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SITE SENSITIVITY VERIFICATION
AND
AGRICULTURAL AGRO-ECOSYSTEM SPECIALIST ASSESSMENT
FOR
THE PROPOSED UJEKAMAMZI WIND ENERGY FACILITY 1
NEAR ERMELO IN MPUMALANGA PROVINCE

Report by
Johann Lanz

4 May 2023

Table of Contents

EXECUTIVE SUMMARY

The agricultural sensitivity of the site was verified as being high on lands that are current croplands. The rest of the site was verified as being of medium agricultural sensitivity. Soil limitations for crop production on approximately 70% of the surface area are predominantly the result of limited depth due to underlying bedrock or hardpan (soils of the Mayo, Milkwood, Glencoe, Swartland, Glenrosa, Mispah, and shallow members of the Clovelly and Hutton soil forms) or underlying clay (soils of the Kroonstad, Estcourt, and Valsrivier soil forms) or poor drainage (soils of the Kroonstad, Estcourt, Longlands, Wasbank, and Rensburg soil forms). Deeper soils of the Bonheim, Avalon, Hutton and Clovelly soil forms allow for crop production on approximately 30% of the surface area.

Farmers in the area utilise suitable soil for grain and soy production as well as for Oulandsgras for hay. Soil that is not suitable for crop production is used for cattle and sheep grazing on natural grasslands.

Two potential negative, direct agricultural impacts have been identified as loss of agricultural potential by occupation of land and loss of agricultural potential by soil degradation. The loss by occupation will exclude only a very small proportion of the land from agricultural production and will therefore have minimal impact on production potential. Three positive, indirect agricultural impacts have been identified as enhanced agricultural potential through increased financial security for farming operations; enhanced agricultural potential through improved security against stock theft and other crime; and an improved farm road network. All impacts are assessed as being of low significance.

The conclusion of this assessment is that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. This is substantiated by the facts that the development will exclude only a very small proportion of the land from agricultural production and will therefore have minimal impact on production potential; the amount of agricultural land loss is within the allowable development limits prescribed by the agricultural protocol; it offers improved financial security, as well as wider, societal benefits; it offers security benefits against stock theft and other crime; it poses a low risk in terms of causing soil degradation; and the loss by occupation is not permanent and land will become available again after the activity ceases.

The proposed development is therefore acceptable from an agricultural impact point of view, and it is recommended that it be approved.

1 INTRODUCTION

Environmental and change of land use authorisation is being sought for the Ujekamamzi Wind Energy Facility 1 near Ermelo in 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, based on the verified high agricultural sensitivity included in the site (see Section 7), the required level of agricultural assessment is an Agro-Ecosystem Specialist Assessment.

Johann Lanz was appointed as an independent agricultural specialist to conduct the agricultural assessment. The objective and focus of an agricultural assessment is to assess whether or not the proposed development will have an unacceptable agricultural impact, and based on this, to make a recommendation on whether or not it should be approved.

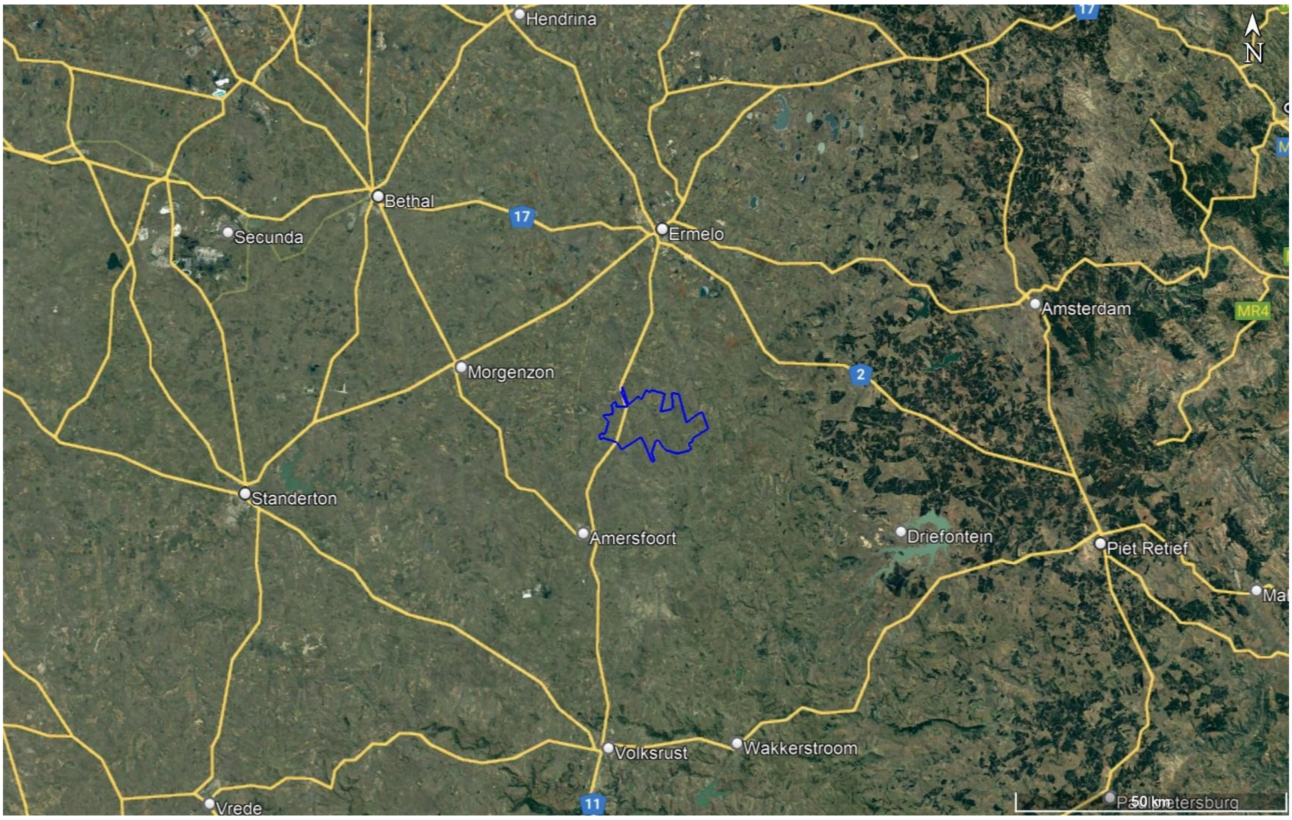

Figure 1. *Locality map of the cadastral boundary of the proposed energy facility (blue outline) to the south of the town of Ermelo.*

The purpose of the agricultural component in the environmental assessment process is to preserve agricultural production potential by ensuring that development does not unnecessarily exclude existing or potential agricultural production from land, or unnecessarily impact agricultural land to the extent that its production potential is reduced. The primary focus is on preservation of the agricultural production potential of scarce, arable land. In this case, the small extent of land loss means that there is an insignificant affect on the crop production potential of the site.

2 PROJECT DESCRIPTION

The proposed facility will consist of the standard infrastructure of a wind energy facility including turbines with foundations; crane pads per turbine; cabling; battery storage; auxiliary buildings; access and internal roads; on-site substation; and temporary construction laydown areas and will have a total generating capacity of up to 650 MW. The grid connection infrastructure is subject to a separate assessment and EA.

What is relevant for agricultural impact in a wind energy facility layout is the extent of the total agricultural footprint – that 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. The identification of individual components within this footprint is irrelevant to agricultural impact because all components have the same impact, namely occupation of agricultural land. Therefore, it is simply the location of the total footprint that matters.

3 TERMS OF REFERENCE

The terms of reference for this study is 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 verified agricultural sensitivity of the site includes land that is of high or more agricultural sensitivity (see Section 7). The level of agricultural assessment required in terms of the agricultural protocol for sites verified as high or more sensitivity is an Agricultural Agro-Ecosystem Specialist Assessment.

The terms of reference for such an 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. (Figure 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:

1. the extent of the impact of the proposed development on the agricultural resources (Section 9.12);
2. whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site (Section 10), 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:
   1. The soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit and slope (Sections 8.1 & 8.2);
   2. Where applicable, the vegetation composition, available water sources as well as agro-climatic information (Sections 8.3, 8.4 & 8.5);
   3. 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 8.7;
   4. The current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure (Section 8.8);
   5. Existing impacts on the site, located on a map where relevant (e.g. erosion, alien vegetation, non-agricultural infrastructure, waste, etc.)(Section 8.9).
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:
   1. 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 9.12);
   2. Change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure (Section 9.12);
   3. 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 9.6).
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:
   1. 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);
   2. A signed statement of independence by the specialist (Appendix 2);
   3. The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment (Section 4);
   4. A description of the methodology used to undertake the on-site assessment inclusive of

the equipment and models used, as relevant (Section 4);

5. 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);
6. 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 9.13);
7. 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 9.7);
8. Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc. (Section 9.8);
9. Information on the current agricultural activities being undertaken on adjacent land parcels (Section 8.6);
10. 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 (not applicable);
11. 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 9.9);
12. 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 10);
13. Any conditions to which this statement is subjected (Section 10);
14. Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr) (Section 9.11);
15. A description of the assumptions made and any uncertainties or gaps in knowledge or data (Section 5).
16. 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 9.10);
17. 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 9.10):
    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

18. a map showing the renewable energy facilities within a 50km radius of the proposed development (Appendix 3)

4 METHODOLOGY OF STUDY

The assessment was based on an on-site investigation of the soils and agricultural conditions and was also informed by existing soil and agricultural potential data for the site. The aim of the on-site assessment was to:

1. ground-truth cropland status and consequent agricultural sensitivity;
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.

This was achieved by a drive and walk-over investigation across the site. The site investigation was conducted from 18 to 20 April 2023. An interview was also conducted with several of the farmers for information on farming practices on the site. Soils were investigated 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, 1991). This level of soil assessment is considered entirely adequate for an understanding of on-site soil potential for the purposes of a wind farm 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 a wind farm.

This is because a wind farm extends over a very large surface area. The layout design of a wind farm is complex and there are multiple interacting factors that determine the turbine locations that will ensure the viability of the wind farm. 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, in order 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 wind farm area that would be practically impossible to achieve.

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 fact that the assessment was done in autmn has no bearing on its results.

The following sources of existing information were also used to inform the assessment:

- Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries (DAFF). This data set originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.
- Land capability data was sourced from the 2017 National land capability evaluation raster data layer produced by the DAFF, Pretoria.
- The spatial demarcation of Protected Agricultural Areas was obtained from the National Department of Agriculture, Land Reform and Rural Development (DALRRD).
- Field crop boundaries were sourced from Crop Estimates Consortium, 2019. *Field Crop Boundary data layer, 2019*. Pretoria. Department of Agriculture, Forestry and Fisheries
- Rainfall and evaporation data was sourced from the SA Atlas of Climatology and Agrohydrology (2009, R.E. Schulze) available on Cape Farm Mapper. Note that Cape Farm Mapper includes national coverage of climate, grazing and certain other data.
- Grazing capacity data was sourced from the 2018 DAFF long-term grazing capacity map for South Africa, available on Cape Farm Mapper.
- Satellite imagery of the site and surrounds was sourced from Google Earth.

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

A renewable energy facility requires approval from the National Department of Agriculture, Land Reform and Rural Development (DALRRD) if the facility is on agriculturally zoned land. 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. It is advisable to apply for this as early in the development process as possible because not receiving this DALRRD approval is a fatal flaw for a project. Note that a positive EA does not assure DALRRD’s approval of this. 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 assessment report will serve that purpose.

The second required approval is a consent for long-term lease in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). If DALRRD approval for the development has already been obtained in the form of the No Objection letter, then SALA approval should not present any difficulties. Note that SALA approval is not required if the lease is over the entire farm portion. SALA approval (if required) 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

In terms of the gazetted agricultural protocol, a site sensitivity verification must be submitted that:

1. confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
2. contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

Agricultural sensitivity is a direct function of the capability of the land for agricultural production. All arable land that can support viable crop production, is classified as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable crop production is much less of a priority to conserve for agricultural use, and is rated as medium or low agricultural sensitivity.

The screening tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is used for cropland or not. All cropland is classified as at least high sensitivity, based on the logic that if it is under crop production, it is indeed suitable for it, irrespective of its land capability rating.

The screening tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. The data is generated by GIS modelling. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land, based on its soil, climate and terrain. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for crop production, while lower values are only likely to be suitable as non-arable grazing land. The direct relationship between land capability and agricultural sensitivity is shown in Table 1.

Table 1. Relationship between land capability and agricultural sensitivity as given by the screening tool.

Land capability value	Agricultural sensitivity
1 - 5	low
6 - 8	medium
9 - 10	high
11 - 15	very high

A map of the proposed development site overlaid on the screening tool sensitivity is given in Figure 2, below. The development site covers a range of classified agricultural sensitivities from low to very high. The high and very high classifications (red in Figure 2) are because those parts are classified as cropland in the data set used by the screening tool. However that data set is outdated. The field-verified and updated indication of which lands should be classified as croplands is shown in Figures 2 and 3.

The classified land capability of the site is predominantly 8, but varies from 3 to 11. Soil capability is determined in the land capability data largely by an average soil capability value attributed to each land type. However, there are a range of soil capabilities within each land type, 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 fairly 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 is 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 and therefore have a real land capability of ≥ 8. 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.

This site sensitivity verification verifies those parts of the site that are indicated as cropland in Figures 2 and 3 as being of high agricultural sensitivity and the rest of the site as being of medium agricultural sensitivity.

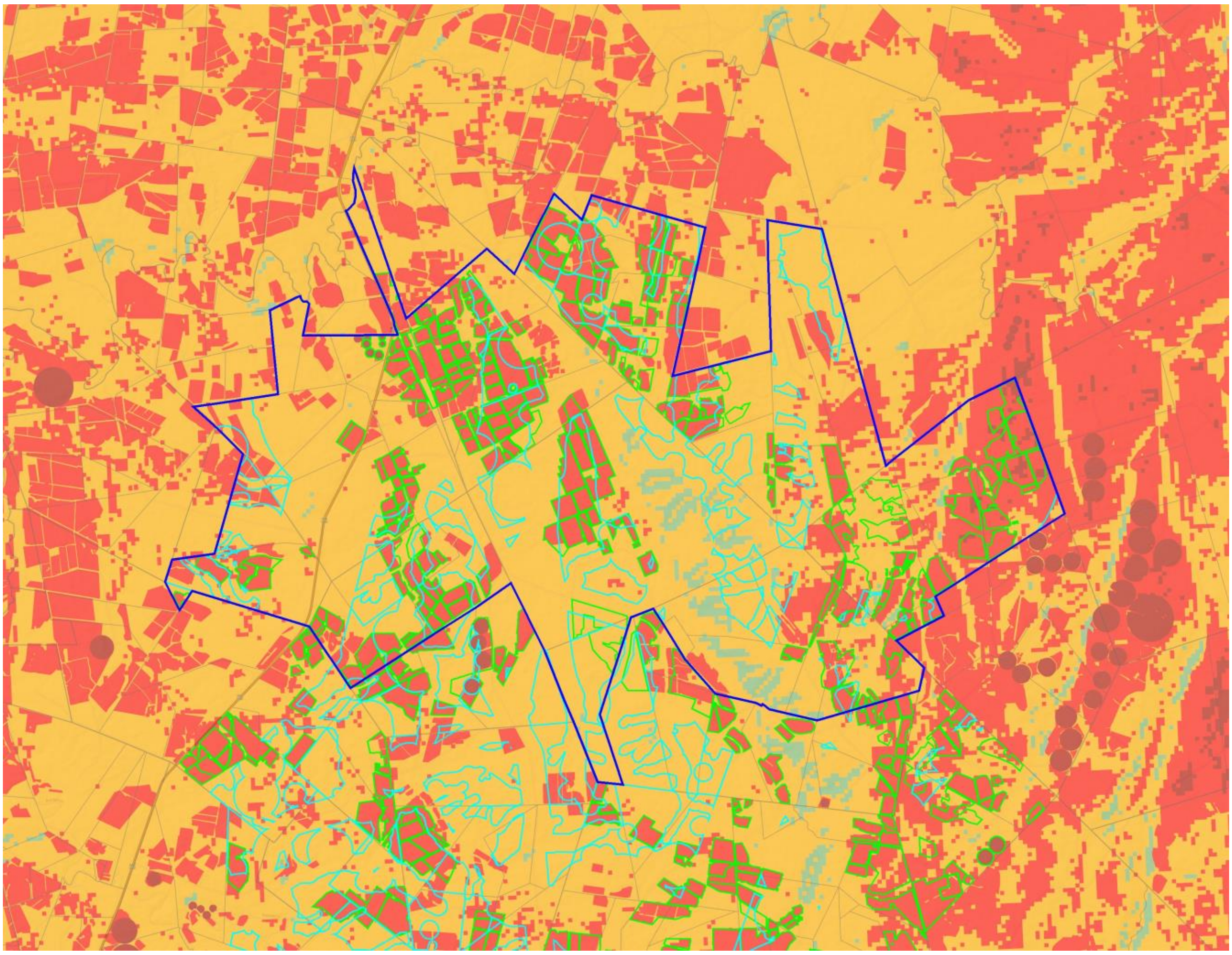

Figure 2. *The proposed development site (dark blue outline) and buildable area (light blue outlines) overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high; dark red = very high). Green outlines show the current, verified high agricultural sensitivity areas (croplands).*

8 BASELINE DESCRIPTION OF THE AGRO-ECOSYSTEM

The purpose of this section of the report is to present the baseline information that controls the agricultural production potential of the site so that an assessment of that potential can be made. Agricultural production potential is one of the main factors that determines the significance of the agricultural impact.

A satellite image map of the development site is shown in Figure 3 and photographs of site conditions are shown in Figures 4 to 5.

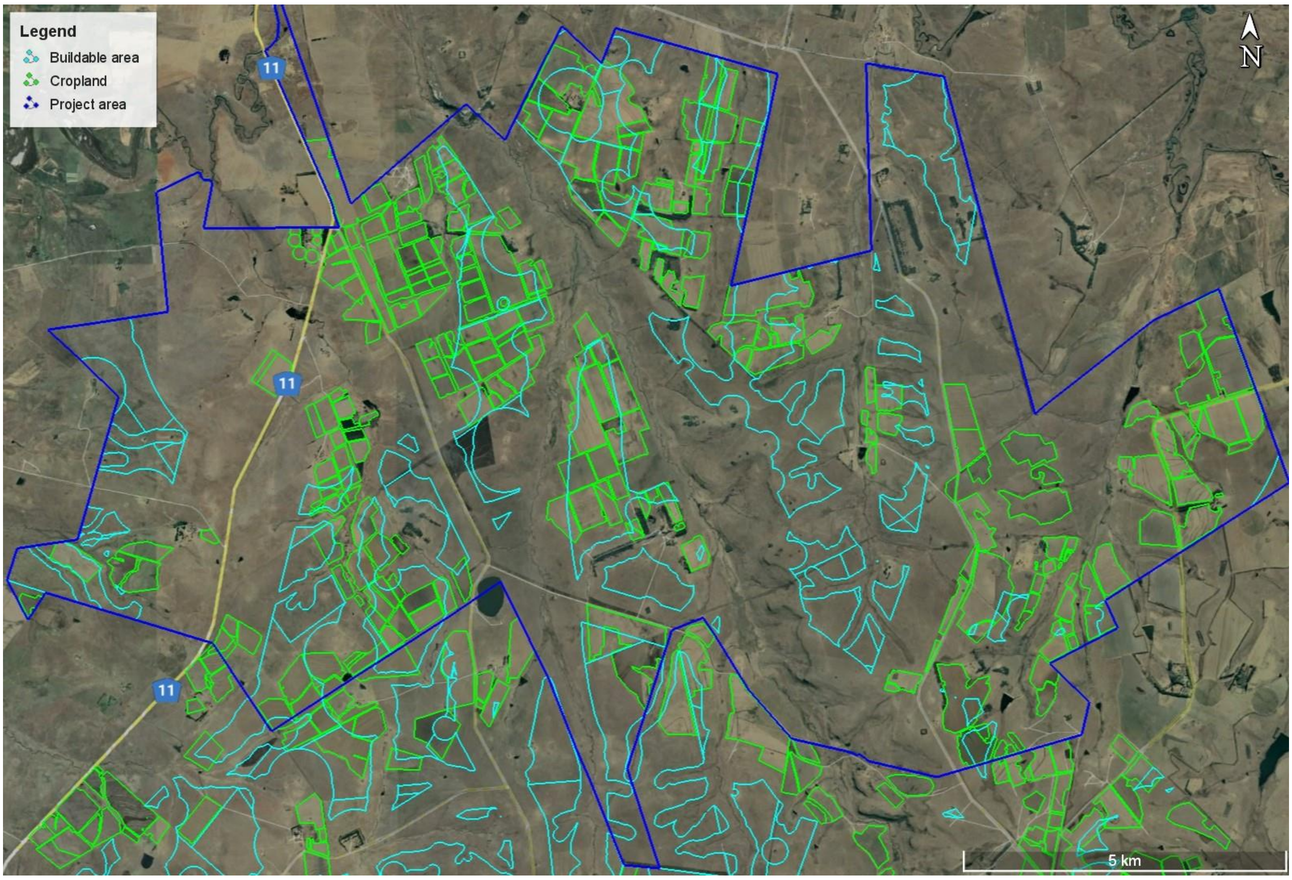

Figure 3. *Satellite image map of the proposed development site showing buildable areas.*

Figure 4. *Typical site conditions showing a combination of grazing land (foreground) and cropland (background).*

Figure 5. *Typical soil conditions on the site where underlying weathered bedrock (dolerite) limits the soil depth and thus the capability of the soil for crop production.*

The site has a summer rainfall with an annual mean of between 596 and 710 mm and a mean annual evaporation of approximately 1265 mm (Schulze, 2009). The climate capability rating, which forms a component of Department of Agriculture's land capability rating, varies form 5 (out of 9) which is described as moderate to 6 which is moderate-high. The site is situated in low, hilly terrain with a range of slope gradients and an altitude of between approximately 1600 and 1750 metres. The terrain capability rating varies greatly from 3 (out of 9) (low) to 7 (high). The geology is Karoo dolerite and fine to coarse grained sandstone, shale, and coal seam of the Vryheid formation. The following land types occur on the site in decreasing order of the proportion of the site that they occupy: Ca3, Ea22, Ac39, Ea25, and Ba51. The land type soil data is given in Appendix 4. In general, the soils across approximately 70% of the site have insufficient capability for viable crop production and those on the remaining 30% are suitable for viable cropping. Soil limitations for crop production are predominantly the result of limited depth due to underlying bedrock or hardpan (soils of the Mayo, Milkwood, Glencoe, Swartland, Glenrosa, Mispah, and shallow members of the Clovelly and Hutton soil forms) or underlying clay (soils of the Kroonstad, Estcourt, and Valsrivier soil forms) or poor drainage (soils of the Kroonstad, Estcourt, Longlands, Wasbank, and Rensburg soil forms). The soil capability rating varies greatly across the site from 3 (out of 9) (low) to 7 (high). As discussed in Section 7, above, the crop-suitable versus unsuitable soils have been identified over time through trial and error. All the suitable soils are generally cropped and uncropped soils can fairly reliably be considered to have limitations that make them unsuitable for crop production. Deeper soils of the Bonheim, Avalon, Hutton and Clovelly soil forms allow for crop production on approximately 30% of the surface area.

The site is located in a predominantly cattle farming area that includes grain. Agricultural land use on the site and surrounds is predominantly grazing of both cattle and sheep on the lower potential soils in combination with dryland crop production of maize, soya and *Oulandsgras* for hay on the higher potential soils.

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. The long-term grazing capacity of the site is classified as 4 hectares per large stock unit, which can be categorised as very high within the range of grazing capacities across South Africa.

The site falls within an area that is classified as a Protected Agricultural Area. A Protected Agricultural Area is an area that has been demarcated because the climate, terrain, and soil are generally conducive for agricultural production and because, historically, it has made important contributions to the production of the various crops that are grown across South Africa. The protection, particularly of arable land, within Protected Agricultural Areas is considered a priority for the protection of food security in South Africa. Obviously, all land within a Protected Agricultural Area is not necessarily of sufficient agricultural potential to be suitable for crop production, due to site-specific terrain, soil, and other constraints, and all land within the area is therefore not necessarily worthy of prioritised protection as agricultural production land.

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

9 ASSESSMENT OF AGRICULTURAL IMPACT

9.1 What constitutes and agricultural impact?

An agricultural impact is a temporary or permanent change to the future production potential of land. The significance of the agricultural impact is directly proportional to the extent of the change in production potential. If a development will not change the future production potential of the land, then there is no agricultural impact. A decrease in future production potential is a negative impact and an increase is a positive impact.

9.2 The significance of agricultural impact and the factors that determine it

The purpose of the agricultural component in the environmental assessment process is to ensure that South Africa balances the need for development against the need to ensure the conservation of the natural agricultural resources, including land, required for agricultural production and national food security.

When the agricultural impact of a development involves the permanent or long term loss/ non-agricultural use of potential agricultural land, as it does in this case, the focus and defining question of the agricultural impact assessment is:

> Does the loss of future agricultural production potential that will result from this development, justify keeping the land solely for potential future agricultural production and therefore not approving the development?

If the loss is small, then it is unlikely to justify non approval. If the loss is big, then it is likely to justify it.

The extent of the loss is a direct function of two things, firstly the amount of land that will be lost and secondly, the production potential of the land that will be lost. In the case of wind farms, the first factor, amount of land loss, 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. This is because the required spacing between turbines means that the amount of land actually excluded from agricultural use is extremely small in relation to the surface area over which a wind farm is distributed. Wind farm infrastructure (including all associated infrastructure and roads) typically occupies less than 2% of the surface area, according to the typical surface area requirements of wind farms in South Africa (DEA, 2015). Most wind energy facilities, for which I have recently done assessments, occupy less than 1% of the surface area. All agricultural activities are able to continue unaffectedly on all parts of the farmland other than this small agricultural footprint and the actual loss of production potential is therefore insignificant.

It is also important to note that renewable energy facilities have both positive and negative affects on the production potential of land (see Section 9.3) and so it is the net sum of these positive and negative affects that determines the extent of the change in future production potential.
The significance of the small loss of production potential is reduced even more because it is compensated by the positive impacts that enhance production potential.

A study done to measure the impact of existing wind farms 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 highly productive and intensively farmed environment with cultivation. 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 wind farms have been established within an area of cultivated farmland that supports intensive and productive farming, it is highly unlikely that this has caused a reduction in agricultural production. Small amounts of production land have been lost, but the consequence of this for agricultural production has been negligible. It is likely that the positive financial impacts of wind farming have outweighed the negative impacts and that wind farming has benefited agriculture and agricultural production in the area.

9.3 Impact identification

There is ultimately only ever a single agricultural impact of a development and that is a change to the future agricultural production potential of the land. This impact occurs by way of different mechanisms some of which lead to a decrease in production potential and some of which lead to an increase. It is the net sum of positive and negative effects that determines the overall agricultural impact.

Two direct mechanisms have been identified that lead to decreased agricultural potential by:

1. **Occupation of land** - Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime. As has been discussed above, the small and widely distributed nature of the agricultural footprint of the facility means that only an insignificant proportion of the available agricultural land is impacted in this way.
2. **Soil erosion and degradation –** Erosion can occur as a result of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Soil erosion and loss of topsoil are completely preventable. The stormwater management that will be an inherent part of the engineering on site and standard, best-practice erosion control and topsoil management measures recommended and included in the Environmental Management Programme (EMPr), are likely to be effective in preventing soil erosion and loss of topsoil.

Three indirect mechanisms have been identified that lead to increased agricultural potential through:

1. **increased financial security for farming operations -** Reliable and predictable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and 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. **an improved road network**, with associated storm water handling system. The wind farm 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.

Considering what is detailed in Section 9.2 above, the extent to which any of these mechanisms is likely to actually affect levels of agricultural production is small and the overall impact of a change in agricultural production potential is therefore small.

There are two additional effects, but because they are highly unlikely to have an impact on 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.

9.4 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 agricultural land, with a consequent decrease in agricultural production. 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?

Department of Forestry, Fisheries and the Environment (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 will consider all renewable energy projects within a 30 km radius. The quantification of the cumulative impact will be done in detail in the EIA phase. This is highly likely to confirm that the cumulative impact of loss of future agricultural production potential is low. The development is highly likely to have an acceptable impact on the agricultural production capability of the area and therefore be recommended for approval from a cumulative agricultural impact point of view.

9.5 Impacts of the no-go alternative

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. There are no agricultural impacts of the no-go alternative.

The development offers an additional income source to agriculture, without excluding agriculture from the land. Therefore, the negative agricultural impact of the no-go alternative is more significant than that of the development, and so, 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.

9.6 Alternative development footprints and comparative assessment of alternatives

The agricultural protocol requires identification of 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.

It can be seen in Figure 3 that the buildable area extends into croplands and therefore that some of the turbines will be located within croplands. The positioning of turbines in a wind farm is complex and there are multiple, interacting factors that determine the locations that will ensure the viability of the wind farm. 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, in order to retain the viability of all the turbines. Turbines cannot therefore simply be shifted off the cropland. However, as has been discussed above, the agricultural impact of these turbines within croplands is so small that it does not make sense to compromise the viability of the wind farm, to make only an insignificant change to the agricultural impact.

Design and layout alternatives are unlikely to make any material difference to the significance of the agricultural impacts. The same applies to technology alternatives, and there are therefore no preferred alternatives from an agricultural impact perspective. All alternatives are considered acceptable.

9.7 Long term project 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.

9.8 Additional environmental impacts

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

9.9 Micro-siting to minimize fragmentation and disturbance of agricultural activities

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. One aspect of wind farm layout that can cause unnecessary fragmentation of croplands is the location of turbine access roads within croplands. This aspect can only be assessed once the road layout is available.

9.10 Impact footprint

The agricultural protocol achieves its purpose, in relation to renewable energy developments on agricultural land, by imposing allowable development limits on different agricultural sensitivity categories of land. The allowable development footprint is the area of a particular sensitivity category of land that can be directly occupied by the physical footprint of a renewable energy development. There are six different allowable development footprints, defined according to a combination of land capability and cropping status, as specified in Table 1, below.

Table 2: Allowable development limits as specified in the agricultural protocol.

Allowable footprint category	Agricultural sensitivity on screening tool	Allowable footprint (ha/MW)	Definition of category
1	Very high	0.00	Land capability of 11-15; or irrigated land; or dryland horticulture or viticulture
2	High	0.20	Land capability of 8-10 on existing field crops
3	High	0.25	Land capability of 6-7 on existing field crops
4	High	0.30	Land capability of 1-5 on existing field crops
5	High	0.35	Land capability of 9-10 outside of existing field crops
	Medium		Land capability of 8 outside of existing field crops
6	Medium	2.5	Land capability of 6-7 outside of existing field crops
	Low		Land capability of 1-5 outside of existing field crops

The calculation of the compliance of the proposed wind farm to the development limits, will be done in detail during the EIA phase, once a proposed turbine and road layout is available. A preliminary assessment suggests that it is highly likely that the agricultural footprint of a wind farm on the site will be within the allowable development limits set by the agricultural protocol.

9.11 Mitigation measures

Mitigation measures are all inherent in the project design and / or are standard, best-practice for construction sites.

- A system of storm water management, which will prevent erosion, will be an inherent part of the road engineering on site. As part of this system, the integrity of the existing contour bank systems of erosion control on croplands, where they occur on steeper slopes, must be kept in tact. 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.
- 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 to 40 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.

9.12 Impact assessment

The detailed impact assessment using the prescribed, semi-quantitative rating methodology will be done in the EIA phase. However, that system does not rate agricultural impacts in a sensible or particularly useful way. As has been discussed above, the significance of the agricultural impact is simply the degree to which the future agricultural production potential of the site will be changed and that is predominantly a function of the size of the area of land that is impacted and the production potential of that impacted land. The dominant factor in this case is the small size of the area of land that will be impacted. Although the development will occupy land that has high agricultural potential, the agricultural use of the land will be integrated with the renewable energy facility and it will therefore lead to no, or at most negligible loss of current production, agricultural employment, or future agricultural production potential. The agricultural impact of the proposed development is therefore assessed as being of low significance.

10 CONCLUSIONS

The agricultural sensitivity of the site was verified as being high on lands that are current croplands. The rest of the site was verified as being of medium agricultural sensitivity. Soil limitations for crop production on approximately 70% of the surface area are predominantly the result of limited depth due to underlying bedrock or hardpan (soils of the Mayo, Milkwood, Glencoe, Swartland, Glenrosa, Mispah, and shallow members of the Clovelly and Hutton soil forms) or underlying clay (soils of the Kroonstad, Estcourt, and Valsrivier soil forms) or poor drainage (soils of the Kroonstad, Estcourt, Longlands, Wasbank, and Rensburg soil forms). Deeper soils of the Bonheim, Avalon, Hutton and Clovelly soil forms allow for crop production on approximately 30% of the surface area.

Farmers in the area utilise suitable soil for grain and soy production as well as for Oulandsgras for hay. Soil that is not suitable for crop production is used for cattle and sheep grazing on natural grasslands.

Two potential negative, direct agricultural impacts have been identified as loss of agricultural potential by occupation of land and loss of agricultural potential by soil degradation. The loss by occupation will exclude only a very small proportion of the land from agricultural production and will therefore have minimal impact on production potential. Three positive, indirect agricultural impacts have been identified as enhanced agricultural potential through increased financial security for farming operations; enhanced agricultural potential through improved security against stock theft and other crime; and an improved farm road network. All impacts are assessed as being of low significance.

The conclusion of this assessment is that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. This is substantiated by the facts that the development will exclude only a very small proportion of the land from agricultural production and will therefore have minimal impact on production potential; the amount of agricultural land loss is within the allowable development limits prescribed by the agricultural protocol; it offers improved financial security, as well as wider, societal benefits; it offers security benefits against stock theft and other crime; it poses a low risk in terms of causing soil degradation; and the loss by occupation is not permanent and land will become available again after the activity ceases.

The proposed development is therefore acceptable from an agricultural impact point of view, and it is recommended that it 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 recommended mitigation measures.

11 REFERENCES

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Department of Agriculture, Forestry and Fisheries, 2017. National land capability evaluation raster data layer, 2017. Pretoria.

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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. SA Atlas of Climatology and Agrohydrology, available on Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/

Soil Classification Working Group. 1991. Soil classification: a taxonomic system for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

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.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- 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*.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

APPENDIX 2: DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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)

PROJECT TITLE

THE PROPOSED UJEKAMANZI WIND ENEERGY FACILITY 1 NEAR ERMELO IN MPUMALANGA PROVINCE

Kindly note the following:

- This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
- This form is current as of 01 September 2018. 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.environment.gov.za/documents/forms.
- A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
- All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
- All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Private Bag X447, Pretoria, 0001
Physical address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Environment House, 473 Steve Biko Road, Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Johann Lanz – Soil Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johann Lanz			
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			
Postal code:	7800	Cell:	082 927 9018	
Telephone:	082 927 9018	Fax:	Who still uses a fax? I don't	
E-mail:	johann@johannlanz.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz**, declare that –

- I act as the independent specialist in this application;
- 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 Act.

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company:

16/04/2023

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company

16/04/2023

Date

Signature of the Commissioner of Oaths

2023-04-16

Date

SUID-AFRIKAANSE POLISIEDIENS
CSM
WYNBERG KP
16 APR 2023
CSM
WYNBERG CP
SOUTH AFRICAN POLICE SERVICE

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 fields(s) of practice (Schedule 1 of the Act)

Soil Science (Professional Natural Scientist)

Effective **15 August 2012** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

APPENDIX 4: PROJECTS INCLUDED IN CUMULATIVE IMPACT ASSESSMENT

Table 3: Table of all projects that were included in the cumulative impact assessment.

DFFE Reference	Project name	Technology	Capacity (MW)
Total solar			
Total wind			
Total			

Cumulative impacts will be assessed in detail in the EIA phase.

APPENDIX 5: SOIL DATA OF LAND TYPES

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ca3	Kroonstad, Estcourt	400 - 900	8 - 15	30 - 40	gc	14,3
Ca3	Avalon	500 - 1000	10 - 20	12 - 25	sp	12,8
Ca3	Valsrivier	300 - 400	20 - 30	35 - 45	vp,gc	11,5
Ca3	Clovelly	400 - 900	10 - 20	12 - 25	so,lc	9,8
Ca3	Glencoe	400 - 900	10 - 20	12 - 25	hp	8,8
Ca3	Hutton	500 > 1200	25 - 30	25 - 40	so,lc,hp	7,5
Ca3	Pinedene	500 - 1000	10 - 20	12 - 25	gc	7,3
Ca3	Longlands, Wasbank	400 - 900	8 - 15		sp	7,0
Ca3	Rensburg	400 - 600	40 - 50		gc	6,0
Ca3	Rock outcrops					3,8
Ca3	Glenrosa	300 - 400	10 - 15		so,lc	3,8
Ca3	Mispah	200 - 400	8 - 15		hp	2,5
Ca3	Bonheim	> 1200	35 - 45	35 - 50		1,5
Ca3	Milkwood	250 - 400	30 - 40		R	1,3
Ca3	Mispah	200 - 400	10 - 30		R	1,3
Ca3	Mispah	200 - 400	6 - 15		hp	1,3
Ea22	Arcadia	300 - 900	40 - 70		so,lc	19,5
Ea22	Mayo, Bonheim	200 - 500	30 - 55	20 - 45	so,lc	14,8
Ea22	Mayo	300 - 500	30 - 55	20 - 45	so,lc	14,8
Ea22	Milkwood	200 - 400	30 - 45		H	10,5
Ea22	Swartland	250 - 400	20 - 30	35 - 45	so,lc	8,5
Ea22	Rock outcrops					6,3
Ea22	Rensburg	600 - 1000	40 - 70		gc	5,5
Ea22	Valsrivier	250 - 400	20 - 30	35 - 50	vp	4,3
Ea22	Kroonstad	500 - 1000	15 - 30	40 - 60	gc	4,3
Ea22	Bonheim	700 > 1200	30 - 55	30 - 50	so,lc	3,3
Ea22	Avalon	600 - 1000	25 - 35	35 - 45	sp	2,8

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ea22	Hutton	400 > 1200	25 - 35	35 - 45	so,lc	2,8
Ea22	Mispah	100 - 300	20 - 30		H,P	2,0
Ea22	Stream bed					1,0
Ac39	Hutton	450 - 1200	20 - 35	30 - 45	so,hp	36,8
Ac39	Mayo	300 - 450	30 - 45		lc	7,8
Ac39	Rock outcrops					7,5
Ac39	Mispah	200 - 450	15 - 25		R	7,4
Ac39	Shortlands	400 - 800	30 - 45	35 - 60	so	7,4
Ac39	Clovelly	500 - 1200	20 - 35	25 - 45	so	7,3
Ac39	Glencoe	500 - 1200	20 - 30	25 - 35	hp	4,9
Ac39	Glenrosa	300 - 450	15 - 25		lc	4,9
Ac39	Bonheim	> 1200	30 - 50	35 - 60		3,0
Ac39	Swartland, Valsrivier	200 - 450	30 - 40	40 - 55	vp	2,8
Ac39	Milkwood	300 - 450	30 - 45		R	2,7
Ac39	Longlands	450 - 900	15 - 25	30 - 40	sp	2,6
Ac39	Mispah	200 - 450	15 - 25		hp	2,5
Ac39	Griffin	> 1200	30 - 45	35 - 60		2,4
Ea25	Rock outcrops					40,3
Ea25	Mayo	200 - 400	30 - 40		so	14,8
Ea25	Milkwood	200 - 300	35 - 40		R(H)	9,5
Ea25	Arcadia	400 - 600	40 - 60		so	7,5
Ea25	Shortlands	250 - 400	35 - 45	35 - 50	so	7,3
Ea25	Mayo	300 - 450	35 - 45		so	5,3
Ea25	Glenrosa	200 - 300	25 - 30		so	4,8
Ea25	Bonheim	400 - 900	30 - 40	30 - 50	so	4,5
Ea25	Hutton	400 - 700	30 - 40	35 - 40	so	3,5
Ea25	Shortlands	400 - 700	35 - 45	35 - 60	so	1,8
Ea25	Rensburg	400 - 600	40 - 60		gc	1,0

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ea22	Arcadia	300 - 900	40 - 70		so,lc	19,5
Ea22	Mayo, Bonheim	200 - 500	30 - 55	20 - 45	so,lc	14,8
Ea22	Mayo	300 - 500	30 - 55	20 - 45	so,lc	14,8
Ea22	Milkwood	200 - 400	30 - 45		H	10,5
Ea22	Swartland	250 - 400	20 - 30	35 - 45	so,lc	8,5
Ea22	Rock outcrops					6,3
Ea22	Rensburg	600 - 1000	40 - 70		gc	5,5
Ea22	Valsrivier	250 - 400	20 - 30	35 - 50	vp	4,3
Ea22	Kroonstad	500 - 1000	15 - 30	40 - 60	gc	4,3
Ea22	Bonheim	700 > 1200	30 - 55	30 - 50	so,lc	3,3
Ea22	Avalon	600 - 1000	25 - 35	35 - 45	sp	2,8
Ea22	Hutton	400 > 1200	25 - 35	35 - 45	so,lc	2,8
Ea22	Mispah	100 - 300	20 - 30		H,P	2,0
Ea22	Stream bed					1,0