Appendix G.8

AGRICULTURAL REPORT

Confidential

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AGRICULTURAL AGRO-ECOSYSTEM SPECIALIST ASSESSMENT
FOR
THE PROPOSED PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY
NEAR ERMELO, MPUMALANGA PROVINCE

Report by
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EXECUTIVE SUMMARY

South Africa urgently needs electricity generation, and renewable energy offers good potential for that, but requires land. Agriculturally zoned land will inevitably need to be used for the renewable energy generation that the country requires. However, to ensure food security, energy facilities should be located where they will not exclude viable, future crop production from land.

The overall conclusion of this assessment is that the proposed development is desirable from an agricultural perspective because it offers a valuable, win-win opportunity for a renewable energy facility to be integrated with agricultural production in a way that provides benefits to agriculture and leads to very little loss of agricultural land with no loss of future agricultural production potential.

The screening tool classifies the assessed area as ranging from low to very high agricultural sensitivity. This assessment disputes some of the detail of the sensitivity classification by the screening tool. It rates those parts of the site, on which there are currently viable croplands as being of high agricultural sensitivity (or very high for pivot areas) and the rest of the site as being of medium agricultural sensitivity with a land capability of <8. The footprint of the proposed facility has deliberately avoided all areas of verified very high agricultural sensitivity.

In general, the soils across more than half of the site have insufficient capability for viable crop production and those on the remaining proportion are suitable for viable cropping. Soil limitations that prevent crop production are predominantly the result of limited depth due to underlying bedrock, clay, or hardpan, or the result of poor drainage. The crop-suitable versus unsuitable soils have been identified over time through trial and error. All the deep, well-drained, suitable soils are generally cropped, and uncropped soils that are used for grazing can fairly reliably be considered to have various limitations that make them unsuitable for crop production.

In general, the agricultural production potential of the site is high, and it is within an area that makes a significant contribution to food production in the country. Due to the favourable climate, crop yields are high on the suitable soils with average maize yields of around 7 tons per hectare.

An agricultural impact is a change to the future agricultural production potential of land. This is primarily caused by the exclusion of agriculture from the footprint of a development. In the case of Wind Energy Facilities (WEFs), the amount of land excluded from agriculture is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has, and regardless of the duration of the impact. Furthermore, WEFs have both positive and negative effects on the production potential of land, and it is the net sum of these positive and negative effects that determines the extent of the change in future production potential. The positive effects include increased financial security for farming

operations; improved security; and an improved road network.

Due to the facts that the proposed development will exclude agricultural production from only an insignificantly small area of land and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

Its acceptability is further substantiated by the following points:

- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
- In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.
- All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country. Furthermore, a reduction in coal power saves national water resources and therefore potentially makes more water available nationally for irrigated agriculture.

From an agricultural impact point of view, it is recommended that the proposed development be approved.

1 INTRODUCTION

Environmental and change of land use authorisation is being sought for the Phefumula Emoyeni One Wind Energy Facility (WEF) near Ermelo, Mpumalanga Province (see location in Figure 1). In terms of the National Environmental Management Act (Act No 107 of 1998 - NEMA), an application for environmental authorisation requires an agricultural assessment. In this case, because the facility footprint includes high agricultural sensitivity land (see Section 7), the level of agricultural assessment required by the protocol is an Agricultural Agro-Ecosystem Specialist Assessment.

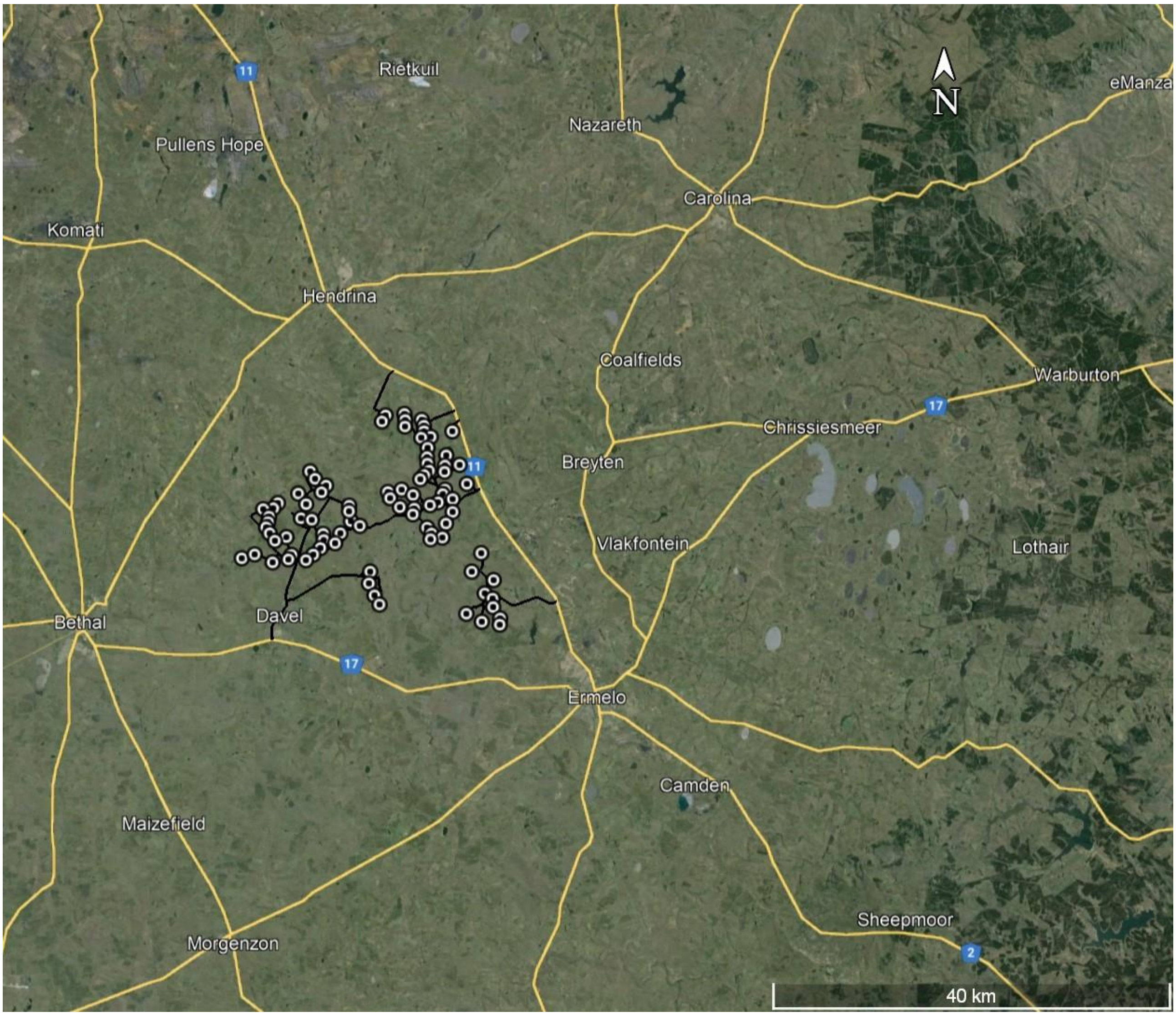

Figure 1. *Locality map of the proposed Phefumula Emoyeni One wind energy facility to the northwest of Ermelo.*

The purpose of an agricultural assessment is to answer the question:

> Will the proposed development cause a significant reduction in agricultural production potential, and most importantly, will it result in a loss of arable land?

Section 9 of this report unpacks this question, particularly with respect to what constitutes a significant reduction. To answer the above question, it is necessary to determine the existing agricultural production potential of the land that will be impacted, and specifically whether it is viable arable land or not. This is done in Section 8 of this report. Sections 8 and 9 of this report directly address the above question and therefore contain the essence and most important part of the agricultural impact assessment.

As is shown in Section 9, this assessed development will not result in a significant loss of viable arable land and therefore poses minimal threat to future agricultural production potential.

2 PROJECT DESCRIPTION

The proposed facility will consist of the standard infrastructure of a WEF including, up to 88 turbines with foundations; crane pads per turbine; cabling; battery energy storage system (BESS); auxiliary buildings; access and internal roads; on-site substation; and temporary construction laydown areas. The facility will have a total generating capacity of up to 550 MW. The grid connection infrastructure is subject to a separate assessment and Environmental Authorization.

What is relevant for agricultural impact in a WEF layout is the small but widely distributed footprint of land on which agriculture is actually excluded. The largest components of this footprint are the crane pads and the roads. All components have the same impact, namely occupation of agricultural land. The agricultural footprint of the facility is shown in Figure 2 and 3.

3 TERMS OF REFERENCE

The terms of reference for this study are to fulfill the requirements of the *Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*, gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

The terms of reference for an Agricultural Agro-Ecosystem Specialist Assessment, as stipulated in the protocol, are listed below, and the section number of this report which fulfils each stipulation is given after it in brackets.

1. The assessment must be undertaken by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professions (SACNASP). (**Appendix 3**)

2. The assessment must be undertaken on the preferred site and within the proposed development footprint. (**Figures 2 and 3**)

3. The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:

   a. the extent of the impact of the proposed development on the agricultural resources (**Section 9.1**);

   b. whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site (**Section 12**), and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.

4. The status quo of the site must be described, including the following aspects which must be considered as a minimum in the baseline description of the agro-ecosystem:

   a. The soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit and slope (**Section 8**);

   b. Where applicable, the vegetation composition, available water sources as well as agro-climatic information (**Section 8**);

   c. The current productivity of the land based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units (**Section 8**);

   d. The current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure (**Section 8**);

   e. Existing impacts on the site, located on a map where relevant (e.g. erosion, alien vegetation, non-agricultural infrastructure, waste, etc **Section 8**).

5. Assessment of Impacts, including the following which must be considered as a minimum in the predicted impact of the proposed development on the agro-ecosystem:

   a. Change in productivity for all agricultural activities based on the figures of the past 5 years, expressed as an annual figure and broken down into production units (**Section 9.1**);

   b. Change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure (**Section 9.1**);

   c. Any alternative development footprints within the preferred site which would be of “medium” or “low” sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification (**Section 9.3**).

6. The findings of the Agricultural Agro-Ecosystem Specialist Assessment must be written up in an Agricultural Agro-Ecosystem Specialist Report that contains as a minimum the following information:

a. Details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vita (**Appendix 1);**

b. A signed statement of independence by the specialist (**Appendix 2**);

c. The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment (**Section 4**);

d. A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant (**Section 4**);

e. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool (**Figure 2**);

f. An indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development **Section 9.1**);

g. an indication of possible long-term benefits that will be generated by the project in comparison to the benefits of the agricultural activities on the affected land (**Section 11.4**);

h. Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc. (**Section 11.5**);

i. Information on the current agricultural activities being undertaken on adjacent land parcels (**Section 8**);

j. a motivation must be provided if there were development footprints identified as per point 5.3 above that were identified as having a medium or low agricultural sensitivity and that were not considered appropriate (**Section 9.3**);

k. Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities (**Section 11.1**);

l. A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development (**Section 12**);

m. Any conditions to which this statement is subjected (**Section 12**);

n. Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr) (**Section 10**);

o. A description of the assumptions made and any uncertainties or gaps in knowledge or data (**Section 5**).

p. calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development (including supporting infrastructure) (**Section 11.3**);

q. confirmation whether the development footprint is in line with the allowable development limits set in Table 1 above, including where applicable any deviation from the set development limits and motivation to support the deviation, including (**Section 11.3**):

a. where relevant, reasons why the proposed development footprint is required to exceed the limit; (not applicable)

b. where relevant, reasons why this exceedance will be in the national interest; (not applicable) and

c. where relevant, reasons why there are no alternative options available including evidence of alternatives considered; (not applicable) and

7. a map showing the renewable energy facilities within a 50km radius of the proposed development (**Figure 7**).

4 METHODOLOGY OF STUDY

The assessment was based on an on-site investigation of the soils and agricultural conditions conducted on 16 August and 12 September 2023. It was also informed by existing climate, soil, and agricultural potential data for the site (see references). The aim of the on-site assessment was to:

1. Ground-truth cropland status;
2. Ground truth the land type soil data and achieve an understanding of the general range and distribution patterns of different soil conditions across the site;
3. Gain an understanding of overall agricultural production potential across the site.

Soils were assessed based on the investigation of existing soil exposures in combination with indications of the surface conditions and topography. Soils were classified according to the South African soil classification system (Soil Classification Working Group, 2018). Interviews were also conducted with farmers for information on farming practices on the site.

This level of soil assessment is considered entirely adequate for an understanding of on-site soil potential for the purposes of a WEF assessment. For this purpose, only an understanding of the general range and distribution patterns of different soil conditions across the site is required. A more detailed soil survey would be extremely time consuming and impractical to conduct, given the very large assessment area, and would not provide any additional data that would add value to the assessment of the agricultural impact of the WEF.

This is because a WEF extends over a very large surface area. The layout design of a WEF is complex and there are multiple interacting factors that determine the turbine locations that will ensure the viability of the WEF. Each turbine influences the amount of wind that the other turbines receive. Therefore, the location of one turbine cannot simply be shifted without requiring other turbines to be shifted as well, to retain the viability of all the turbines. To shift turbines to account for variation in soil conditions would be extremely complex and would require a level of soil mapping detail across the whole WEF area that would be practically impossible to achieve. Even with this level of detail, it is highly unlikely that it would have any influence on agricultural impact.

An assessment of soils and long-term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the date on which this assessment was done has no bearing on its results.

5 ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

There are no specific assumptions, uncertainties or gaps in knowledge or data that affect the findings of this study.

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

This section identifies all applicable legislation and permit requirements over and above what is required in terms of NEMA.

The development requires approval from the National Department of Agriculture, Land Reform and Rural Development (DALRRD) because it is on agriculturally zoned land. This approval is separate to the Environmental Authorisation. There are two approvals that apply. The first is a No Objection Letter for the change in land use. This letter is one of the requirements for receiving municipal rezoning. This application requires a motivation backed by good evidence that the development is acceptable in terms of its impact on the agricultural production potential of the development site. This agricultural assessment report will serve that purpose.

The second approval is a consent for long-term lease required in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). SALA approval is not required if the lease is over the entire farm portion. If DALRRD approval for the development has already been obtained in the form of the No Objection letter, then SALA approval is likely to be readily forthcoming. SALA approval can only be applied for once the Municipal Rezoning Certificate and Environmental Authorisation has been obtained.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983 - CARA). A consent in terms of CARA is required for the cultivation of virgin land. Cultivation is defined in CARA as “any act by means of which the topsoil is disturbed mechanically". The purpose of this consent for the cultivation of virgin land is to ensure that only land that is suitable as arable land is cultivated. Therefore, despite the above definition of cultivation, disturbance to the topsoil that results from construction of infrastructure does not constitute cultivation as it is understood in CARA. This has been corroborated by Anneliza Collett (Acting Scientific Manager: Natural Resources Inventories and Assessments in the Directorate: Land and Soil Management of the Department of Agriculture, Land Reform and Rural Development (DALRRD)). The construction and operation of the facility will therefore not require consent from the Department of Agriculture, Land Reform and Rural Development in terms of this provision of CARA.

7 SITE SENSITIVITY VERIFICATION

A specialist agricultural assessment is required to include a verification of the agricultural sensitivity of the development site as per the sensitivity categories used by the web-based environmental screening tool of the Department of Forestry, Fisheries and the Environment (DFFE). Agricultural sensitivity is an indication of the capability of the land for agricultural production, based only on its climate, terrain, and soil capabilities and its agricultural land use. The different categories of agricultural sensitivity indicate the priority by which land should be conserved as agricultural production land. However, the screening tool's agricultural sensitivity is often of very limited value for assessing agricultural impact. What is of importance to an agricultural assessment, rather than the site sensitivity verification, is its assessment of the cropping potential and its assessment of the impact significance, both of which are not necessarily correlated with sensitivity.

The screening tool classifies agricultural sensitivity according to two independent criteria, from two independent data sets, both of which may be indicators of the land's agricultural production potential but are limited in that the first is outdated and the second relies on fairly course, modelled data. The two criteria are:

1. If the land is classified as cropland or not on the field crop boundary data set (Crop Estimates Consortium, 2019), and
2. The land capability rating on the land capability data set (DAFF, 2017)

All classified cropland is, by definition, either high or very high sensitivity. Land capability is defined as the combination of soil, climate, and terrain suitability factors for supporting rain-fed agricultural production. It is rated by the Department of Agriculture's updated and refined, country-wide land capability mapping (DAFF, 2017). The higher land capability values (≥8 to 15) are likely to indicate suitability as arable land for crop production, while lower values (<8) are likely to only be suitable as non-arable grazing land. The direct relationship between land capability rating, agricultural sensitivity, and rain-fed cropping suitability is shown in Table 1.

Table 1: Relationship between land capability, agricultural sensitivity, and rain-fed cropping suitability.

<table>
<tr><th rowspan="2">Land capability value</th><th rowspan="2">Agricultural sensitivity</th><th colspan="2">Rain-fed cropping suitability</th></tr>
<tr><th>Summer rainfall areas</th><th>Winter rainfall areas</th></tr>
<tr><td>1 - 5</td><td>Low</td><td rowspan="3">Unsuitable</td><td rowspan="2">Unsuitable</td></tr>
<tr><td>6</td><td rowspan="2">Medium</td></tr>
<tr><td>7</td><td rowspan="4">Suitable</td></tr>
<tr><td>8</td><td rowspan="2">High</td><td rowspan="3">Suitable</td></tr>
<tr><td>9 - 10</td></tr>
<tr><td>11 - 15</td><td>Very High</td></tr>
</table>

Note: There is an error in the screening tool whereby a land capability of 8 is classified as medium sensitivity, but according to NEMA's agricultural protocol, should in fact be classified as high sensitivity. This assessment follows the agricultural protocol definition and classifies a value of 8 as high sensitivity.

The agricultural sensitivity of the site, as classified by the screening tool, is shown in Figure 2. However, the screening tool sensitivity requires specialist verification because of the limitations of the data sets on which it is based.

This verification of sensitivity addresses both components that determine it, namely cropping status and land capability. The screening tool classifies the assessed area as ranging from low to very high agricultural sensitivity. The high sensitivity classification is due to a combination of some land being classified as cropland and some being classified with a land capability of 9. However, the data set used by the screening tool to classify cropland is outdated. This assessment has verified all current areas of viable cropland, which differ from those classified as cropland by the screening tool. The verified areas of viable cropland are shown in Figures 2 and 3. This assessment therefore confirms the high sensitivity rating by the screening tool that is based on cropping status, only for those areas that have been verified as cropland.

The classified land capability of the site ranges from 6 to 9. The high sensitivity classification is due to some land being classified with a land capability of 9. The rating of land capability used by the screening tool is determined by an average soil capability value attributed to each land type. However, there are a range of soil capabilities within each land type, the detail of which the land capability data is unable to take account of and map. On the ground, the soils (and therefore the land capability) vary in a complex pattern across the landscape, which is not reflected at the scale of the land capability data. The most reliable indication of soil cropping potential or soil capability at a landscape scale in this environment is current and historical land use. The suitable versus the unsuitable soils have been identified over time through trial and error. In an agricultural environment like the one being assessed, all the suitable soils are generally cropped. Cropped soils have a real land capability of ⩾8 because the relationship between land capability and agricultural production potential is such that a land capability of ⩾8 should denote land that is suitable for viable rainfed crop production. Uncropped soils can fairly reliably be considered to have limitations that make them unsuitable for crop production with the result that their real land capability is less than 8.

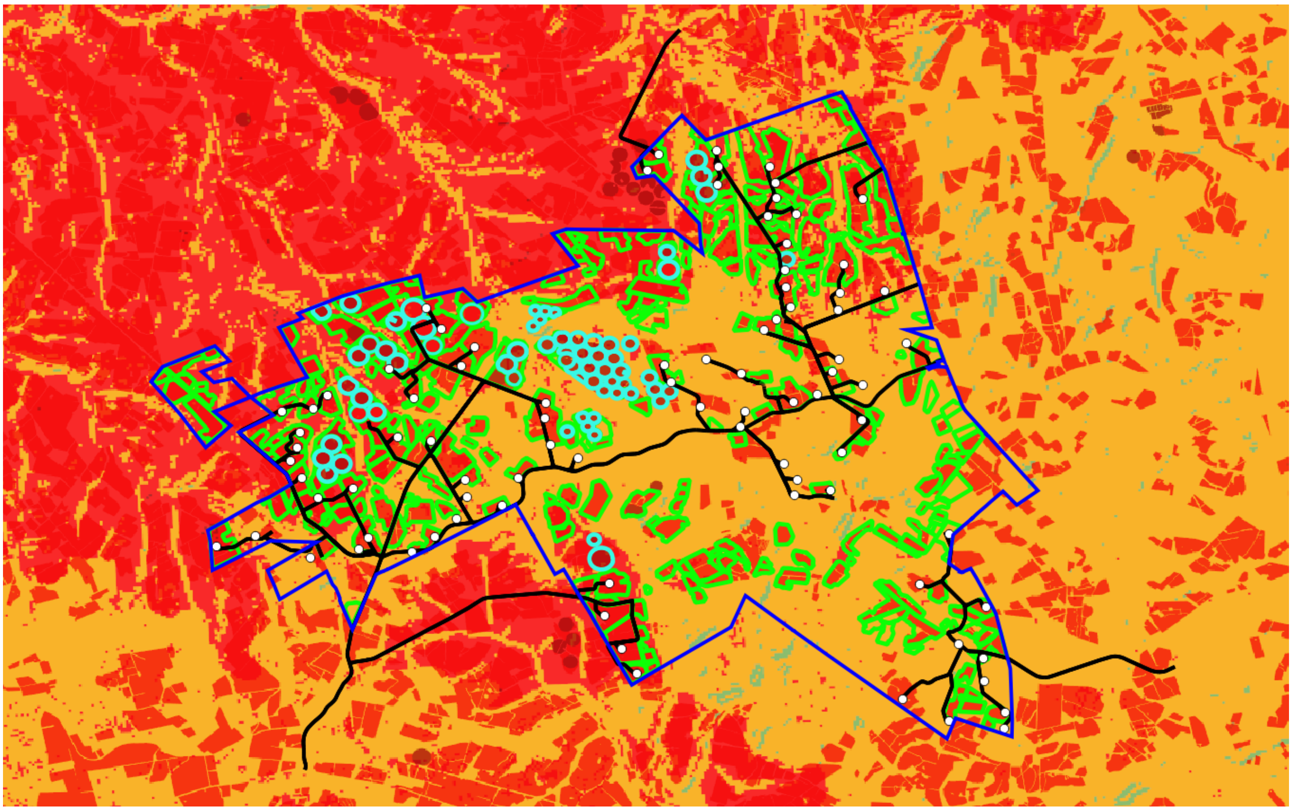

Figure 2. *The development overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high; dark red = very high). All confirmed areas of high sensitivity (croplands) are shown in green outline and very high sensitivity (pivots) are shown in blue outline. All areas outside of these are rated as medium sensitivity.*

In conclusion, this assessment disputes some of the detail of the sensitivity classification by the screening tool. It rates those parts of the site, on which there are currently viable croplands, as shown in Figures 2 and 3, as being of high agricultural sensitivity (or very high for pivot areas) and the rest of the site as being of medium agricultural sensitivity with a land capability of <8.

8 BASELINE DESCRIPTION OF THE AGRO-ECOSYSTEM

The purpose of this section is firstly to present the baseline information that controls the agricultural production potential of the site and then to assess that potential. Agricultural production potential, and particularly cropping potential, is one of three factors that determines the significance of an agricultural impact, together with size of footprint and duration of impact (see Section 9).

All the important parameters that control the agricultural production potential of the site are given in Table 2. The land type soil data are given in Appendix 5. A satellite image map of the development site is given in Figure 3 and site photographs are shown in Figures 4 to 6.

The site is within a Protected Agricultural Area (PAA) (DALRRD, 2020). A PAA is a demarcated area in which the climate, terrain, and soil are generally conducive for agricultural production and which, historically, or in a regional context, has made important contributions to the production of the various crops that are grown across South Africa. Within PAAs, the protection, particularly of arable land, is considered a priority for the protection of food security in South Africa.

Table 2: Parameters that control and/or describe the agricultural production potential of the site.

	Parameter	Value
Climate	Köppen-Geiger climate description (Beck *et al*, 2018)	Temperate, dry winter, warm summer
	Mean Annual Rainfall (mm) (Schulze, 2009)	644
	Reference Crop Evaporation Annual Total (mm) (Schulze, 2009)	1281
	Climate capability classification (out of 9) (DAFF, 2017)	5 (moderate) to 6 (moderate-high)
Terrain	Terrain type	Low hills
	Terrain morphological unit	Varied
	Slope gradients (%)	
	Altitude (m)	1760
	Terrain capability classification (out of 9) (DAFF, 2017)	3 (low) to 7 (high)
Soil	Geology (DAFF, 2002)	Dolerite; sandstone, grit and shale of the Ecca Group, Karoo Sequence.
	Land type (DAFF, 2002)	Ea23, Bb4, Ba33, Ba22, Bb21, Ba19, Ab9, Dc3, Ea20
	Description of the soils	Predominantly very shallow to deep, heavy textured soils on underlying rock, clay, or hardpan.
	Dominant soil forms	Hu, Ar, Av, My, Mw, Sw, Gs, Gc
	Soil capability classification (out of 9) (DAFF, 2017)	4 (low-moderate) to 6 (moderate-high)
	Soil limitations	Limited soil depth, drainage
Land	Agricultural land use in the surrounding area	Irrigation, dry land crop production, grazing

	Parameter	Value
	Agricultural land use on the site	Irrigation, dry land crop production, grazing
General	Long-term grazing capacity (ha/LSU) (DAFF, 2018)	5
	Land capability classification (out of 15) (DAFF, 2017)	6 (low-moderate) to 9 (moderate-high)
	Within Protected Agricultural Area (DALRRD, 2020)	Yes
	Within Renewable Energy Development Zone (REDZ)	No

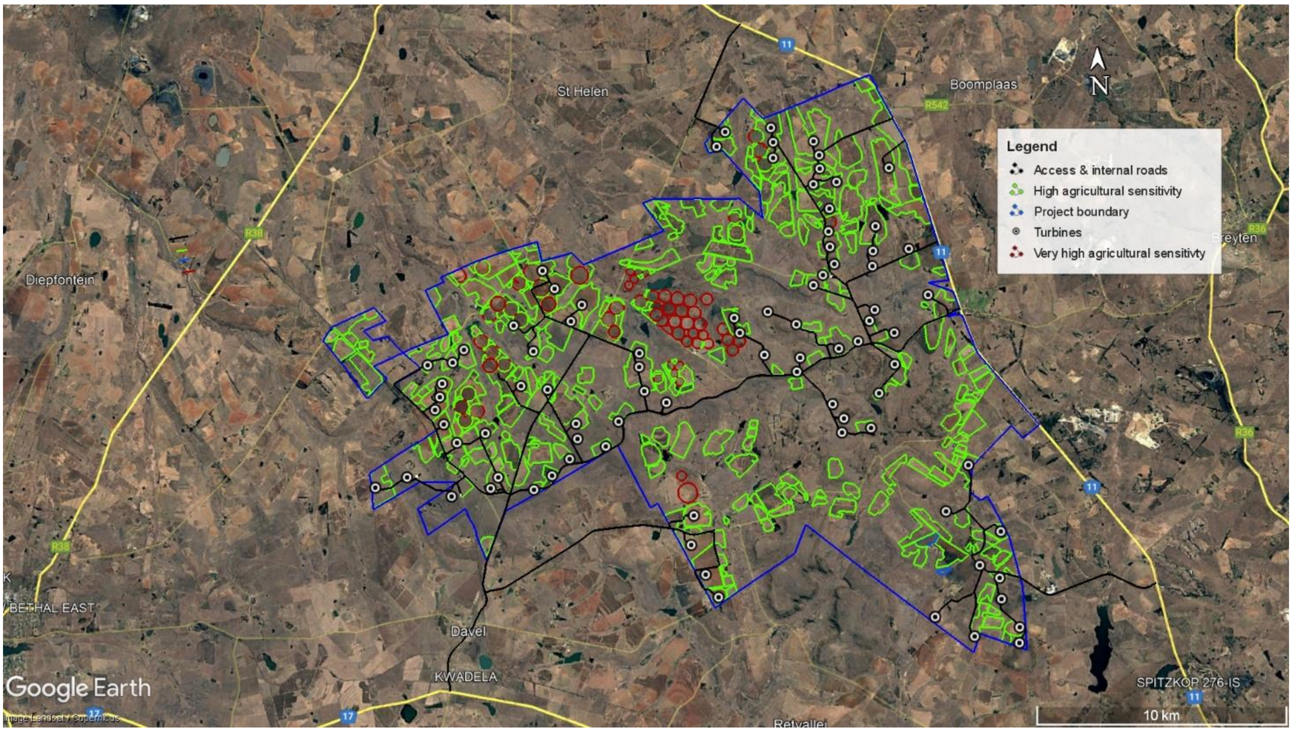

Figure 3. *Satellite image map of the assessed Proposed Phefumula Emoyeni One WEF development.*

The agricultural protocol requires the current productivity of the land based on detailed production figures and it requires the current employment figures. This detail is entirely irrelevant to the assessment of the agricultural impact, given that the expected losses in production and employment will be zero (see Section 9.1). It is therefore unnecessary to include this detail.

There are no existing impacts on the site that are relevant to agricultural impact.


Figure 4. *Typical site conditions.*


Figure 5. *Typical site conditions.*

Figure 6. *Typical soil profiles on site from a location in close proximity to the site, showing the subsoil bedrock that limits soil depth.*

8.1 Assessment of the agricultural production potential

This assessment of the agricultural production potential of the site is based on an integration of the different parameters in Table 2 above and the on-site soil investigation.

In general, the soils across more than half of the site have insufficient capability for viable crop production and those on the remaining proportion are suitable for viable cropping. Soil limitations that prevent crop production are predominantly the result of limited depth due to underlying bedrock, clay, or hardpan, or the result of poor drainage.

As discussed in Section 7, the crop-suitable versus unsuitable soils have been identified over time through trial and error. All the deep, well-drained, suitable soils are generally cropped, and uncropped soils that are used for grazing can fairly reliably be considered to have various limitations that make them unsuitable for crop production.

In general, the agricultural production potential of the site is high, and it is within an area that makes a significant contribution to food production in the country. Due to the favourable climate, crop yields are high on the suitable soils with average maize yields of around 7 tons per hectare according to the farmers on site.

9 ASSESSMENT OF AGRICULTURAL IMPACT

9.1 Impact identification and assessment

There is only ever a single agricultural impact of any development, and it is a net change to the future agricultural production potential of land. It occurs as a result of different mechanisms, some of which decrease production potential (for example exclusion of agriculture from land) and some of which increase it (for example increased financial security). Change to the future agricultural production potential of land takes place over the lifetime of a development. What is of relevance is the net change from pre-development to post-development. It is not helpful to distinguish different levels of impact during the different phases of the development such as design, construction, and operation. The total, integrated impact is what matters.

In most developments the decrease in production potential is primarily caused by the exclusion of agriculture from the footprint of the development. Soil erosion and degradation may also contribute to loss of agricultural production potential, but these can be managed so as not to cause impact. The significance of a loss of agricultural production potential is a direct function of the following three factors:

1. the size of the footprint of land from which agriculture will be excluded (or the footprint that will have its potential decreased);
2. the baseline production potential (particularly cropping potential) of that land; and
3. the length of time for which agriculture will be excluded (or for which potential will be decreased).

In the case of WEFs, the first factor, size of footprint, is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has, and regardless of the duration of the impact. This is because the required spacing between turbines means that the amount of land excluded from agricultural use is extremely small in relation to the surface area over which a WEF is distributed. WEF infrastructure (including all associated infrastructure and roads) typically occupies less than 2% of the surface area, according to the typical surface area requirements of WEFs in South Africa (DEA, 2015). Most WEFs, for which I have recently done assessments, occupy less than 1% of the surface area. All agricultural activities can continue unaffectedly on all parts of the farmland other than this small footprint, from which agriculture is excluded, and the actual loss of production potential is therefore insignificant.

A study done to measure the impact of existing WEFs on agricultural production potential (Lanz, 2018) is highly informative of the extent of the agricultural impact that is likely for this proposed development. Although the study was done in a different agricultural environment, it is similar in terms of being a site that incudes croplands. There is no reason that the results obtained in that study would not be applicable to the area in this assessment. The overall conclusion of the study was that, although WEFs have been established within an area of cultivated farmland, it is highly unlikely that this has caused a reduction in agricultural production. Tiny amounts of cropland have been lost, but the consequence of this for agricultural production has been negligible. It is likely that the positive financial impacts of WEFs have outweighed the negative impacts, and that WEFs have benefited agriculture and agricultural production in the area.

As identified in the study, it is important to note that WEFs have both positive and negative effects on the production potential of land. It is the net sum of these positive and negative effects that determines the extent of the change in future production potential. The positive effects are:

1. **Increased financial security for farming operations -** Reliable and predictable income will be generated by the farming enterprises through the lease of land to the energy facility. This will increase financial security and could improve farming operations and productivity through increased investment into farming.
2. **Improved security against stock theft and other crime** due to the presence of security infrastructure and security personnel at the energy facility.
3. **Improved road network**, with associated storm water handling system. The WEF will construct turbine access roads of a higher standard than the existing farm roads which will give farming vehicles better access to farmlands. This will be especially relevant during wet periods when access to croplands for spraying etc is limited by the current farm roads.

There are two additional effects, but because they are highly unlikely to influence agricultural production, they are not considered further. They are:

- **Prevention of crop spraying by aircraft over land occupied by turbines** – ground based or using drones for spraying are effective, alternative methods that can be used without implications for production or profitability.
- **Interference with farming operations** - Construction (and decommissioning) activities are likely to have some nuisance impact for farming operations but are highly unlikely to have an impact on agricultural production.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore pose a significant impact risk.

Due to the facts that the energy facility will exclude only an insignificantly small area of land from agricultural production and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

The agricultural protocol requires an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development. As this assessment has shown, the agricultural use of the land will be integrated with the renewable energy facility, and it will continue with no discernible change in terms of production. The expected losses in production and employment will therefore be zero.

9.2 Cumulative impact assessment

Specialist assessments for environmental authorisation are required to include an assessment of cumulative impacts. The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present, or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

The DFFE requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

This cumulative impact assessment determines the quantitative loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. These projects are listed in Appendix 4 of this report. Note that electrical grid infrastructure projects do not contribute to a loss of agricultural land and are not therefore included in this calculation of cumulative land loss. The area of land taken out of agricultural use as a result of all the projects listed in Appendix 4 (total generation capacity of 526.7 MW) will amount to a total of approximately 217 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30 km radius (approximately 282,700 ha), this amounts to only 0.08% of the surface area. This is within an acceptable limit in terms of loss of agricultural land, much of which is only suitable for grazing.

All the projects contributing to cumulative impact for this assessment have the same agricultural impacts in a very similar agricultural environment, and therefore the same mitigation measures apply to all.

Specialist assessments for environmental authorisation are required, if the associated grid infrastructure is being applied for separately, to include it as part of the cumulative assessment for the facility. However, due to their negligible agricultural impact, power lines do not contribute to the cumulative impact of the facility. Given the small footprint of the substations, their contribution will also not be significant. Inclusion of the impact of the grid connection of the facility does not therefore change the significance of the cumulative impact of the facility.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore pose a cumulative impact risk.

Due to all the considerations discussed above, the cumulative impact of loss of future agricultural production potential is assessed as low. It will not have an unacceptable negative impact on the agricultural production capability of the area, and it is therefore recommended, from a cumulative agricultural impact perspective, that the development be approved.

9.3 Assessment of alternatives

Specialist assessments for environmental authorisation are required to include a comparative assessment of alternatives, including the no-go alternative. The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The development compliments agriculture by providing an additional income source, without excluding agriculture from the land, or decreasing production. Therefore, the negative agricultural impact of the no-go alternative is more significant than that of the development, and so, purely from an agricultural impact perspective, the proposed development is the preferred alternative between the development and the no-go. In addition, the no-go option would prevent the proposed development from contributing to the environmental, social, and economic benefits associated with the development of renewable energy in South Africa.

10 MITIGATION

All areas that were identified as agricultural no-go areas in the site sensitivity verification and scoping phases of this project have been deliberately avoided by the facility footprint. There are no additional areas that are within the proposed footprint that need to be avoided in terms of agricultural impacts and no buffers are applicable.

Generic mitigation measures that are effective in preventing soil degradation are all inherent in the engineering of such a project and/or are standard, best-practice for construction sites.

- A system of storm water management, which will prevent erosion on and downstream of the site, will be an inherent part of the engineering design on site. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there. As part of the system, the integrity of the existing contour bank systems of erosion control on croplands, where they occur on steeper slopes, must be kept intact.
- Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction lay down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface.

11 ADDITIONAL ASPECTS REQUIRED IN AN AGRICULTURAL ASSESSMENT

11.1 Micro siting

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. An aspect of the WEF layout that can cause unnecessary fragmentation of croplands is the location of turbine access roads within croplands. In this development, access roads have deliberately been laid out on existing roads and on the edges of croplands wherever possible, so that croplands are not unnecessarily fragmented.

11.2 Confirmation of linear activity exclusion

If linear infrastructure has been given exclusion from complying with certain requirements of the agricultural protocol because of its linear nature, the protocol requires confirmation that the land impacted by that linear infrastructure can be returned to the current state within two years of completion of the construction phase. No such exclusion applies to this project.

11.3 Compliance with the allowable development limits

The agricultural protocol stipulates allowable development limits for renewable energy developments of > 20 MW. Allowable development limits refer to the area of a particular agricultural sensitivity category that can be directly impacted (i.e. taken up by the physical footprint) by a renewable energy development. The agricultural footprint is defined in the protocol as the area that is directly occupied by all infrastructures, including roads, hard standing areas, buildings, substations etc., that are associated with the renewable energy facility during its operational phase, and that result in the exclusion of that land from potential cultivation or grazing. It excludes all areas that were already occupied by roads and other infrastructure prior to the establishment of the energy facility but includes the surface area required for expanding existing infrastructure (e.g. widening existing roads). It excludes the corridor underneath overhead power lines but includes the pylon footprints. It therefore represents the total land that is actually excluded from agricultural use as a result of the renewable energy facility (the agricultural footprint).

As discussed above, the land outside of the existing viable croplands is rated as medium agricultural sensitivity with a land capability of < 8. It is on this land that most of the agricultural footprint is located. The allowable development limit on this land is 2.5 ha per MW. This means that, even though some of the agricultural footprint is on land with a much lower development footprint (up to 0.2 ha per MW), the total footprint is still in line with the allowable development limits contained in the agricultural protocol.

11.4 Long term benefits versus agricultural benefits

The development will generate a significant and reliable additional income for the farming enterprises, without compromising the existing farming income. It will also generate additional income and employment in the local economy. In addition, it will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact than existing, coal powered energy generation.

11.5 Additional environmental impacts

There are no additional environmental impacts of the proposed development that are relevant to agriculture.

12 CONCLUSION

The overall conclusion of this assessment is that the proposed development is desirable from an agricultural perspective because it offers a valuable, win-win opportunity for a renewable energy facility to be integrated with agricultural production in a way that provides benefits to agriculture and leads to very little loss of agricultural land with no loss of future agricultural production potential.

The screening tool classifies the assessed area as ranging from low to very high agricultural sensitivity. This assessment disputes some of the detail of the sensitivity classification by the screening tool. It rates those parts of the site, on which there are currently viable croplands as being of high agricultural sensitivity (or very high for pivot areas) and the rest of the site as being of medium agricultural sensitivity with a land capability of <8. The footprint of the proposed facility has deliberately avoided all areas of verified very high agricultural sensitivity.

In general, the soils across more than half of the site have insufficient capability for viable crop production and those on the remaining proportion are suitable for viable cropping. Soil limitations that prevent crop production are predominantly the result of limited depth due to underlying bedrock, clay, or hardpan, or the result of poor drainage. The crop-suitable versus unsuitable soils have been identified over time through trial and error. All the deep, well-drained, suitable soils are generally cropped, and uncropped soils that are used for grazing can fairly reliably be considered to have various limitations that make them unsuitable for crop production.

In general, the agricultural production potential of the site is high, and it is within an area that makes a significant contribution to food production in the country. Due to the favourable climate, crop yields are high on the suitable soils with average maize yields of around 7 tons per hectare.

An agricultural impact is a change to the future agricultural production potential of land. This is primarily caused by the exclusion of agriculture from the footprint of a development. In the case of WEFs, the amount of land excluded from agriculture is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has, and regardless of the duration of the impact. Furthermore, WEFs have both positive and negative effects on the production potential of land, and it is the net sum of these positive and negative effects that determines the extent of the change in future production potential. The positive effects include increased financial security for farming operations; improved security; and an improved road network.

Due to the facts that the proposed development will exclude agricultural production from only an insignificantly small area of land and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

Its acceptability is further substantiated by the following points:

- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
- In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.
- All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country. Furthermore, a reduction in coal power saves national water resources and therefore potentially makes more water available nationally for irrigated agriculture.

From an agricultural impact point of view, it is recommended that the proposed development be approved. The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions, other than implementation of the proposed mitigation measures.

13 REFERENCES

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Lanz, J. 2018. The impact of wind farms on agricultural resources and production: a case study from the Humansdorp area, Eastern Cape. Unpublished Report.

Schulze, R.E. 2009. South African Atlas of Agrohydrology and Climatology, available on Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/

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APPENDIX 1: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I have been registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science since 2012 (registration number 400268/12) and am a member of the Soil Science Society of South Africa.

Soil & Agricultural Consulting **Self employed** **2002 - present**

Within the past 5 years of running my soil and agricultural consulting business, I have completed more than 170 agricultural assessments (EIAs, SEAs, EMPRs) in all 9 provinces for renewable energy, mining, electrical grid infrastructure, urban, and agricultural developments. I was the appointed agricultural specialist for the nation-wide SEAs for wind and solar PV developments, electrical grid infrastructure, and gas pipelines. My regular clients include: Zutari; CSIR; SiVEST; SLR; WSP; Arcus; SRK; Environamics; Royal Haskoning DHV; ABO; Enertrag; WKN-Windcurrent; JG Afrika; Mainstream; Redcap; G7; Mulilo; and Tiptrans. Recent agricultural clients for soil resource evaluations and mapping include Cederberg Wines; Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; and Goedgedacht Olives.

In 2018 I completed a ground-breaking case study that measured the agricultural impact of existing wind farms in the Eastern Cape.

Soil Science Consultant **Agricultural Consultors International (Tinie du Preez)** **1998 - 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

Completed a contract to advise soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
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- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

APPENDIX 2: SPECIALIST DECLARATION FORM

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE: THE PROPOSED PHEFUMULA WIND ENERGY FACILITY NEAR ERMELO, MPUMALANGA PROVINCE

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

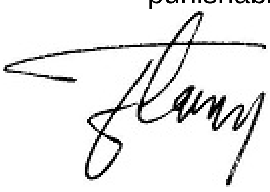
1. SPECIALIST INFORMATION

Title of Specialist Assessment	Agricultural Assessment
Specialist Company Name	SoilZA (sole proprietor)
Specialist Name	Johann Lanz
Specialist Identity Number	6607045174089
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Telephone	Not applicable
Cell phone	+27 82 927 9018
E-mail	johann@soilza.co.za

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz** declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
  - any decision to be taken with respect to the application by the competent authority; and;
  - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.



Signature of the Specialist

SoilZA (sole proprietor)

Name of Company:

6 August 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

SoilZA – sole proprietor

Name of Company

6 Aug 2024

Date

Signature of the Commissioner of Oaths

2024/08/06

Date

SUID-AFRIKAANSE POLISIEDIENS
LENASIA
2024 -08- 06
VISPOL COMMANDER
SOUTH AFRICAN POLICE SERVICE

APPENDIX 3: SACNASP REGISTRATION CERTIFICATE

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Johan Lanz

Registration Number: 400268/12

is a registered scientist

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

Soil Science (Professional Natural Scientist)

Effective **15 August 2012** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

APPENDIX 4: PROJECTS INCLUDED IN CUMULATIVE IMPACT ASSESSMENT

Table 2**:** Table of all projects that were included in the cumulative impact assessment.

DFFE Reference	Project name	Technology	Capacity (MW)
TBC	Phefumula	WEF	100
14/12/16/3/3/2/2137	Camden 1	WEF	200
14/12/16/3/3/1/452	Forzando North	SEF	9.5
14/12/16/3/3/2/2131	Hendrina	WEF	200
14/12/16/3/3/2/760	Arnot	SEF	17.2
Total solar			26.7
Total wind			500
Total			526.7

Note: Electrical grid infrastructure projects do not contribute to a loss of agricultural land (see Section 9.2) and are not therefore included in this table and in the calculation of cumulative land loss.

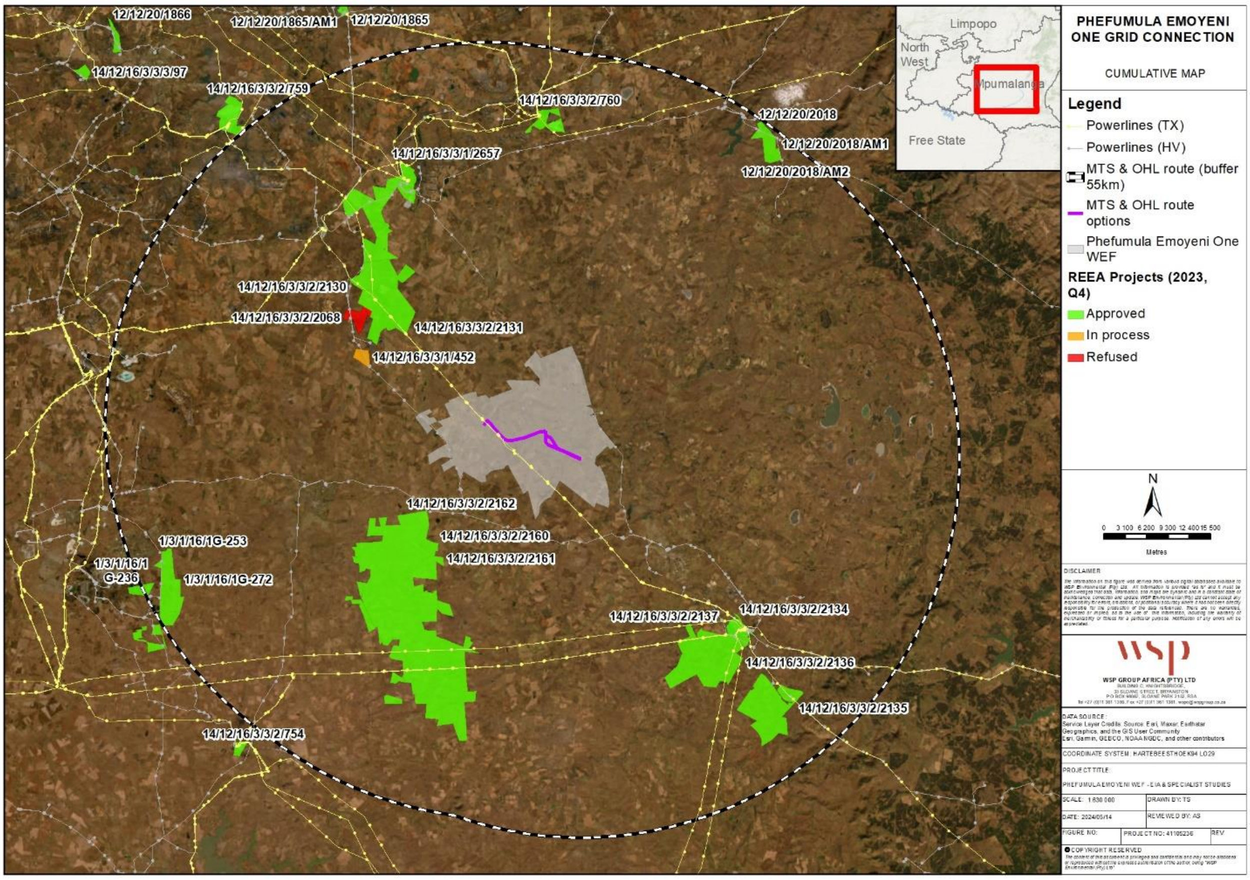


***Figure 7.** Projects that were included in the cumulative impact assessment.*

APPENDIX 5: SOIL DATA

Table 4: land type soil data

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ea23	Ar	300 - 900	40 - 70		so,lc	19,5
Ea23	My, Bo	200 - 500	30 - 55	20 - 45	so,lc	14,8
Ea23	My	300 - 500	30 - 55	20 - 45	so,lc	14,8
Ea23	Mw	200 - 400	30 - 45		H	10,5
Ea23	Sw	250 - 400	20 - 30	35 - 45	so,lc	8,5
Ea23	R					6,3
Ea23	Rg	600 - 1000	40 - 70		gc	5,5
Ea23	Va	250 - 400	20 - 30	35 - 50	vp	4,3
Ea23	Kd	500 - 1000	15 - 30	40 - 60	gc	4,3
Ea23	Bo	700 > 1200	30 - 55	25 - 50	so,lc	3,3
Ea23	Av	600 - 1000	25 - 35	35 - 45	sp	2,8
Ea23	Hu	400 > 1200	25 - 35	35 - 45	so,lc	2,8
Ea23	Ms	100 - 300	20 - 30		H,P	2,0
Ea23	S					1,0
Bb4	Av	800 - 1200	15 - 20	15 - 35	sp	30,0
Bb4	Hu	900 > 1200	15 - 25	15 - 35	so,hp	10,5
Bb4	Av	700 - 1000	25 - 30	35 - 45	sp	9,0
Bb4	Gc	700 - 1000	15 - 20	15 - 25	hp	9,0
Bb4	Ms	200 - 400	10 - 20		hp	6,0
Bb4	We	300 - 500	15 - 25	35 - 45	sp	4,8
Bb4	Lo	700 - 1000	10 - 15	30 - 40	sp	4,5
Bb4	Gc	700 - 1000	10 - 15	10 - 15	hp	4,5
Bb4	Ms	200 - 400	10 - 25		R	4,5
Bb4	Gs	300 - 500	10 - 25		lc	4,5
Bb4	P					4,5
Bb4	Rg	400 - 500	40 - 60		gc	2,5
Bb4	Es	300 - 500	10 - 20	40 - 50	pr	1,8
Bb4	Ka	300 - 400	15 - 30		gc	1,5
Bb4	Va	400 - 500	25 - 30	35 - 45	vp	1,3
Bb4	Ss, Sw	300 - 400	10 - 20	35 - 45	pr	0,5
Bb4	Ar	300 - 600	40 - 60		so,lc	0,5
Bb4	Kd	500 - 700	10 - 15	35 - 45	gc	0,3

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ba33	Hu	> 1200	20 - 25	25 - 35		42,0
Ba33	Av	900 - 1200	15 - 20	20 - 35	sp	32,0
Ba33	Gc	800 - 1200	15 - 20	20 - 30	hp	15,0
Ba33	Lo	800 - 1200	15 - 20	35 - 45	sp	4,0
Ba33	Va, Sw	400 - 500	25 - 30	35 - 45	vp	4,0
Ba33	Ms, Wa	100 - 300	10 - 20		hp	3,0
Ba22	Hu	800 > 1200	15 - 25	15 - 35	lc,so,hp	27,5
Ba22	Gc	600 - 1000	10 - 20	15 - 25	hp	12,5
Ba22	Av	700 - 1200	15 - 25	15 - 30	sp	7,0
Ba22	Wa	450 - 600	10 - 15		hp	7,0
Ba22	Gs	200 - 400	10 - 20		lc,so	6,0
Ba22	Gc	600 - 1000	10 - 15	10 - 15	hp	4,8
Ba22	Ms	200 - 400	10 - 20		hp	4,8
Ba22	R					4,3
Ba22	Ms	100 - 400	10 - 20		R	4,3
Ba22	Hu	800 > 1200	25 - 30	35 - 40	lc,so	4,3
Ba22	Cv	500 - 800	15 - 20	15 - 30	so,lc	4,3
Ba22	Av	700 - 1200	10 - 15	10 - 15	sp	3,0
Ba22	Lo	600 - 900	10 - 20		sp	3,0
Ba22	Cf	200 - 400	10 - 15		lc,so	1,8
Ba22	P					1,8
Ba22	Rg	400 - 600	35 - 45		gc	1,5
Ba22	Ka	300 - 400	15 - 25		gc	1,0
Ba22	Kd	600 - 900	10 - 20	30 - 40	gc	1,0
Ba22	Wo	300 - 500	35 - 40		gc	0,5
Ba21	Hu	500 - 900	15 - 30	20 - 35	so,hp	22,3
Ba21	Cv	400 - 900	15 - 30	20 - 40	so	15,3
Ba21	Av, Gc	500 - 900	15 - 25	15 - 35	sp	14,3
Ba21	Hu	400 - 900	25 - 35	35 - 55	so	10,5
Ba21	Hu	150 - 450	20 - 30	20 - 40	so	7,5
Ba21	Gs, Ms	100 - 400	15 - 25		lc,so,R	6,3
Ba21	Wa	200 - 450	10 - 25		hp	5,8
Ba21	Sd	400 - 900	30 - 35	35 - 50	so	4,8
Ba21	R					3,8
Ba21	Cv	150 - 450	15 - 30	20 - 40	so	3,8

Land type	Soil series (forms)	Depth (mm)			Clay % A horizon			Clay % B horizon			Depth limiting layer	% of land type
Ba21	Ka, Kd	350	-	600	10	-	30				gc	3,5
Ba21	Bo, Wo		>	1200	30	-	35				gc	2,5
Ba19	Hu	500	>	1200	8	-	15	8	-	15	so,lc,hp	12,8
Ba19	Av	500	-	1200	15	-	20	15	-	25	sp	12,3
Ba19	Hu	500	>	1200	15	-	25	15	-	35	hp,so,lc	10,8
Ba19	Lo	500	-	1000	6	-	15				sp	8,8
Ba19	Cv	450	-	1200	8	-	15	8	-	20	so,lc	7,5
Ba19	Hu	250	-	500	8	-	15	8	-	15	so,lc,hp	6,0
Ba19	Av	500	-	1200	15	-	20	15	-	25	sp	6,0
Ba19	Pn	500	-	1000	15	-	20	15	-	25	gc	5,5
Ba19	Av	500	-	1200	6	-	15	6	-	15	sp	5,5
Ba19	Wa	300	-	600	6	-	15				hp	4,8
Ba19	Ms	100	-	400	6	-	10				hp	4,8
Ba19	Gs	300	-	500	10	-	25				so,lc	4,0
Ba19	P											4,0
Ba19	Fw		>	1200	6	-	15					2,5
Ba19	Hu	750	>	1200	25	-	35	35	-	40	so,lc	2,0
Ba19	Ka	300	-	400	25	-	35				gc	2,0
Ba19	Du		>	1200	6	-	15					1,0
Ab9	Hu	900	>	1200	25	-	35	35	-	65	so,lc	38,5
Ab9	Hu	900	>	1200	20	-	30	25	-	35	so,lc,hp	14,3
Ab9	Sw	300	-	400	25	-	35	40	-	55	vp	14,0
Ab9	Av	700	-	1000	20	-	30	30	-	40	sp	6,0
Ab9	Bv	800	-	1200	20	-	30	35	-	45	sp	4,8
Ab9	Va	300	-	450	30	-	40	45	-	65	vp	4,8
Ab9	R											4,3
Ab9	Rg	450	-	600	50	-	70				gc	4,0
Ab9	Bo		>	1200	35	-	40	35	-	45		3,8
Ab9	Ar	450	-	700	50	-	70				so,lc	3,0
Ab9	My	300	-	500	35	-	40	35	-	40	so,lc	2,8
Dc3	Sw	250	-	450	20	-	30	40	-	60	vp	24,3
Dc3	Kd	500	-	800	12	-	20	50	-	60	gc	24,0
Dc3	Es	300	-	550	12	-	20	50	-	60	pr	18,3
Dc3	Ss	250	-	450	15	-	25	40	-	55	pr	13,0
Dc3	Va	250	-	450	20	-	30	40	-	60	vp	10,5

Land type	Soil series (forms)	Depth (mm)			Clay % A horizon			Clay % B horizon			Depth limiting layer	% of land type
Dc3	Rg, Wo	400	-	700	35	-	60				gc	5,0
Dc3	Ar	400	-	900	40	-	60				so	3,0
Dc3	Bo		>	1200	35	-	45	40	-	50		2,0
Ea20	Ar	300	-	600	45	-	70				so,H	29,0
Ea20	Sw	250	-	400	20	-	30	35	-	45	vp	10,8
Ea20	Mw, My	200	-	300	30	-	45				H,so,lc	10,8
Ea20	Ms, Gs, Sd	200	-	300	20	-	30				H,so	10,5
Ea20	Av	600	-	900	20	-	30	25	-	40	sp	9,0
Ea20	Va	250	-	400	20	-	35	40	-	50	vp,gc	7,3
Ea20	We	300	-	400	20	-	30	35	-	50	sp	6,0
Ea20	R											4,5
Ea20	Rg, Wo	400	-	600	30	-	70				gc	4,3
Ea20	Ss	250	-	400	15	-	20	35	-	50	pr	3,3
Ea20	Es	300	-	500	10	-	20	35	-	50	pr	3,3
Ea20	S											1,0
Ea20	Bo	900	>	1200	30	-	45	30	-	45	so,lc	0,5