6. IMPACTS

The Impact Assessment Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

6.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 1.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

6.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Description of terms

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		

1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects

INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
Significance		

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.

51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The impact can be summarized as follows:

Table 4 Rating of impacts (loss of potential)

IMPACT TABLE FORMAT		
Environmental Parameter	***Soil resources and associated agricultural potential***	
Issue/Impact/Environmental Effect/Nature	***The loss of agriculturally productive soil due to the establishment of the infrastructure of the PV project***	
Extent	*Confined to the **site only***	
Probability	*It is **probable** that impacts will occur*	
Reversibility	*The impact will in all probability be **partly to completely reversible** if the infrastructure is removed.*	
Irreplaceable loss of resources	***No loss** of irreplaceable resources.*	
Duration	***Long term**, for the operational life of the project*	
Cumulative effect	***Negligible to no** cumulative effects*	
Intensity/magnitude	***Low** to **medium** – not to any significant degree.*	
Significance Rating	*A brief description of the importance of an impact which in turn dictates the level of mitigation required*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	2	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	**-22 (negative low)**	**-10 (negative low)**

IMPACT TABLE FORMAT	
Mitigation measures	Due to the generally low potential agricultural environment, little or no mitigation measures are required. The footprint of the development should be kept to a minimum, so that at least the effect on grazing land for livestock is reduced.

Table 5 Rating of impacts (erosion hazard)

IMPACT TABLE FORMAT		
Environmental Parameter	***Increased hazard of soil erosion***	
Issue/Impact/Environmental Effect/Nature	***The loss of topsoil by being exposed to wind action due to construction processes***	
Extent	*Confined to the **site only**, but possibly in the broader vicinity, if not mitigated*	
Probability	*It is **probable** that impacts will occur*	
Reversibility	*The impact will in all probability be **partly to completely reversible** if the infrastructure is removed.*	
Irreplaceable loss of resources	***No loss** of irreplaceable resources.*	
Duration	***Long term**, for the operational life of the project*	
Cumulative effect	***Possible medium** cumulative effects*	
Intensity/magnitude	***Medium** – not to any significant degree, though some modification is possible*	
Significance Rating	*A brief description of the importance of an impact which in turn dictates the level of mitigation required*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	**-42 (negative medium)**	**-9 (negative low)**
Mitigation measures	The main mitigation would be to ensure that physical disturbance caused by soil removal and/or re-distribution is kept to a minimum. In such an area of low rainfall and hot conditions, vegetation is fragile and often difficult to re-establish. The loamy nature of the soils means that if	

IMPACT TABLE FORMAT	
	exposed, there is only a small hazard of soil removal by wind erosion, especially in the drier winter months. However, to combat this, any bare soil should be re-vegetated as soon as possible and preventative measures, such as soil covering and windbreaks, may also be required.

6.3 Cumulative Impacts

The main cumulative impact would be as a result of the fact that several solar power generation projects are planned in the vicinity of Lichtenburg (seven projects within an approximate 20 km radius). The ***soils*** on each site would not have an impact on any other site, but there would be a potential of increased dust production as a result of construction activities, especially in the drier months, when wind can cause soil particles to become detached from the bare soil surface. The main mitigation measures would include ensuring that the topsoil remains moist if possible, and that the construction footprint is as small as possible, with minimum soil surface disturbance due to construction activities.

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