EIA FOR THE HAGA HAGA WIND ENERGY DEVELOPMENT: EAST LONDON REGION, EASTERN CAPE PROVINCE

Agricultural Assessment Study: Soils and soil suitability and Agricultural economic assessment

by

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DRAFT REPORT

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Grahamstown

EXECUTIVE SUMMARY

This report (which is a revision of the October 2017 report) deals with the implications for agricultural production of the envisaged 150 MW Wind Energy Facility (WEF) to be developed on approximately 8 730 ha of agricultural land, 50km from East London in the Eastern Cape Province. The October 2017 report had to be revised due to changing farm financial factors as well as the layout amendment of turbines as some turbines have been dropped and others micro-sited. The impact of this layout amendment on agricultural production is very small but also important as the dropped turbines used to occupy the better agriculturally suited soils.

The 150 MW wind energy facility (WEF), with a maximum of 36 turbines, is planned to be constructed by **Haga Haga Wind Farm (RF) (Pty) Ltd** on 13 to 15 adjacent farms in that region (refer to Figure 1 for outside figure). The WEF is expected to have an operational life span of 25 years. The investigation is coordinated by CES- Environmental and social advisory services, Grahamstown.

The environment where the turbines are planned to be placed consists of low ridges that are generally well vegetated and some lower areas that are currently used as grazing land. No permanent irrigation practices occur anywhere along the route. There is a generally low density of human occupation of the land almost all of which are involved in farming activities. The development potential of the land for more intensive agricultural production purposes, like cropping, is limited due to, *inter alia*:

- relatively low and unreliable rainfall in the region, and
- absence of lasting irrigation water

This situation is not expected to change in the future.

The surveyed area for the Haga Haga WEF is indicated in Figure 1. The farm areas that are planned to be used for the WEF can be described as consisting of mainly Bhisho Thornveld and Albany Coastal Belt vegetation (Mucina & Rutherford, 2006), with a bearing capacity of approximately 5ha/large stock unit (LSU). It is presently mainly utilized by beef cattle. This investigation will thus focus on the expected impact of the proposed WEF on farming activities on the farm parcels that are earmarked for the proposed development. The existing ''placement map'' for the turbines and associated infrastructure will form the base for the impact analyses.

The DEA requested in their Scoping Report Acceptance Letter that the soil investigation must comply to the Terms of Reference given in a document dated 23 January 2017. These points were addressed using a modified survey method and results given in Section A of the Report and Figures and Tables in Appendixes. This information was used for the agricultural economic evaluation as presented in Section B of the report.

The agricultural potential of the farms that are involved as well as the expected loss of agricultural output value due to the proposed WEF development, will be illustrated with the most common farming branches of the region, namely beef cattle, as a point of reference. A 100-cow unit will be used as research entity to estimate the expected financial impact of the placement of the turbines for the wind energy facility on farming in the region. Farm size differs a lot and will thus consist of multiple 100 cow units, depending on the area of the farm and the

bearing capacity of the veld. A bearing capacity of, say, 5ha/Large stock unit (LSU) is assumed for the Haga Haga area. The expected yearly average financial results from a 100-cow unit of beef cattle in the area is presented in Table 4.1. It is clear that farming operations are profitable. The total gross margin (i.e. before taking account of farm overhead costs) of a typical 100 cow unit (beef cattle) on natural graze land in the Haga Haga area is expected to be approximately R346 872 per year (i.e. approximately R390 per ha graze land at a bearing capacity of, say, 5ha/LSU).

The expected impact (refer to Section C) of the proposed WEF on potential farming activities can be discussed in terms of, *inter alia*, the nature, magnitude, duration, extent and consequences thereof, as follows:

- It can be seen as a relative permanent substitution of some of the agricultural resources for the WEF installations for the development of alternative energy.
- The magnitude of the impact of the alternative energy project at a national level is expected to be more positive than negative (i.e. the positive contribution towards electricity development is expected to be considerably more than the negative impact of the loss in agricultural output value at the farm level).
- The duration of the project can be seen as long term (i.e. relative permanent)
- The loss of agricultural resources can, however, also be seen as reversible (i.e. should the project be terminated after, say, 20 years the land will become ‘’free’’ again for agricultural production purposes.

The impact of the project on the financial situation of the farms will thus be determined by, *inter alia*, the following aspects:

- Profitability levels of the current farming activities
- Loss of farming income due to the impact of the project, for example the negative effect of the loss of land on agricultural output, and
- The expected market related remuneration agreement of farmers for the utilization of their land.

The loss of farming income (refer to Table 5.2) will be determined by, *inter alia*, the following aspects:

- The area to be taken up by the Infra structure for the WEF will determine the loss of income from farming.
- The placing-strategy (i.e. positioning) of the turbines and associated infrastructure
- Expropriation of farmland, if applicable.
- Appropriate mitigation measures, like the conservation of the top-soil, the proper rehabilitation of the construction sites and roads, and the sensible placing of the turbines.

It is expected that only about 0.9% of the yearly gross margin from farming operations on the site for the WEF will be lost due to the proposed wind energy project (refer to Table 5.2). It is thus clear that, should appropriate mitigation measures be employed

during construction, the negative impact of the project on farming practices in the investigation area can be seen as virtually ignorable. It should further be possible for the farmers to organize their grazing schedule in such a way that the reproduction process of the livestock will not be notably disturbed during the construction period. Farming practices should thus be able to continue as in the past.

The expected yearly remuneration agreement for the utilization of their land will serve as a stabilizing factor as far as the flow of yearly income is concerned. Farming practices should thus be able to continue in a more stable financial environment and the security in this regard of the farmers, their farm workers and their families should thus be furthered.

Policy-makers have various goals for the development of South Africa. As far as this project is concerned*, inter alia* the following are relevant:

- The management and utilization of natural agricultural resources (i.e. land and water) in such a way that the goal of food-security will not be jeopardized. This goal is 'looked after' by the Department of Agriculture.
- To add new capacity to the national electricity grid, *inter alia*, via the utilization of renewable energy sources, for example wind energy, and thus reducing carbon emissions. This goal is the 'business' of the Department of Energy.

It seems that in this case both these goals can be furthered via the utilization of a relatively ignorable portion of relative low potential agricultural land on the farms where the development of the proposed wind energy facility is planned.

Based on findings of this investigation, we are of the opinion that the proposed wind energy facility could be beneficial to both the involved farmers, the alternative energy developer and also to the development of "clean" energy supply to South Africa.

DECLARATION OF INDEPENDENCE

I, Johann Laubscher, declare that I am an independent consultant, and that I am financially independent of the client and their consultants, and that all opinions expressed in this report are substantially my own.

Johann Laubscher

Abridged CV

Surname: Laubscher
First names: Johann
Date of Birth: 29 July 1945
University of Stellenbosch, South Africa. Ph D (Agric) 1987

Key Experience

I retired in 2006 as professor in Agricultural Economics at the University of Stellenbosch with 32 years' experience. My expertise covers various fields, *inter alia*, strategic planning and -management, financial viability analyses, agricultural enterprise budgeting and advice, business plans and environmental impact analyses (Agricultural economic perspective). I was involved, since 1990, in 18 projects in water resource planning, *inter alia* the Western Cape Systems Analysis (Estimation of the irrigation water demand) and the financial viability analysis of various envisaged irrigation schemes in the Olifants-, Doring- and Breede river basins.

I was involved, since 2011, in 16 projects that focussed on the impact of the development of alternative energy installations on farms on their agricultural production potential.

I trade under the name **Johann Laubscher**.

DECLARATION OF INDEPENDENCE

I, Freddie Ellis, declare that I am an independent consultant, and that I am financially independent of the client and their consultants, and that all opinions expressed in this report are substantially my own.

Freddie Ellis
Pr. Sci. Nat. (registration Number 400158/08)

Abridged CV

Surname: Ellis
First names: Freddie
Date of Birth: 21 April 1947
University of Stellenbosch, South Africa. PhD Agric (Soil Science) 1988

I have been working as a soils consultant for more than 30 years and consult under my own name**.**

Some of the activities are briefly listed below:

1990	**South Africa:** An agricultural evaluation of the Atlantis Corridor (approx. 75 000 ha) area
2001	**Namibia** Soil survey and land interpretation for irrigation development along the Lower Orange River near Koeskop and Daberas
2001-2003	**South Africa:** Western Cape Olifants/Doring River Irrigation Study. Responsible for field soil survey and classification and mapping of the soils. Soil suitability evaluations for irrigated crop production; recommendations for physical and chemical ameliorations measure.
2001-2003+	**South Africa:** Water quality information systems for integrated water resource management: The Riviersonderend-Berg River systems (funded by WRC) involved as a *Soil Science Team Member:*
2008	**Uganda:** Potential for afforestation of an area of approximately 24 000 ha at Sango Bay, Uganda.
2009	**South Africa:** Reconnaissance soil survey and land use plan for the Heidelberg farms (approx. 5 000 ha), University of Stellenbosch

EXECUTIVE SUMMARY ii

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APPENDIX 1

Figure 1 Land types of the Haga Haga survey area

Figure 2 Soil suitability per turbine site

Figure 3 Agricultural impact per turbine

Figure 4 Opportunities and constraints map (as given in the scoping report) seen from an agricultural point of view.

Table 1 Memoirs of Land types

Table 2 Data of the natural resource soil and terrain and impact assessment on agriculture for turbine positions

Table 3 Observation coordinates and soils identified at turbine sites

APPENDIX 2

WATER AND WIND EROSION CLASSES DEFINED BY SCOTNEY et al (1987)

1 INTRODUCTION

This report (which is a further revision of the October 2017 report) deals with the implications for agricultural production of the envisaged 150 MW Wind Energy Facility (WEF) to be developed on approximately 8 730 ha of agricultural land, 50km from East London in the Eastern Cape Province. The October 2017 report had to be revised due to changing farming financial factors as well as the layout amendment of turbines as some turbines have been dropped and other micro-sited. The positive impact of this layout amendment on agricultural production is very small but also important as the dropped turbines used to occupy the better agriculturally suited soils.

The 150 MW wind energy facility (WEF), with a maximum of 36 turbines, is planned to be constructed by **Haga Haga Wind Farm (RF) (Pty) Ltd** on about 13 to 15 farm business units consisting of different farm portions (consult Table 5.1). The outside figure and focus area of the WEF is indicated in Figure 1. The WEF is expected to have an operational life span of 25 years. The investigation is coordinated by CES- Environmental and social advisory services, Grahamstown.

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The environment consists of low ridges that are generally well vegetated consisting of mainly Bhisho Thornveld and Albany Coastal Belt vegetation (Mucina & Rutherford, 2006) and some lower lying areas that are currently used as grazing land. No irrigation practices occur anywhere along the route. Small portions of some of the farms are cultivated, while the major portion of the land is used for animal grazing, mainly meat type beef cattle. There is a low density of human occupation on the land, of which almost all are involved in farming activities.

The scope of work will thus involve an investigation of the impact of the envisaged wind energy project on agricultural production possibilities. It will comprise of the required Environmental Permitting Process (EIA phase) in terms of the NEMA Regulations, (2014) as amended. The existing ''placement map'' for the turbines of the WEF will form the base for the impact analyses.

The purpose of this report is to provide input with regard to the expected impact of the envisaged WEF on agricultural activities on the sites that are earmarked for the development. The investigation thus focused on the potential of the natural resource base as far as production/utilization possibilities are concerned as well as on the economics of current and potential agricultural production practices.

Due to the fact that the area where the turbines are planned lies outside the traditional cultivated areas (see Section A below) we changed the methodology to comply to the Terms of Reference regarding the very strict rules about the soil investigation. The reason for this change is explained just after point B of the TOR (DEA dated 23 January 2017) given below.

The Terms of Reference was to provide agricultural economic input into the feasibility study for the proposed wind energy development. It includes the following:

- Provide a description of site characteristics (soil and climate i.e. agricultural natural resources) that will form the basis to evaluate the agricultural potential of the area. The agricultural natural resource data will serve as a base for the agricultural economic perspective of the area.
- Provide a description of site characteristics from an agricultural economic point of view.
- Provide a brief description of any issues/impacts foreseen.

The agricultural economic perspective (refer to Section B) is based, inter alia, on the suitability analyses as far as the natural resource base of the proposed development sites is concerned (refer to Section A).

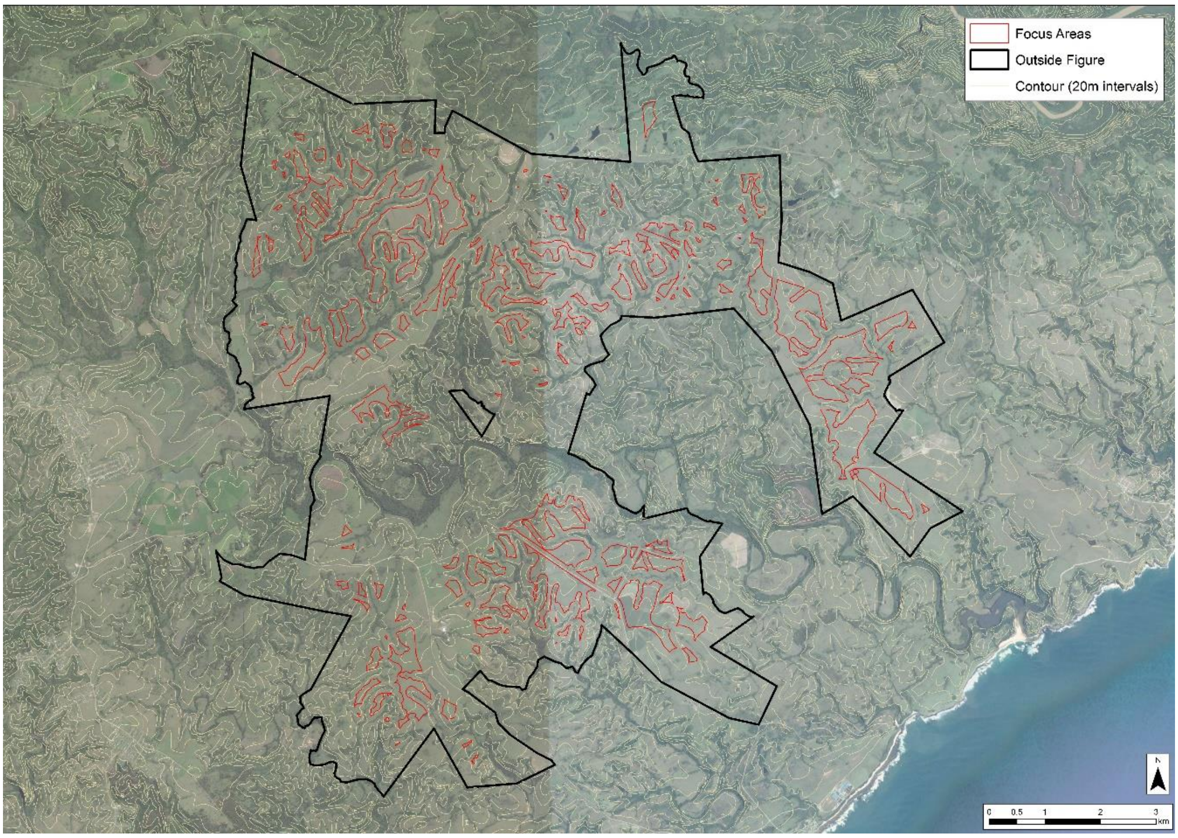

Figure 1 Map showing the outside figure and focus areas of the Haga Haga WEF (map supplied by Terramanzi)

The **negative impacts** on farming will mainly be the loss of agricultural land and thus by implication the loss of net output value due to the construction of:

- The footprint of the turbines and service platform
- Access roads
- Sub station
- Construction camp footprint.

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The analysis of the impact (agricultural perspective) of the proposed WEF is presented in Section C of this report. The investigation thus focused on the potential of the natural resource base as far as production possibilities are concerned, influence that the placement of the turbines and roads will have on water and wind erosion, as well as on the economics of current and potential agricultural production practices on the affected areas.

The negative impacts on farming will mainly be the loss of agricultural land and thus by implication the loss of net output value due to the construction of the proposed Haga Haga WEF.

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Appropriate information was gathered during a site-visit on 5 and 6 December 2016 and again on 28 September 2017.

SECTION A

SOIL AND SOIL SUITABILITY ASSESSMENT

2 GENERAL DESCRIPTION AND LAND USE OF THE AREAS WHERE THE WIND ENERGY FACILITIES ARE PLANNED

The 150 MW wind energy facility (WEF), with a maximum of 36 turbines, is planned to be constructed by **Haga Haga Wind Farm (RF) (Pty) Ltd** on 13 to 15 adjacent farms in that region. The outside figure and focus area of the WEF is indicated in Figure 1.
The environment within the focus area consists of low ridges that are generally well vegetated (mainly Eastern Valley Bushveld and Bhisho Thornveld (Mucina & Rutherford, 2006)) and some lower areas that are currently used as grazing land. No organized irrigation practices occur anywhere along the route. There is a generally low density of human occupation of the land almost all of which are involved in farming activities.

Mudstone, shale and sandstone of the Beaufort Group (Fa and Db land types) dominate the whole area, with occasionally some dolerite outcrops, but on the Ea land type (lies outside the present turbine zone but inside the focus area given in Figure 1 above and given on a map in in Tables in the Scoping Report) dolerite dominate. Due to the lithology, terrain and climate of the area, the soils are fairly shallow developed (less than 500 mm to weathered rock). Only on the dolerite parent material deeper soils (about 800 mm to weathered rock) with some swelling properties, occur. The deepest soil (more than 800 mm deep to any restriction to roots or water), usually without coarse fragments and originated from weathering *in situ* from shale or transported local colluvium of alluvium, occur on the lowland areas or along streambeds.

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In Tables 2.1.1 – 2.1.3 below climate statistics for three farms lying in the survey area, are given.

Table 2.1.1: Climate statistics for farm 447 lying within the survey area (Schulze, 1997)

Frost (days)	0		
Mean annual rainfall (mm)	914	**Median annual Temp. (C)**	18.9
Median Jan. rainfall (mm)	77	**Median Jan. Temp. (C)**	21.9
Median Feb. rainfall (mm)	84	**Median Feb. Temp. (C)**	22.3
Median Mar. rainfall (mm)	98	**Median Mar. Temp. (C)**	21.4
Median Apr. rainfall (mm)	54	**Median Apr. Temp. (C)**	19.6
Median May rainfall (mm)	30	**Median May Temp. (C)**	18.1
Median Jun. rainfall (mm)	16	**Median Jun. Temp. (C)**	16.3
Median Jul. rainfall (mm)	14	**Median Jul. Temp. (C)**	15.9
Median Aug. rainfall (mm)	27	**Median Aug. Temp. (C)**	16.3
Median Sept. rainfall (mm)	58	**Median Sept. Temp. (C)**	17.1
Median Oct. rainfall (mm)	90	**Median Oct. Temp. (C)**	17.8
Median Nov. rainfall (mm)	91	**Median Nov. Temp. (C)**	19.2
Median Dec. rainfall (mm)	72	**Median Dec. Temp. (C)**	20.6
Total Annual Pot. Evap. (mm)	1619		

Table 2.1.2: Climate statistics for farm RE/132 lying within the survey area (Schulze, 1997)

Frost (days)	11		
Mean annual rainfall (mm)	912	**Median annual Temp. (C)**	19.0
Median Jan. rainfall (mm)	80	**Median Jan. Temp. (C)**	22.0
Median Feb. rainfall (mm)	85	**Median Feb. Temp. (C)**	22.4
Median Mar. rainfall (mm)	97	**Median Mar. Temp. (C)**	21.5
Median Apr. rainfall (mm)	52	**Median Apr. Temp. (C)**	19.8
Median May rainfall (mm)	29	**Median May Temp. (C)**	18.2
Median Jun. rainfall (mm)	15	**Median Jun. Temp. (C)**	16.5
Median Jul. rainfall (mm)	13	**Median Jul. Temp. (C)**	16.2
Median Aug. rainfall (mm)	24	**Median Aug. Temp. (C)**	16.6
Median Sept. rainfall (mm)	55	**Median Sept. Temp. (C)**	17.3
Median Oct. rainfall (mm)	90	**Median Oct. Temp. (C)**	17.8
Median Nov. rainfall (mm)	93	**Median Nov. Temp. (C)**	19.2
Median Dec. rainfall (mm)	76	**Median Dec. Temp. (C)**	20.6
Total Annual Pot. Evap. (mm)	1621		

Table 2.1.3: Climate statistics for farm 452 lying within the survey area (Schulze, 1997)

Frost (days)	11		
Mean annual rainfall (mm)	906	**Median annual Temp. (C)**	19.1
Median Jan. rainfall (mm)	80	**Median Jan. Temp. (C)**	22.1
Median Feb. rainfall (mm)	85	**Median Feb. Temp. (C)**	22.5
Median Mar. rainfall (mm)	96	**Median Mar. Temp. (C)**	21.6
Median Apr. rainfall (mm)	54	**Median Apr. Temp. (C)**	19.8
Median May rainfall (mm)	30	**Median May Temp. (C)**	18.3
Median Jun. rainfall (mm)	15	**Median Jun. Temp. (C)**	16.5
Median Jul. rainfall (mm)	15	**Median Jul. Temp. (C)**	16.1
Median Aug. rainfall (mm)	27	**Median Aug. Temp. (C)**	16.6
Median Sept. rainfall (mm)	56	**Median Sept. Temp. (C)**	17.4
Median Oct. rainfall (mm)	88	**Median Oct. Temp. (C)**	17.9
Median Nov. rainfall (mm)	92	**Median Nov. Temp. (C)**	19.3
Median Dec. rainfall (mm)	75	**Median Dec. Temp. (C)**	20.8
Total Annual Pot. Evap. (mm)	1621		

From Tables 2.1.1 to 2.1.3 it is clear that rainfall is generally too low to grow any crop for commercial purposes under dry land conditions. Although annual rainfall is over 900 mm it is the distribution, coupled with the high evapotranspiration, which are responsible for the low effective rainfall. During the growing season (summer months) moisture availability is too low for adapted annual crops (e.g. maize) to ensure a crop each year. Only when irrigation water is available farming with annual crops will be possible. Irrigation water is not readily available in the areas where turbines are planned. Here and there farmers have made small dams to catch run-off water, mainly for animal use. Rainfall is however high enough to ensure that there is enough grazing on the natural veld, especially during the summer months, for livestock and this area is therefore important for cattle farming. I was informed by some of the farmers in the area that pineapple plantations were in existence on some farms more than 10 years ago. They could not give a clear answer of why there are no pineapples growing on any of the farms presently.

3 METHODOLOGY FOLLOWED TO ADDRESS THE SOIL PART OF THE TOR

The Terms of Reference for this Soil and Agricultural Potential Assessment (Impact Assessment Phase) was supplied in a document from the DEA dated 23 January 2017 re the following:

Determine the agricultural suitability of the soils covering the lease area and suggest actions to minimise the possible impact on agriculture.

Include, as per your proposal:

- Compilation of a soil legend based on soil forms/families and other important soil properties;
- Evaluation of soil map legend units important for agricultural purposes, relevant to the area;
- To assess the extent to which the current agricultural activities on the properties would be interrupted by the construction and operation of a wind energy facility and to propose appropriate mitigation measures (i.e. impact analyses);
- Investigation of the profitability levels of current and potential farming activities;
- Estimation of the loss in farming income for the duration of the lease period for the project (at least a 20-year period);
- Estimation of the income for the land owners due to a profit-sharing/rent-income agreement with the developer (20-year period);
- Undertake a comparison of such costs and what your conclusions are; and
- Reporting of the findings of the investigation.

B. AGRICULTURAL STUDY REQUIREMENTS

Part of the agricultural requirements for the TOR is given below. It is the methodology followed to address these aspects that are briefly discussed below the section on requirements for agricultural soil studies.

1. *Detailed soil assessment of the site in question, incorporating a radius of 50 m surrounding the site, on a scale of 1:10 000 or finer. The soil assessment should include the following:*

   - Identification of the soil forms present on site.
   - The size of the area where a particular soil form is found.
   - GPS readings of soil survey points.
   - The depth of the soil at each survey point.
   - Soil colour.
   - Limiting factors.
   - Clay content.
   - Slope of the site.
   - A detailed map indicating the locality of the soil forms within the specified area.
   - Size of the site.

2. *Exact locality of the site*

3. *Current activities on the site, developments, buildings*

4. *Surrounding developments I land uses and activities in a radius of 500 m of the site*

5. *Access routes and the condition thereof*

6. *Current status of the land (including erosion, vegetation and a degradation assessment)*

7. *Possible land use options for the site*

8. *Water availability, source and quality*

9. *Detailed descriptions of why agriculture should or should not be the land use of choice*

10. *Impact of the change of land use on the surrounding area*

11. *A shape file containing the soil forms and relevant attribute data as depicted on the map*

Methodology followed for the agricultural soil study:
***For the area where the turbine placements are planned a soil investigation at each turbine position was done by logic interpretation of the data available (Land type data and knowledge of the soils gathered with the previous site visit). Use was also made of a 5m contour map on a good photo background to first determine on which terrain unit each turbine placement is planned. On 28 September 2017 twelve of the sites were visited in the field by Ellis and Schloms to verify their correct classification and to make adjustments to some. This information is given in Appendix 1, Tables 1 – 3. It should be mentioned here that the field visit was very valuable as it confirmed the correctness of the soil data for this purpose and therefore the methodology that was used to obtain the data*.**

3.1 SOIL INVESTIGATION TO DETERMINE THE SOIL SUITABILITY IN THE SURVEY AREA BEFORE TURBINE PLACEMENTS

Only one source (Agricultural Research Council, 2010) of soil information was originally available for use for the evaluation of the suitability of the property for agricultural use. This is information of the land type survey (a survey of country wide soil, climate and terrain forms, on 1:250 000 scale) of South Africa. The soil information per land type is given in Appendix 1, Table 1 and the map showing the land types in Appendix 1, Figure 1.

Verification and adjustments to some of the soils occurring on the proposed turbine sites were done during a field visit by Ellis and Schloms (*Pr. Sci. Nat. (registration Number* 400059/10) during September 2017.

Soil suitability and land evaluation:

The most common limitations for crop production of the soils in the study area are the following:

- Rock or weathering rock at a shallow depth;
- low to medium low clay content in top and upper subsoils of soils developed from shale.

Interpretation using data from the land type map

The information gathered from the land type map and the interpretation of sites after the field visit reported above was used (see following paragraph) and interpreted in terms of their suitability for the commercial production of annual and perennial crops. Annual crops included pastures and mealies, while irrigated olives or pineapples (potential crops that can be grown if irrigation water would become available) were used as perennial crop. For soil suitability criteria related to pineapple growing the criteria given by Sys, Van Ranst, Debaveye and Beernaert (1993) were used.

The soil suitability rating ranges from 1 to 10, with 1 the lowest and 10 equals to the highest or best suitability. For both annual and perennial crops, the suitability rating refers to vigour and potential production potential without considering product quality. Although fairly subjective, suitability ratings by experienced soil scientists (in this case an average of two soil scientists) with many years of field experience are a handy tool to group soil types into production potential classes and for land use recommendations. The ratings can be interpreted according to the guidelines given in Table 3.1.

Information derived from "The Soil Suitability Map of South Africa (SSMSA)" (Lambrechts, Ellis & Van Niekerk, 2011) was used in this evaluation. The Soil Suitability Map of South Africa (SSMSA) was produced using the land type data of South Africa (scale 1:250 000) as basis (Agricultural Research Council, 2010). An algorithm was developed and implemented to rate each land type according to its suitability for perennial crops. The algorithm takes into consideration the individual soils within each land type, as well as the texture and depth of each soil identified. The result of the algorithm is a soil suitability index out of 100. The values for annual crops were not determined with this method but normally are the same or better as for perennial crops. Results of the Ellis & Van Niekerk (2011) method is given in Table 3.2.

Table 3.1: Interpretation of suitability ratings for perennial crops

Rating (%)	General suitability	
≤20	Very low	Not recommended
>20 - ≤30	Low	
>30 - ≤40	Low-medium	Marginally recommended
>40 - ≤50	Medium	Conditionally recommended
>50 - ≤60	Medium-high	Recommended
>60	High	Highly recommended

Table 3.2: Soil suitability for perennial crops on the two land types where turbine are planned

Landtype number	Land type suitability rating for perennial crops (%)	General soil suitability description
Fa 420	32.1	Low-medium
Fa 419	31.1	Low-medium

From Table 3.2 above it is clear that the soil suitability, using only land type data, where the proposed turbines are planned is rated Low-medium for any perennial crop (in general slightly higher for annual crops) to be grown. With fairly high but still unreliable rainfall however, the potential for annual winter or summer grain crops and pastures is also low and therefore the area is generally seen as **not suitable** for any agricultural crop that is dependent on natural rainfall (see remarks about pineapple growing above)**.**

3.2 COMPARISON OF PRESENT SOIL AND LAND CONDITIONS WITH CONDITIONS EXPECTED TO OCCUR AFTER TURBINES AND ROADS HAVE BEEN IMPLIMENTED (i.e. IMPACTS ON AGRICULTURE)

In an attempt to quantify the possible affect that the placement of roads and turbines might have on the inherent properties of the land (i.e. soils and terrain) we prepared Table 3.3 (based on an extract of a table given in Appendix 1 Tables 2 and 3) where soil suitability alone and the combined influence of soil suitability, water and wind erosion (using criteria given by Scotney et al, 1987, see Appendix 2) was evaluated to come up with a so-called “**agricultural impact class**”. This class can be considered to represent the dominant impact that the use of the areas where turbines are planned, would have on the natural resources evaluated. **A value of low would indicate that placing of turbines should have a minor influence while a rating of high would mean that the impact on the natural resources is so high that it will influence agriculture (and the environment) very negatively**

Table 3.3 Impacts of placement of turbines on agricultural land (extract summary of Appendix 1, Table 2)

Turbine number[1]	Soil suitability on turbine site[2]	Combined influence of soil, water and wind erosion on turbine site that will have an impact on agriculture[3]
T01	Medium	Low
T02	Low – medium	Low
T03	Low – medium	Low
T04	Medium	Low
T05	Low – medium	Low
T06	Low – medium	Low
T07	Low – medium	Low
T08	Medium	Low
T09	Low – medium	Low
T10	Low – medium	Low
T11	Low – medium	Low
T12	Low – medium	Low
T13	Low – medium	Low
T14	Low – medium	Low
T15	Low – medium	Low
T16	Low – medium	Low
T17	Low – medium	Low
T18	Low – medium	Low
T19	Medium	Low
T20	Low – medium	Low
T21	Low – medium	Low
T22	Low – medium	Low
T23	Low – medium	Low
T24	Low – medium	Low
T25	Low – medium	Low
T26	Low – medium	Low
T27	Low – medium	Low

T28	Low – medium	Low
T29	Low – medium	Low
T30	Low – medium	Low
T31	Low – medium	Low
T32	Low – medium	Low
T33	Low – medium	Low
T34	Low – medium	Low
T35	Low – medium	Low
T36	Low – medium	Low

[1] Numbers given as indicated on map in Appendix 1, Figure 1
[2] Soil suitability for perennial crops (Also refer to Appendix 1, Figure 1)
[3] This column represents a combined value of the natural resource data of soil and terrain, but also potential water and wind erosion of areas where turbines are planned (Also refer to Appendix 1, Figure 2)

To sum up the main findings of the soil and erosion analyses given in Tables 3.2 and 3.3 the following:

- **Soil suitability is general low – medium for perennial crops but slightly higher for annual crops.**
- **Combined influence of soil and erosion hazard (wind and water) is generally low.**
- **The suggested placings of turbines (July 2020) is acceptable from an agricultural point of view provided that mitigation measures prescribed in section 7.5 below, be followed.**

SECTION B

AGRICULTURAL ECONOMIC ASSESSMENT

4 PRODUCTION POSSIBILITIES AND LIMITING FACTORS

The farm areas that are considered for the construction of the wind energy facility can be described as consisting of mainly Bhisho Thornveld and Albany Coastal Belt vegetation (Mucina & Rutherford, 2006), with a bearing capacity of approximately 5ha/Large Stock Unit (LSU). It is presently mainly utilized by beef cattle.

The land, in general, where the wind turbines and associated infrastructure are planned to be placed, was rated a generally Low-medium suitability for any perennial crop production (refer to Table 3.2 above). The critical limiting factor in this regard is a low rainfall. Crop production will thus be too risky and the land can thus be described as good grazing land. Income from farming varies from year to year depending on weather conditions, mainly whether enough rainfall is realized. The agricultural potential of the farms that are involved as well as the expected loss of agricultural output value due to the proposed wind energy development, will be illustrated with the most common farming branches of the region, namely various beef cattle types, as a point of reference. A 100-cow unit will be used as research entity to estimate the expected financial impact of the wind energy facility on farming in the region. Farm size differs a lot and will thus consist of multiple 100 cow units, depending on the area of the farm and the bearing capacity of the veld. A bearing capacity of, say, 5ha/LSU is assumed for the Haga Haga area. The expected yearly average financial results from a 100-cow unit of beef cattle in the area is presented in Table 4.1.

Table 4.1: Gross margin analyses: Beef Cattle, Haga Haga region, Eastern Cape Province, 2019*

CATTLE FOR MEAT PRODUCTION: per 100 cow unit		
Key assumptions:		
Calving %	80	
Weaning %	80	
Cow replacement (%)	15	
Bearing capacity of veld (ha/LSU**)	5	
Herd composition	**Number**	**LSU****
Cows	100	100
Bulls	4	4
Young heifers	32	21
Steers	32	21
Heifer calves	32	16
Bull calves	32	16
Total	232	178
Gross Production value per year		
Sales:	**Rand**	**Rand Per LSU**
Culled cows (15 @ R9000)	135000	
Steers (32 @ R7563)	242000	
Young heifers (17 @ R6188)	105196	
Total	**482196**	**R 2 709**
Running costs:		
Marketing	21315	
Transport	11214	
Vetenarian	46725	
Feedstuff and licks	56070	
Total	**135324**	**R 760**
Gross margin	**R 346 872**	**R 1 949**
Gross margin/ ha veld	**R 390**	
*Source: Group discussion with farmers		
and other industry experts		
** Large stock unit		

It is clear that farming operations are profitable. The total gross margin (i.e. before taking account of farm overhead costs) of a typical 100 cow unit (Beef Cattle) on natural graze land in the Haga Haga area is expected to be approximately R346 872 per year (i.e. approximately R390 per ha graze land at a bearing capacity of, say, 5ha/LSU).

The development potential of the land for more intensive agricultural production purposes, like cropping, is limited due to, *inter alia*:

- relatively low and unreliable rainfall in the region, and
- absence of lasting irrigation water

This situation is not expected to change in the future.

5 LOSS OF AGRICULTURAL PROUCTION POTENTIAL AS A RESULT OF THE CONSRUCTION OF THE WEF

The expected impact of the placement of the 36 turbines (including the footprint for the new battery storage technology) on the agricultural land of the investigation area and thus by implication on the farming financial situation (i.e. negative impact) is presented in Table 5.1**.** The footprint per turbine is expected to be approximately 996 square metres, crane platform per turbine of 3700 square metres, 42.5 km of service roads (8 m wide) and other supporting infrastructure (i.e. buildings, storage and construction lay down) of 16.6 ha. **Only approximately 76 ha (i.e. 0.9%) of the farmland is thus expected to be utilized for the infrastructure of the WEF.** It should also be emphasised that the grazing of the livestock around the turbines is not expected to be impacted negatively (i.e. farming activities should be able to be continued as presently).

Table 5.1: Expected negative impact of the turbines and associated infra structure (including the footprint of the new battery storage technology) on the agricultural natural resource base in the Haga Haga development site

Farm owner/Number	Size	Turbines		Roads		Total	% of farm
	(ha)	Number	Area (ha)	Length (m)	Area (ha)	(ha)	area
IZOTSHA PROP HOLDINGS CC[1]	1884	4	1.9	9204	7.4	9.2	0.5%
SAINT FAMILY TRUST[2]	1303	8	3.8	7325	5.9	9.6	0.7%
THEO DICKE TRUST[3]	1997	9	4.2	14207	11.4	15.6	0.8%
THEO DICKE PTY LTD[4]	556	3	1.4	7290	5.8	7.2	1.3%
RALTON JOHN FREITAG[5]	128	0	0.0	316	0.3	0.3	0.2%
HECTOR ALLISON FREITAG [6]	236	2	0.9	1353	1.1	2.0	0.9%
JOHN WINSTON JEFFERIES [7]	283	1	0.5	1816	1.5	1.9	0.7%
P OSTERLOH PROP TRUST [8]	387	1	0.5	2070	1.7	2.1	0.5%
MKULU KEI NATURE RESERVE[9]	784	2	0.9	2599	2.1	3.0	0.4%
MBAMBANI FAMILY TRUST[10]	407	3	1.4	3437	2.7	4.2	1.0%
MNYAMANA KOMANA[11]	338	2	0.9	2902	2.3	3.3	1.0%
CAROL VAN DER TOORN[12]	108	0	0.0	557	0.4	0.4	0.4%
Khula Dhamma CC[13]	180	1	0.5	49	0.0	0.5	0.3%
Kembali farms CC (farm 255)	138	0	0.0	0	0.0	0.0	0.0%
Other[14]						16.6	
TOTAL	**8730**	**36**	**16.9**	**53125**	**42.5**	**76**	**0.9%**

[1] Farm 268, 270, 271, 272, 280, 281, 282, 283, 446

[2] Farm 71, 112, 113, 115, 253, 254, 256

[3] Farm 131, 132, 134, 135, 231, 242, 244, 245, 248,

[4] Farm 447

[5] Farm 238, 239

[6] Farm 236, 240

[7] Farm 226, 227, 228, 232, 233

[8] Farm 139, 140, 141

[9] Farm 452

[10] Farm 136, 142, 229, 230

[11] Farm 133, 137, 138

[12] Farm 241, 243

[13] Farm 237

[14] Buildings, storage and lay down areas

Table 5.2: Expected negative financial impact of the wind energy facility on the financial situation of farming in the proposed Haga Haga development site

ITEM	TOTAL
Farm area (ha)	**8730**
Affected area:*	
Natural grazeland (ha):	**76**
TOTAL AFFECTED AREA (ha)	**76**
% of farm area affected	**0.9%**
Expected loss in gross margin/year (Rand)	
Natural grazeland:	
Expected gross margin/LSU(Rand)	**R 1 949**
Expected gross margin/ha farmland (Rand)**	**R 390**
Expected yearly loss in Gross margin on natural grazeland (Rand)	**R 29 623**
TOTAL EXPECTED YEARLY LOSS IN GROSS MARGIN***	**R 29 623**
Expected yearly gross margin of total farm area (Rand)*****	**R 3 402 526**
% of total yearly Gross margin of farming lost	**0.9%**

*Land to be taken up for the turbines, roads and other infra structure

** At a bearing capacity of 5 ha/LSU

*** Loss in Gross margin due to loss of production on affected areas.

**** Gross margin per year from 8730 ha of natural graze land

It is expected that approximately only **0.9% of the yearly output value of farming (i.e. only R29 623 on 8 730 ha farmland) will be lost due to the construction of the turbines for the Haga Haga wind energy facility** (refer to Table 5.2).

It should further be possible for the farmers to organize their grazing schedule in such a way that the reproduction process of the livestock will not be notably disturbed during the construction period. Farming practices should thus be able to continue as in the past.

SECTION C

IMPACT OF PROJECT: AGRICULTURAL PERSPECTIVE

6 PROJECT ACTIVITIES THAT MAY IMPACT ON PRESENT AND FUTURE AGRICULTURAL PRODUCTION ACTIVITIES

6.1 GENERAL

This section describes the potential impacts of the envisaged wind energy facility (WEF) on the future agricultural production potential of farming in the region. The impacts can either be positive or negative on the existence (i.e. existing role, contribution or function) of an entity (i.e. the farms impacted). For example, the construction of the turbine component of the wind energy facility would impact negatively on the natural resource base of the relevant farms in the Haga Haga region should it take up such a large portion of the farmland that farming becomes unprofitable. On the other hand, the remuneration that the farmers will receive for the use of their property for a project could serve as a valuable 'financial injection' to enable the farmers to continue farming under the mentioned risky production conditions and thus keep workers employed and should thus contribute to the national goal of food security. It will further make a positive contribution towards electricity development for the national energy network.

6.2 IMPACT IDENTIFICATION

The expected impact of the proposed Haga Haga wind energy project (i.e. the turbine component) on potential farming activities can be discussed in terms of, *inter alia*, the nature, magnitude, duration, extent and consequences thereof, as follows:

- It can be seen as a relative permanent substitution of some of the agricultural resources for the WEF installations for the development of alternative energy.
- The magnitude of the impact of the alternative energy project at a national level is expected to be more positive than negative (i.e. the positive contribution towards electricity development is expected to be considerably more than the negative impact of the loss in agricultural output value at the farm level).
- The duration of the project can be seen as long term (i.e. relative permanent)
- The loss of agricultural resources can, however, also be seen as reversible (i.e. should the project be terminated after, say, 20 years the land will become ''free'' again for agricultural production purposes.

The impact of the project on the financial situation of the farms will thus be determined by, *inter alia*, the following aspects:

- Profitability levels of the current farming activities
- Loss of farming income due to the impact of the project, for example the negative effect of the loss of land on agricultural output, and

- The gain in yearly income for the farmers due to a market related remuneration agreement for the use of a very small portion of their land for the project infra structure.

The loss of farming income (refer to Table 5.2) will be determined by, *inter alia*, the following aspects:

- The area to be taken up by the turbines, service roads and other infra structure for the WEF will determine the loss of income from farming.
- The placing-strategy (i.e. positioning) of the turbines and other infrastructure
- Expropriation of farmland, if applicable.
- Appropriate mitigation measures, like the conservation of the top-soil, the proper rehabilitation of the construction sites, and the sensible placing of the turbines.

The negative impacts on farming will thus be the loss of agricultural land and thus output value (farming income) due to the construction of the infrastructure for the WEF.

Only approximately 76 ha (i.e. less than 1%) of agricultural natural grazeland of 8 730 ha that comprises the total farmland where the project is planned (refer to Table 5.2), will be lost for the project infrastructure and service roads.

The ***on-farm impact*** of the proposed WEF is thus situated in:

- **The yearly loss of agricultural output value of only R29 623 (i.e. only approximately 0.9%, refer to Table 5.2) on the farms due to the envisaged project.**
- The income that will be generated for the farmers due to a market related remuneration from the developer of the WEF for the use of their farmland. This capital 'injection' should enable them to continue farming under the mentioned risky production conditions and thus keep workers employed and should thus contribute to the national goal of food security.

The impacts associated with the ***"no-go" option*** is the following:

- Farming activities will continue as in the past. **The estimated yearly loss of future agricultural output value of R29 623 that is associated with the development of the WEF, will thus *not* be realized.**

6.3 IMPACT ASSESSMENT METHODOLOGY

The impacts associated with the proposed WEF and the "no-go" option were analysed and assessed with the emphases on the agricultural production potential of the relevant areas that are considered for the project.

The significance of each potential impact (Department of Environmental Affairs and Development Planning. 2010 and Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005), with and without the implementation of the proposed mitigation measures, can be assessed based on the following variables (evaluation components):

- **Extent** (spatial scale);
- **Magnitude (positive or negative)**;
- **Duration** (time scale);
- **Probability** of occurrence;
- **Irreplaceable** loss of resources; and
- **Reversibility** of the impact.

The evaluation components, ranking scales and descriptions to be used to assess these are provided in **Table 6.1** below. Once the evaluation components have been ranked for each impact, the **significance** of the potential impact are calculated using the following formula:

SP (Significance Points) =
(Magnitude + Duration + Extent + Irreplaceable + Reversibility) X Probability

The maximum value is **150 SP** (Significance Points).

Table 6.1: **Evaluation components, ranking scales and descriptions (assessment criteria) of an impact analyses.**

Evaluation Component	Ranking Scale and Description (Criteria)
MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale)	**10 - Very high (negative)**: Biophysical and/or social functions and/or processes might be *severely* altered. **8 - High (negative)**: Biophysical and/or social functions and/or processes might be *considerably* altered. **6 - Medium (negative)**: Biophysical and/or social functions and/or processes might be *notably* altered. **4 - Low (negative)**: Biophysical and/or social functions and/or processes might be *slightly* altered. **2 - Very Low (negative)**: Biophysical and/or social functions and/or processes might be *negligibly* altered. **0 - Zero**: Biophysical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Biophysical and/or social functions and/or processes might be *substantially* enhanced. **8 - High (positive)**: Biophysical and/or social functions and/or processes might be *considerably* enhanced. **6 - Medium (positive)**: Biophysical and/or social functions and/or processes might be *notably* enhanced. **4 - Low (positive)**: Biophysical and/or social functions and/or processes might be *slightly* enhanced. **2 - Very Low (positive)**: Biophysical and/or social functions and/or processes might be *negligibly* enhanced. **0 - Zero**: Biophysical and/or social functions and/or processes will remain *unaltered.*
DURATION	**5 – Permanent** **4 - Long term**: Impact ceases after Operational Phase/life of the activity (~ 20 years). **3 - Medium term**: Impact might occur during the Operational Phase/life of the activity (0 to 20 years). **2 - Short term**: Impact might occur during the Construction Phase (~ 1 year). **1 – Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0 –** None
IRREPLACEABLE (loss of resources)	**5 - Definite** loss of irreplaceable resources. **4 - High** potential for loss of irreplaceable resources. **3 - Moderate** potential for loss of irreplaceable resources. **2 - Low** potential for loss of irreplaceable resources. **1 - Very low** potential for loss of irreplaceable resources. **0 – None**
REVERSIBILITY (of impact)	**5 -** Impact **cannot** be reversed. **4 - Low** potential that impact might be reversed. **3 - Moderate** potential that impact might be reversed. **2 - High** potential that impact might be reversed. **1 -** Impact **will be** reversible. **0 -** No impact.
PROBABILITY (of occurrence)	**5 - Definite**: >95% chance of the potential impact occurring. **4 - High probability**: 75% - 95% chance of the potential impact occurring. **3 - Medium probability**: 25% - 75% chance of the potential impact occurring. **2 - Low probability**: 5% - 25% chance of the potential impact occurring. **1 - Improbable**: <5% chance of the potential impact occurring.

The **CONFIDENCE** criterion of an impact analyses presents the plausibility thereof and can be:

high: when it is based on sound original research

medium: when it is based on, for example, expert opinion and supported only by a 'desk-top' analysis of available information

low: when it is mainly based on conjecture.

Table 6.2 below provides the definitions of the calculated significance ratings.

Table 6.2: Definition of significance ratings (positive and negative).

Significance Points	Environmental Significance	Description
125 – 150	Very high (VH)	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	High (H)	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options. **Cumulative Impacts:** The activity is one of several similar past, resent or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
75 – 99	Medium-high (MH)	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be re-evaluated at.
40-74	Medium (M)	If left unmanaged, an impact of medium significance could influence a decision about whether or not to proceed with a proposed project. **Cumulative Impacts:** The activity is one of a few similar past, resent or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
<40	Low (L)	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation. **Cumulative Impacts:** The activity is localised and might have a negligible cumulative impact.
+	Positive impact (+)	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

6.4 IMPACT ASSESSMENT

The impacts associated with the proposed wind energy facility and the "no-go" option were analysed and assessed with the emphases on *agricultural production potential*. The significance rating of the unmitigated and mitigated scenarios for each impact-group was calculated and rated as indicated on **Table 6.3** below.

The analyses are largely based on sound original research and the results can thus be classified in the **'medium-high'** category as far as the ***confidence*** criterion is concerned (i.e. a high level of plausibility).

Table 6.3: Impact Matrix: Haga Haga wind energy facility: Agricultural perspective.

Negative impact

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																		MITIGATION
		BEFORE MITIGATION									AFTER MITIGATION									
		M	D	E	I	R	P	TOTAL (SP)	S	CUMULATIVE	M	D	E	I	R	P	TOTAL (SP)	S	CUMULATIVE	
	Potential impacts on soils and agricultural production potential																			
Project activity:	**Site clearance and construction**																			
Development of the Haga Haga Wind Energy Facility	On-farm impacts [1]	2	4	1	1	1	4	36	**L (-)**	**L (-)**	2	4	1	1	1	4	36	**L (-)**	**None**	Directives have been included in the EMP for the Construction Phase management and protection of soil and ground and surface water resources.
"No-go" alternative	The non-realization of the loss of scarce agricultural resources.	0	4	1	0	4	5	45	**M (-)**	**M (-)**	-	-	-	-	-	-	-	-	-	No mitigation would be applicable without the development.

1. Loss of agricultural land and thus by implication future agricultural output value

The impact of the project is expected to be as follows:

- It can be seen as a permanent substitution of **approximately 76 ha (i.e. only 0.9%)** of the agricultural land of the site for the construction of the WEF (i.e. turbine component) for the development of alternative energy.
- The magnitude of the impact of the alternative energy project at a national level is expected to be more positive than negative (i.e. the positive contribution towards electricity development is expected to be considerably more than the negative impact of the loss in agricultural output value).
- The duration of the project can be seen as long term (i.e. relative permanent)
- The loss of agricultural resources can, however, also be seen as reversible (i.e. should the project be terminated after, say, 20 years the land will become ''free'' again for agricultural production purposes).

The expected loss in farmland as well as the expected loss in farm output value per year is expected to be less than 1%, thus *virtually ignorable*. When viewed from an agricultural production perspective, the envisaged WEF should not have any additional negative impact than that stated in this report. **It is thus clear that, should appropriate mitigation measures be employed during construction, the negative impact of the project on farming practices in the investigation area can be seen as virtually ignorable.**

It should further be possible for the farmers to organize their grazing schedule in such a way that the reproduction process of the livestock will not be notably disturbed during the construction period. Farming practices should thus be able to continue as in the past.

The expected market related remuneration agreement for the use of their property will serve as a stabilizing factor from a financial point of view. Possible farming practices should thus be able to continue in a more stable financial environment and the security in this regard of the farmer, his farm workers and their families should thus be furthered by the envisaged project. The **''no-go''** option will therefore be disadvantageous for the farmers that are involved in the alternative energy development as far as the establishment of a more stabilized financial set-up is concerned.

A placing strategy for the turbine infrastructure that ensures that soils with relative better agricultural production potential and lowest erosion risk will be conserved, **should further minimize the minor negative impact** of the proposed wind energy development on farming activities at the farm units. The above strategy is largely seen as impracticable as the placement of the turbines was not planned with agriculture in mind. However, mitigation measures (see Section 6.5) can soften some of the abovementioned negative impacts on the land.

The project should, however, contribute by a **larger magnitude** to the national energy network (i.e. the positive contribution towards electricity development is expected to be considerably more than the negative impact of the loss in agricultural output value on the farms). The contribution of the project to the national energy network should obviously decrease the pressure on energy development from non-renewable sources and thus contribute to a cleaner environment.

Cognition should be taken of appropriate mitigation measures during construction (refer to Section 6.5).

6.5 MITIGATION MEASURES

It seems that the development will have minor negative impacts on the current farming activities as well as on possible future farming developments. The main contributing factor in this regard is:

- The small areas influenced by the development. The development should thus have a small negative effect on the total agricultural output value of the farms.

Appropriate mitigation measures with regard to the conservation of the natural resource base should form an important part of the planning process, *inter alia* regarding the following aspects:

1. Avoiding of sensitive areas, where possible (i.e. wetlands, slopes in excess of 15 % and existing soil conservation works such as contours), in order to prevent the degradation thereof.

2. Proper planning of road layout so that roads follow the contours as far as possible or where contours are crossed, proper structures be developed and implemented that will ensure proper functioning of the existing contours. It should be mentioned that some so-called duplex (high permeable topsoil on a low permeable subsoil) soils, which are sensitive to soil erosion, occur in some lower lying areas in parts where new roads are planned. The abovementioned actions will prevent unnecessary soil erosion.

3. Conservation of the topsoil during construction and the proper rehabilitation of the construction sites after construction.

4. Protection of the vegetation and veld by means of the construction of proper service roads and the proper maintenance thereof over time.

5. The construction of the project infrastructure should be synchronised, as far as possible with the seasonal pattern of farming activities in order to minimize the possible disturbance of the latter. **Farmers should thus be informed on the timing of construction in order to minimize possible disturbance of farming activities**.

Measures to include in the draft Environmental Management Program are detailed in Table 6.4 below:

Table 6.4: Environmental Management Table for Agriculture

Objective: To minimize the impact of the wind farm on agricultural land
Project component/s: Construction of all components that are planned on the soil surface
Potential Impact: Permanent loss of agricultural land if not managed properly
Activity/risk source: After construction less, agricultural land remains and normal farming will be influenced (positive and negative) but uncontrolled water erosion can be responsible for permanent loss of land.
Mitigation:
Target/Objective: To minimize any negative influence on agriculture by identifying the possible problems and to control them to a minimum by recommending proper mitigation measures

Mitigation: Action/control	Responsibility	Timeframe
Appropriate mitigation measures to control and avoid erosion (i.e. stabilizing lay-down areas, water run-off lanes along roads and where existing contours area crossed, proper structures be developed and implemented that will ensure proper functioning of the contours or waterways). Conservation of the top-soil during construction and the proper rehabilitation of the construction sites after construction. **Note: Moving of turbines to comply with the above actions is not seen necessary**	Construction team	During construction phase The construction of the project infrastructure should be synchronised, as far as possible with the seasonal pattern of farming activities in order to minimise the possible disturbance of the latter.

Performance Indicator: Lay-out according to plan submitted, proper handling of topsoil during construction and erosion structures that are put in place
Monitoring: It is recommended that a responsible soil conservation officer from the Department of Agriculture be involved to make sure that erosion control is done according to the correct procedures on a regular basis during and after construction

The proper execution of the mentioned planning principles, as far as the conservation of existing farming activities is concerned, should thus lead to the minor disturbance, if any, of agricultural production practices on the farms.

7 CONCLUSION

The agricultural potential of the farmland (i.e. natural veld) that comprises the development site is totally dependent on weather conditions, mainly whether enough rainfall is realized during the raining season. The development potential of the land for more intensive agricultural production purposes, like cropping, is limited due to, *inter alia*:

- relatively low and unreliable rainfall in the region, and
- absence of lasting irrigation water.

The land, in general, where the infrastructure for the WEF is planned to be placed, has a low to medium suitability for crop production (refer to Table 3.2 above). The critical limiting factor in this regard is an unreliable rainfall to produce crops successfully. Rain fed crop production will thus be too risky and the land can thus be described as good natural grazing land. This situation is not expected to change in the future. Beef Cattle, as the most prominent farming branch of the region, is produced profitable on the natural graze land (refer to Table 4.1).

It is expected that only about 0.9% of the yearly gross margin from farming operations on the site for the WEF will be lost due to the proposed wind energy project (refer to Table 5.2). It is thus clear that, should appropriate mitigation measures be employed during construction, the negative impact of the project on farming practices in the investigation area can be seen as virtually ignorable. It should further be possible for the farmers to organize their grazing schedule in such a way that the reproduction process of the livestock will not be notably disturbed during the construction period. Farming practices should thus be able to continue as in the past.

The expected market related remuneration agreement with the farmers for the utilization of their land will, however, serve as a stabilizing factor as far as the flow of yearly income is concerned. Farming practices should thus be able to continue in a more stable financial environment and the security in this regard for the farmers, their farm workers and their families should thus be furthered.

The contribution of the project to the national energy network should obviously decrease the pressure on energy development from non-renewable sources and thus contribute to a cleaner environment.

The **''no-go''** option will be to the disadvantage of the involved farmers, as the market related remuneration agreement for the utilization of their land will then not be realized.

The most important mitigation measures with regard to the conservation of the natural resource base should form an integral part of the planning process. The proper execution of relevant planning principles, as far as the conservation of existing farming activities is concerned, should thus lead to the minor disturbance, if any, of agricultural production practices on the farms. The most important mitigation measures include:

- Avoiding of placing turbines and roads in sensitive places

- Proper planning of new road layout so that roads follow the contours as far as possible or where contours are crossed, proper structures be developed and implemented that will ensure proper functioning of the existing contours

- Conservation of the topsoil during construction and the proper rehabilitation of the construction sites after construction.

Based on findings of this investigation, we are of the opinion that the proposed wind energy facility could be beneficial to both the involved farmers, the alternative energy developer and also to the development of “clean” energy supply to South Africa.

8 REFERENCES

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