Environmental Impact Assessment for the Establishment of the Wolseley Wind Farm, Western Cape Province

Environmental Impact Report

AGRICULTURAL IMPACT ASSESSMENT

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Date: 05 October 2012
I, Francois H Knight, as duly authorised representative of Agri Informatics, hereby confirm my independence (as well as that of Agri Informatics) as the Agricultural specialist for the Wolseley Wind Farm and declare that neither I nor Agri Informatics have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Arcus GIBB was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act) for the Wolseley Wind Farm. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it. I have disclosed, to the environmental assessment practitioner, in writing, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act. I have further provided the environmental assessment practitioner with written access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 and any other specific and relevant legislation (national and provincial), policies, guidelines and best practice.

Signature: ______________________________

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Date:       05 October 2012
Title / Position:   Director
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Experience (years/ months):   25 years
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EXECUTIVE SUMMARY

Agri informatics was contracted by Gibb Engineering and Science – the appointed Environmental Assessment Practitioner – on behalf of the applicant Sagit Energy Ventures to conduct an Agricultural Impact Assessment of the proposed Wolseley Wind Farm, consisting of up to 30 turbines of maximum 3 MW each. The study area included 12 farm portions with a combined farm area of almost 2000 ha. Farming activities vary from intensive irrigated deciduous fruit in net houses, to low intensity grazing on permanent pastures, while one chicken battery and some waterblommetjie dams are also found within the study area.

The study evaluated the possible impacts, using the guidelines of the Department of Agriculture Forestry and Fisheries on renewable energy structures on agricultural land. The study entailed an extension of the desktop assessment earlier conducted by Patterson (2012) followed by field observations of the natural resources and agricultural practices. The impacts of the proposed wind turbine layout was assessed, whereafter recommendations were made to minimise the anticipated impacts. Except for a single wind turbine, all recommendations were accepted by the applicant and integrated into the current layout plan. Specific mitigation measures to reduce the impact of this turbine where made, which is believed to offer a more productive agricultural scenario at this turbine location, after the construction of the wind farm, than at present. These mitigation measures have also been accepted by the applicant.

All potential impacts can be effectively mitigated to very low or insignificant levels, by the proposed mitigation plan. The additional farm income generated from the lease of the land to the wind farm operator is expected to contribute significantly to the general economic outlook of the farming ventures involved.
# ENVIRONMENTAL IMPACT ASSESSMENT FOR THE
# ESTABLISHMENT OF THE PROPOSED WOLSELEY WIND FARM,
# WESTERN CAPE PROVINCE:
# AGRICULTURAL IMPACT REPORT

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APPENDICES

Appendix 1: Climate summary of La Plaisante
ABBREVIATIONS

AIA  Agricultural Impact Assessment
amsl  Above Mean Sea Level
ARC  Agricultural Research Council
BGIS  Biodiversity GIS
CARA  Conservation of Agricultural Resources Act
DAFF  Department of Agriculture Fisheries and Forestry
DAWC  Department of Agriculture: Western Cape
DWA  Department of Water Affairs
ESRI  Environmental Systems Research Institute
GIS  Geographic Information Systems
GPS  Global Positioning System
ISCW  Institute for Soils Climate and Water
LSU  Large Stock Unit
LUPO  Land Use planning Ordinance
NDA  National Department of Agriculture
SALA  Subdivision of Agricultural Land Act
SRTM  Shuttle Radar Topographic Mission
SSU  Small Stock Unit
WRC  Water Research Commission

GLOSSARY

**Study area:** Refers to the entire study area encompassing all the farm portions as indicated on the study area map.

**Turbine site:** Refers to the specific location of one of the turbines

**Aeolian:** Wind transported soil material

**Alluvial:** Water transported soil material

**Colluvial:** Soil material transported by the force of gravity

**Scree:** Accumulation of broken rock fragments at the base of steep mountain slopes

**Horizon (Soil horizon):** A diagnostic layer in the soil

**Solum:** The upper part of the soil above the parent material, where geomorphologic processes occur actively.
1 DETAILS OF SPECIALIST AND EXPERTISE

This report was compiled by François H Knight, principal consultant at Agri Informatics. Mr Knight holds a B.Sc.Agric.Hons degree in Soil Science from the Free State University, a post graduate diploma in terrain evaluation from Potchefstroom University and a M.Sc.Agric. *cum laude* degree in Soil Science from the University of Stellenbosch. He has more than 25 years’ experience in natural agricultural resource assessments, which stems from his work as a senior researcher at the Department of Agriculture and, for the past 11 years, as an independent consultant.
2 INTRODUCTION

2.1 Background

Sagit Energy Ventures is planning to develop the proposed Wolseley Wind Farm on a site approximately 6 km south of Wolseley in the Western Cape (Figure 1). The project proposes the installation of up to 30 wind turbines, each with a nominal generation capacity of maximum 3.0 MW, for national distribution and would contribute to targets for renewable energy generation in South Africa and the Western Cape Province.

This study forms part of a full Environmental Impact Assessment (EIA). Therefore an Agricultural Impact Assessment (AIA) was commissioned by Gibb Engineering and Science (GIBB) – the appointed Environmental Assessment Practitioner (EAP) – on behalf of the applicant Sagit Energy Ventures. This document reports on the findings of such an investigation and attempts to fulfil this requirement.

2.2 Legislative and Policy Context

The Department of Agriculture, Forestry and Fisheries (DAFF) has enacted a set of regulations pertaining to the development of renewable energy facilities on agricultural land in terms of Subdivision of Agricultural Land Act 70 of 1970 and the Conservation of Agricultural Resources Act 43 of 1983. The following is an excerpt from the regulations, dated 8 September 2011:

The following regulations aim to adhere to the requirements and specifications as stated in the mentioned Act. The regulations should be seen in context with another and not as separate entities and should be adhered to or taken into consideration when establishing a renewable energy operation with its associated structures:

1. No renewable energy structure, its footprint, service area, supporting infrastructure or access routes in any form or for any purpose will be allowed on high potential or unique agricultural land as has been determined or identified by DAFF or the relevant provincial Department of Agriculture through its existing or future developed spatial information data sets and / or through a detail agricultural potential survey. Any area under any form of irrigation is also defined as high potential agricultural land

2. No renewable energy structure, its footprint, service area, supporting infrastructure or access routes in any form or for any purpose will be allowed on areas currently being cultivated (cultivated fields/ production areas) or on land that have been cultivated in the last ten years. This is relevant to cultivated land utilized for dry land production as well as land under any form of irrigation

3. No sub-division of agricultural land will be allowed to accommodate the establishment of any renewable energy structure, supporting infrastructure or access routes in any form or for
any purpose unless the application adheres to the norms and standards for approval of the sub-division of agricultural land

4. Change of land use on demarcated agricultural land for the establishment of any renewable energy structure, supporting infrastructure or access routes in any form or for any purpose will be reviewed on merit and informed or guided by the relevant planning legislation applicable to the area concerned. The recommended change of land use will be temporarily, depended on the life span of the project where after the land should revert back to agriculture automatically. This exemption will be underwritten by specific conditions to ensure continued agricultural production and the protection of the natural agricultural resources, where applicable.

5. No renewable energy structure, its footprint, service area, supporting infrastructure or access routes in any form or for any purpose should intervene with or impact negatively on existing or planned production areas (including grazing land) as well as agricultural infrastructure (silos, irrigation lines, pivot points, channels, feeding structures, dip tanks, grazing camps, animal housing, farm roads etc).

6. No renewable energy structure, its footprint, service area, supporting infrastructure or access routes in any form or for any purpose should result in a degradation of the natural resource base of the farm or surrounding areas. This include, but are not limited to, the limit of soil degradation or soil loss through erosion or any manner of soil degradation, the degradation of water resources (both quality and quantity) and the degradation of vegetation (composition and condition of both natural or established vegetation). It also should not impact negatively on:

   6.1. Wetlands (land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil). No renewable energy structure, supporting infrastructure or access routes will be allowed on a wetland, vlei, pan, drainage line or any other water body unless otherwise approved by DAFF.

   6.2. Flow pattern of run-off water. No renewable energy structure, supporting infrastructure or access routes shall in any manner divert any run-off water from a water course to any other water course or obstruct the natural flow pattern of runoff water, except with the permission from DAFF.

   6.3. Utilization and protection of vegetation. Every care should be taken before, during and after the construction and future maintenance of the renewable energy structure, supporting infrastructure or access routes to protect the vegetation and veld condition against deterioration and destruction.

7. No renewable energy structure, supporting infrastructure or access routes should result in soil loss as a result of erosion through the action of water or wind. It is the responsibility of the owner of the renewable energy project to ensure that suitable soil conservation works be established on the site to limited or restrict the loss of soil.

8. No renewable energy structure, its footprint, service area, supporting infrastructure or access routes in any form or for any purpose should result in a degradation of existing soil conservation work. This includes but is not limited to:
8.1. Established contour banks. Where possible every care should be taken not to erect a renewable energy structure, supporting infrastructure or access routes on an existing established contour bank. Should it however necessitate such an action (per approval from DAFF) all precautionary actions should be taken not to degrade the contour bank. The applicant has the responsibility to ensure that a contour bank should be re-established in a suited standard, as approved by a qualified soil conservation specialist.

8.2. Waterways (an artificial flow path constructed on land in order to carry away run-off water without causing excessive soil loss). Where possible every care should be taken not to erect a renewable energy structure, supporting infrastructure or access routes on an existing established waterway. Should it however necessitate such an action (per approval from DAFF) all precautionary actions should be taken not to degrade the waterway. The applicant has the responsibility to ensure that a waterway should be re-established in a suited standard, as approved by a qualified soil conservation specialist.

9. Renewable energy structures or supporting infrastructure should, where possible, not be established on slopes (the vertical difference in height between the highest and the lowest points of that portion of land, expressed as a percentage of the horizontal distance between those two points) of more than 20%. Should there however be no other suitable site, every care should be taken not to cause erosion in any form on the site concerned. This may necessitate the establishment of contours, terraces, gabion structures or any other soil conservation feature that may deem to be necessary.

10. All access routes, existing or newly constructed and utilized during the construction and / or maintenance of the renewable energy structures should be restore to its original state after completion of the establishment of the structures. Ever care should be taken not to damage or degrade the status of the natural resources base of the farm during the construction phase of the mentioned or to impact negatively on the farming or production practices on the farm.

11. All service routes that will be used to gain access to the renewable energy structures for maintenance purposes have to be covered in gravel, tarred or compressed in order to limit the possibility of degradation and erosion.

12. The installation of the underground power cables should not negatively impact on the resource base of the site. During the installation no soil conservation structure should be disturbed, the soil texture should be restored, the work area should not be wider than 5 m, should not be directed through existing or future cultivated land nor impact negatively on existing farming infrastructure or any farming activity.

13. A lease agreement under Act 70 of 1970 if granted and conceded to will be granted for a period of maximum 25 years or shorter period as may have been applied for by the Applicant.

14. The lease agreement should be transferred to the new land owner, should the farmer decide to sell the property during the time period of the current lease agreement. DAFF needs to be informed of the transfer of the lease agreement upon which a new approval number will be issued. Supporting documentation should be provided that the new land owner concurs with the specifications of the existing lease agreement.

15. DAFF will comment and raise its concerns pertaining to the EIA Regulations operational under the National Environmental Management Act through the registration of an “Affected and interested party” and through formal interaction with the Department of Environmental Affairs.
16. The Department reserves the right to visit the renewable energy site at any time without prior arrangement to review the status of the natural resource base and the impact of the renewable energy structures. Should it be found that a degradation of the resource base has occurred as a result of the renewable energy structures or related activities, it will be the responsibility of the renewable energy structure lessee to restore the resource base at his/her own cost and within time frames as indicated by DAFF.

Both potential impacts and guidelines for mitigation are addressed in these regulations and will be drawn from, when evaluating the specific impact potential of the Wolseley Wind Farm, in the following chapters of this report.

An Agricultural Impact Assessment (AIA) is also required in terms of the Land Use Planning Ordinance 15 of 1985 (LUPO) in so far as the comment of the Department of Agriculture is needed in all applications for a long term lease agreement on agricultural land.

2.3 **Scope and limitations**

Agri Informatics was contracted to conduct an Agricultural Impact Assessment on the properties and sites identified for the wind energy facility (WEF) at Wolseley, as indicated in Figure 1.

2.3.1 **Scope of work**

The assessment had to include:

- Reconnaissance scale soil survey and geology of the site;
- Climate analysis, crop suitability assessment and water requirements;
- Summary of available water sources (ground water, surface water and scheme water for irrigation and/or livestock);
- Topography/surface hydrology and impact on agricultural activities;
- Current and historic agricultural activities;
- Compilation of an agricultural land use map, including cultivated fields, natural veld, sensitive agricultural infrastructure such as contour banks and waterways;
- Existing carrying capacity derived from general grazing capacity norms for the site;
- Assessment of the agricultural potential of the properties, as determined by the availability and condition of the resources and relative access to markets;
- Agricultural use during and after wind farm operation;
- Description of potential impacts of the proposed WEF on agricultural resources, activities and potential farm income;
- General description of mitigation measures and possible benefits;
- Management and monitoring guidelines; and
- Report and Constraints Map.
2.3.2 Presentation of findings

The findings of the assessment had to be presented in both digital and hardcopy formats. GIS data to be projected to WGS84, Transverse Mercator LO19.

2.3.3 Limitations

Although the study included two site visits during which extensive field observations were made, it was not possible to conduct a systematic reconnaissance scale soil survey due to very wet soil conditions. A determined attempt was however made to obtain as much site specific soil information as possible by inspection of trenches, road cuttings, river banks, drainage ditches, etc. The level of detail obtained with this procedure is deemed sufficient for the purpose of the study.

2.4 Assessment Methodology

2.4.1 The study area

The study area is situated in the Western Cape, between ±5 and ±10 km south-southwest of Wolseley, to the east of the R43 and consists of 12 farm portions, spanning an area of 2110 ha as shown in Figure 2. The target properties are listed in Table 1.

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\(^a\) Digital spatial data provided by Surveyor General
\(^b\) Area as per title deed
Proposed Wolseley Windfarm

Agricultural Impact Assessment

No turbines are proposed for Portion 4 of 323, Portion 5 of 334 or Portion 64 of 208. The targeted ESKOM sub-station is situated on Remainder of Farm 320 (Figure 2).

2.4.2 Information base

The information used in this study was based on the following:

- A literature review; (see list provided in References)
- A collection of relevant spatial data;
- A site visit and reconnaissance scale soil survey;
- Interaction with selected land owners or farm managers; and
- Professional judgment based on experience gained with similar projects.

2.4.3 Literature surveys

A literature study was undertaken on the agricultural potential and activities of the study area. The literature search included formally published literature, documentation provided by the Provincial Department of Agriculture and other parastatal bodies and spatial (GIS) data from various sources, such as the Water Research Commission and the ARC Institute for Soils, Climate and Water.

Relevant documentation compiled by various specialists and GIBB for the earlier Environmental Impact Assessment process, was also consulted, with specific reference to the Soils and Agricultural Potential Scoping Assessment of the ARC-Institute for Soils Climate and Water and also the relevant minutes/summaries of the public participation process. Also see the list of publications.
2.4.4 Aerial photo interpretation

Agricultural land use activities and trends were derived from aerial photo interpretation, observations made during the site visits and limited GPS recordings. Delineation (digitising) of clearly recognisable features and spatial patterns were used to derive surface areas per land use class, while features such as farm roads, dams, drainage lines and other farm infrastructure were also mapped from aerial imagery.

2.4.5 Ground truthing

Ground truthing mainly entailed the observation and GPS surveying of mapped features as well as observations on the soil properties visible in exposed soil profiles.

2.5 Description of any assumptions made, uncertainties or gaps in knowledge

No specific assumptions that could significantly alter the findings of the study were made.
3 DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 General overview of affected environment

3.1.1 Geomorphology

The study area is situated in a part of the Breede River Valley, known as Breedeekloof, characterised by high mountain ranges to both the west (Elandskloof and Limietberge) and the east (Waaihoekberge).

Figure 2: The land portions of the study area. The profiles above is along the cross sections A-B and C-D, indicated by the dotted lines. Yellow dots represent the proposed turbine positions.
The landscape of the study area varies from steep mountain slopes in the east to a very flat valley floor in the west and southwest. Although the farm portions involved, reaches to an altitude of 820 m amsl, the turbines will be on the footslopes and valley floor at altitudes between 250 m and 380 m amsl. Seventy percent of the land area has slope gradients less than 10% (Map 2 in Appendix) and ±15% of the land has slopes steeper than 20%. These steep slopes occur on the high elevations in the east, out of the proposed development area. The cross sections in Figure 2 shows the gentle sloping gradients of the footslopes and valley floor, where the turbines are to be placed.

All proposed turbine sites are on slopes less steep than 10%.

3.1.2 Surface hydrology

The entire study area is situated in quaternary catchment H10F, a sub-catchment of the Breede River. The Romans River and a number of smaller streams and furrows drain the higher ground in the east and flows in a westerly direction to join the Breede River, to the west of the study area. None of the rivers or streams are perennial, but most will have flowing water during the rainy season from late April to September or October. Peak flows will occur shortly after rainfall events, as most streams originate in or near the study area (Figure 4).

A large number of dams (±20) – both in and off stream – have been constructed to retain runoff water for irrigation purposes. The three biggest dams are situated on Portion 72 of Farm 208 (Worcester RD), Portion 5 of Farm 334 (Tulbagh RD) and the Romans River dam on Remainder of Farm 320 (Tulbagh RD).
3.2 Present agricultural activity

3.2.1 Regional agriculture

The Breede River Valley is one of the prominent wine grape and deciduous fruit growing regions of South Africa. Since the demarcation of the Breede Kloof wine of origin district in 2006, the area has grown in stature amongst the wine regions of the Cape. The Mountain Ridge co-operative wine cellar (formerly Romansrivier) is situated on a land portion abutting the study area, while other renowned wine cellars in the immediate vicinity include Lateganskop, Bergsig and Waboomsrivier. Most of the wine cellars rely strongly on cellar door sales and thus offer some wine tasting / tourism facilities to bring wine lovers to their premises. The annual Breedekloof Outdoor & Wine festival is another very popular event on the wine calendar of the Cape, which lures thousands of visitors to the valley. Some farms have expanded the tourism facilities to include bistro style restaurants, conference facilities or/and accommodation in the form of camping, self catering cottages or in B&B style. Frequently other activities are also on offer, such as hiking or mountain bike trails, fishing, tractor rides, etc.

The deciduous fruit plantings in the area include mainly peaches, plums and pears. The latter is often the only crop option on the lower laying, poorly drained soils, as it is rather tolerant to wet conditions in the root zone. Some small plantings of citrus are also found in the valley.
The main limiting factor in the valley, in terms of natural resources, is the high incidence of strong wind that can easily damage crops, resulting in poor fruit quality and low pack out percentages (i.e. the part of the crop suitable for export or quality driven markets). The high incidence of wind also gives rise to high evaporative demand resulting in high irrigation requirements. It also renders most high pressure sprinkler type irrigation systems very inefficient.

The grazing capacity of the natural fynbos vegetation is low and therefore the mountain slopes are rarely utilised for livestock grazing. Some of the poorly drained low laying areas offer better grazing opportunity, but due to the warm dry summer season and the sandy nature of these soils (low water retention capacity) the production of fodder during late summer is low and supplementary feeding for livestock becomes essential, thereby often limiting livestock to small herd sizes.

Figure 5, provides an overview of the regional agricultural context of the site.

![Figure 5: The study area is situated in the Tulbach-Wolseley homogeneous farming area (orange). Perennial crops (mostly irrigated) are shown in green.](image)

### 3.2.2 Agriculture in the study area

A land use map (Figure 6) has been compiled from aerial imagery (NGI & Google Earth) and personal ground observations, to determine the extent of the cultivated areas. Table 2, provides a summary of the results. Although older imagery does not indicate significant land use changes, the observations made during the site visits, indicated a significant fruit development on Remainder of Farm 320, which includes mostly nectarines under netting, that was developed after the most recent aerial imagery.
Table 2: Areas per land use category.

<table>
<thead>
<tr>
<th>Land use category</th>
<th>Area (ha)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural veld &amp; Drainage areas</td>
<td>1001</td>
<td>51.5%</td>
</tr>
<tr>
<td>Fallow land / Pastures</td>
<td>344</td>
<td>17.7%</td>
</tr>
<tr>
<td>Perennial crops</td>
<td>191</td>
<td>9.8%</td>
</tr>
<tr>
<td>Vineyards</td>
<td>106</td>
<td>5.5%</td>
</tr>
<tr>
<td>Earth dams, dam areas &amp; ponds</td>
<td>88</td>
<td>4.5%</td>
</tr>
<tr>
<td>Old fields</td>
<td>80</td>
<td>4.1%</td>
</tr>
<tr>
<td>Perennial crops under netting</td>
<td>65</td>
<td>3.3%</td>
</tr>
<tr>
<td>Farmsteads and un-cultivated land</td>
<td>26</td>
<td>1.3%</td>
</tr>
<tr>
<td>Roads &amp; roads reserves</td>
<td>22</td>
<td>1.1%</td>
</tr>
<tr>
<td>Waterblommetjie ponds</td>
<td>10</td>
<td>0.5%</td>
</tr>
<tr>
<td>Plantations</td>
<td>10</td>
<td>0.5%</td>
</tr>
<tr>
<td>Chicken houses</td>
<td>9</td>
<td>0.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1943</strong></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6: Land use in the study area of the proposed Wolseley wind farm.
Photoset 1: The following photographs provide a visual overview of the activities and character of the land and the farming activities.

Well managed pear orchard

Bee hives in fynbos

Net houses for deciduous fruit

Fynbos on mountain foot slopes in Waboomsrivier conservancy
Peaches in net house

Early nectarines in net house

Citrus orchard

Deciduous fruit orchard

Cattle on pastures in spring
Proposed Wolseley Windfarm

Date: 15 October 2012

Agricultural Impact Assessment

Severe die back of orchard on poorly drained soils

Well maintained vineyards

Chicken houses on Portion 4 of Farm 323
Sandy soils presumably prepared for vineyard establishment.

Waterblommetjie ponds in harvest time.

Volunteer growth on open fields.
3.3 Natural resources of the study area

Agricultural activity and potential depends on the properties of the natural resources of the farm, namely the soil, climate, water and – for extensive grazing – the natural vegetation. The relative abundance and quality of these resources largely determines the natural agricultural potential of the property. Secondary factors like access to market, cost of production, producer prices, availability of labour and security related issues like stock/equipment theft and personal safety ultimately determines the viability of the farming enterprise.

3.3.1 Climate

The study area is ±75 km from the nearest coastline (Atlantic Ocean) and situated in an inland valley surrounded by high mountain ranges. This results in a continental climate with orographic rain induced by the mountain ranges.

The winter rainfall map in Figure 8 suggests a winter rainfall variation between 400 mm and 500 mm in the study area. This correlates well with the rainfall record at the nearby La Plaisante weather station (±2 km north) which indicates a rainfall of 455 mm between April and September. The area receives almost 80% of its annual rainfall during the winter months, bringing the total annual rainfall to 572 mm, while the A-pan evaporation amounts to 2013 mm per annum (Figure 7). The warmest months are January and February with an average maximum temperature of 30.5°C and 30.4°C respectively, when average highest maximum temperatures above 37°C can also be expected. Temperatures above 40°C are not uncommon during heat wave events. The coldest months are July and August at average minimum temperatures of 6.6°C and 7.0°C, respectively. Lowest average minimums are 1.2°C and 1.6°C respectively with the extreme low at -1.7°C. Light frost does occur infrequently, but is expected to be limited to the low laying areas. The highest wind incidence is during the summer months from October to March, when the average wind speed is moderately high at 6.5 km/h.

![Figure 7: Rainfall and evaporation as recorded at the La Plaisante weather station.](image)
Figure 8 clearly indicates the orographic effect on the spatial distribution of the annual winter rainfall in this part of the Western Cape, leading to winter rainfall figures above 500 mm closer to the mountain ranges, whilst the rainfall at the site is ±450 mm. A comprehensive monthly summary of the climate data of la Plaisante is attached in the appendix.

![Figure 8: Spatial distribution of winter rainfall. Note position of the La Plaisante weather station indicated by the triangle.](image)

### 3.3.2 Water

The National Water Act Act no 36 of 1998 (NWA) regulates the lawful and permitted use of all water sources. In terms of the rulings of Government Notice No 399, certain water uses have been allowed for under a General Authorisation (GA) as described under Section 39 of the NWA. The GA’s are allocated on a quaternary catchment basis and for the catchment of the study area (H10F) it allows for the abstraction of 400 m³/ha/annum from the groundwater source. Given the total study area of 2110 ha, the volume of groundwater available under the GA amounts to 884 000 m³/a. The taking of surface water is however restricted by means of an exclusion from the general authorisations, despite the fact that the mean annual runoff (MAR) for this catchment is high at 349 mm. This implies that a Water Licence needs to be obtained from DWA for all dams (taking of surface water) prior to construction, apart from water harvested for livestock watering purposes. All water use also needs to be registered with DWA in their WARMS database, irrespective whether it is a licenced use or a use under the GA.

A total of 20 dams have been identified in the study area, most of which are small and will make little contribution to the total supply of irrigation water. There are however three dams listed at the dam safety office at DWA:

- Romansrivier dam - 1 000 000 m³
- De Liefde dam - 198 000 m³
A further two large dams – with estimated storage capacities of 165 000 m³ and 215 000 m³ respectively, are on Portion 72 of Farm 208 (Worcester) and Portion 5 of Farm 334 (Tulbach). [Although these dams are not registered in the dam safety database, they may still be in the process of registration as DWA is continuously expanding their data.] The total storage capacity of the remaining small dams is estimated at ±100 000 m³, bringing the total dam capacity in the study area, to 1 737 000 m³.

As most of the irrigation water will be required during the dry summer season, when no or little inflow into the dams is expected, the total supply of irrigation water is assumed to be equal to the total storage capacity of the dams plus the groundwater available under the GA. Thus a total of 2 621 000 m³/a. There is no irrigation scheme or other source of surface water available to the farms in the study area.

3.3.3 Geology and soils

The geology and soils of the study area has been described, based on a desktop study, by Patterson (2012) as part of the EIA process. That soils information has been amended by further assessment of available data sources and the observations made during two site visits, as presented below.

Figure 9: Soil observation points (white squares) and wind turbine positions (red circles) amongst the perennial crop orchards.
The basic geology of the study area (Geoscience^7, 1990) comprises scree and colluvial (talus) material on the foot and upper midslopes, which originates from the Table Mountain sandstone and Malmesbury phylitic shale of the upper slopes at higher elevations. On the flat bottom slopes deep Quaternary sandy alluvial material dominates.

![Diagram of geology](image)

**Figure 10:** Geology of the study area, with layout of perennial crop orchards and proposed turbine positions are superimposed. (Recompiled from the 1:250 000 scale geological map series, GeoScience, 1997).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Era</th>
<th>Group</th>
<th>Formation</th>
<th>Geology</th>
</tr>
</thead>
<tbody>
<tr>
<td>~~~</td>
<td>Quaternary</td>
<td>Alluvium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qg</td>
<td>Quaternary</td>
<td>Light grey to pale red sandy soil, wind-blown in places</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-Qt</td>
<td>Quaternary to late Tertiary</td>
<td>Scree and gritty sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ope</td>
<td>Ordovician</td>
<td>Table Mountain Peninsula</td>
<td>Light grey quartzic sandstone, minor siltstone and shale</td>
<td></td>
</tr>
<tr>
<td>Npo</td>
<td>Namibian</td>
<td>Malmesbury Porterville</td>
<td>Phyllitic shale, fine to medium grained greywacke</td>
<td></td>
</tr>
</tbody>
</table>

The Land type dataset^8 (ARC: ISCW) provides a 1:250 000-scale overview of the soil types and properties of South Africa. This dataset can be used as a first approximation of the soil potential of the study area, based on the descriptive information contained by the Land type memoirs. The following information was extracted from this data source and relates to the map units (Land types) as shown below.
Table 3: Area weighted mean depth, clay content and resulting water retention capacity of the Land types of the Wolseley site.

<table>
<thead>
<tr>
<th>Land Type</th>
<th>Description</th>
<th>Ave Depth mm</th>
<th>Clay% A-hor ¹</th>
<th>Clay% B-hor ¹</th>
<th>WRC ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fa193</td>
<td>GLENROSA AND/OR MISPAH FORMS (Lime rare or absent in the entire landscape)</td>
<td>400</td>
<td>&lt;10</td>
<td>15</td>
<td>ML</td>
</tr>
<tr>
<td>Fa194</td>
<td>GLENROSA AND/OR MISPAH FORMS (Lime rare or absent in the entire landscape)</td>
<td>500</td>
<td>15</td>
<td>18</td>
<td>M</td>
</tr>
<tr>
<td>Fa659</td>
<td>GLENROSA AND/OR MISPAH FORMS (Lime rare or absent in the entire landscape)</td>
<td>500</td>
<td>15</td>
<td>18</td>
<td>M</td>
</tr>
<tr>
<td>Ia23</td>
<td>UNDIFFERENTIATED DEEP DEPOSITS</td>
<td>800</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>M</td>
</tr>
</tbody>
</table>

¹ Average clay content calculated from memoir data on an area weighted basis
² Water Retention Capacity derived from average depth and clay content

Figure 11: Land types of the study area (ARC: ISCW). [Turbines in red and soil observations as white squares.]
The soil associations map provide a more detailed spatial definition of the soil patterns of the study area and corresponds well with the observations made during the site visits.

**Figure 12:** Soil associations of the study area (Lambrechts et al, 2001). [Turbines in red and soil observations as white squares.]

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Dominant soil forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ak</td>
<td>Moderately shallow, stony, loamy soils on rock or hardpan</td>
<td>Gs, Sw</td>
</tr>
<tr>
<td>C</td>
<td>Moderately deep, gravelly, loamy, dry greyish duplex soils</td>
<td>Sw, Km, Tu, Cf, Gs</td>
</tr>
<tr>
<td>D</td>
<td>Moderately deep, stony, sandy loam, wet non-saline duplex soils</td>
<td>Kd, Es, Km</td>
</tr>
<tr>
<td>Dv</td>
<td>Shallow, stony, sandy loam, wet non-saline duplex soils</td>
<td>Kd, Es, Km</td>
</tr>
<tr>
<td>E</td>
<td>Deep, non-gravelly, loamy, dry alluvial soils</td>
<td>Du, Oa, Tu</td>
</tr>
<tr>
<td>Ev</td>
<td>Shallow, non-gravelly, loamy, dry alluvial soils</td>
<td>Du, Oa, Tu, Vf</td>
</tr>
<tr>
<td>kEv</td>
<td>Shallow, stony, loamy, dry alluvial soils</td>
<td>Du, Oa, Tu, Vf</td>
</tr>
<tr>
<td>L</td>
<td>Variable depth, very stony, sandy, grey, talus material on steep slopes</td>
<td>Rock, Ms, Lt, Vf, Hh</td>
</tr>
<tr>
<td>R</td>
<td>Shallow, stony, sandy rock outcrops on steep slopes</td>
<td>Rock, Ms</td>
</tr>
</tbody>
</table>
Photoset 2: The following photographs provide a visual overview of the soil character of the study area.

A: Scree at drainage canal
B: Colluvial deposits on upper footslope
C: Poorly drained alluvial deposits. [Young pears on high ridges.]
G & J: Neucutanic and duplex soils with signs of wetness on alluvial deposits.

H: Shallow poorly drained duplex soils

L: Deep well drained sand
K: Sandy duplex soil

J: Neocutanic with signs of wetness

D: Very stony colluvial material
L, M & N: Cut-off drains between vineyards on the alluvial deposits
The term “land capability” is often used to refer to the suitability of land for agricultural activities. Various independent but similar Land Capability classification systems have been developed or used internationally to classify land. Most systems put strong emphasis on soil properties, but other factors such as climate and topography can also play a role. The National Department of Agriculture, Forestry and Fisheries (DAFF), provides an 8 class Land Capability classification of the RSA, with the following interpretation:

<table>
<thead>
<tr>
<th>Class</th>
<th>Group</th>
<th>Description</th>
<th>Increased intensity of land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Arable Land</td>
<td>Very high potential arable land</td>
<td>Wildlife</td>
</tr>
<tr>
<td>II</td>
<td>Arable Land</td>
<td>High potential arable land</td>
<td>Forestry</td>
</tr>
<tr>
<td>III</td>
<td>Arable Land</td>
<td>Moderate potential arable land</td>
<td>Light Grazing</td>
</tr>
<tr>
<td>IV</td>
<td>Arable Land</td>
<td>Marginal potential arable land</td>
<td>Moderate Grazing</td>
</tr>
<tr>
<td>V</td>
<td>Grazing Land</td>
<td>Non-arable; moderate potential grazing land</td>
<td>Intensive Grazing</td>
</tr>
<tr>
<td>VI</td>
<td>Grazing Land</td>
<td>Non-arable; low to moderate potential grazing land</td>
<td>Light Cultivation</td>
</tr>
<tr>
<td>VII</td>
<td>Grazing Land</td>
<td>Non-arable; low potential grazing land</td>
<td>Moderate Cultivation</td>
</tr>
<tr>
<td>VIII</td>
<td>Wildlife</td>
<td>Wilderness</td>
<td>Intensive Cultivation</td>
</tr>
</tbody>
</table>

In terms of the DAFF classification, the mountain land in the study area has been mapped as Class VII – “non-arable, low potential grazing land”. The parts of the study area targeted for the placement of the wind turbines are either Class V – “non-arable, moderate potential grazing land” or Class VI – “non-arable, low to moderate potential grazing land”. It should be remembered that this DAFF classification is intended to be used at a scale of 1:250 000 and therefore is often too generalised to inform decisions regarding the potential impact of a proposed wind energy facility on the agricultural potential of a specific site.

In this report therefore, agricultural potential would rather be viewed as the combined result of the quality of the natural resources, soil, climate and water – as discussed above – with full incorporation of the concept of sustainability with respect to both environmental and financial sustainability.

Medium or high agricultural potential therefore implies an above average possibility to conduct agricultural activities that will be sustainable and financially viable under normal market
conditions. The discussions below attempt to analyse each of the main possible agricultural activities against this definition of agricultural potential.

**Figure 13:** All areas where turbines are to be erected have been mapped as Class 5 (Non-arable, moderate potential grazing land) or Class 6 (Non-arable, low to moderate potential grazing land (DAFF: Land Capability).

### 3.4.1 Irrigated cultivation

Irrigation allows the farmer to supply water to the plant when needed and therefore adds significant flexibility to the production system. With irrigation it becomes possible to grow crops with a higher water demand than supplied by the natural rainfall, while it also compensates for other limitations, such as poor soil properties (i.e. low water retention capacity) and rectification of low fertility through technologies such as fertigation. It does however add a significant cost factor in the production chain and therefore irrigation farming tends to elevate the entire production process in terms of technology, skills and management requirements. This inevitably leads to the production of high value crops, often with high quality and food safety standards and challenging marketing (export) conditions.

Against this background, the irrigation potential of the Wolseley study area is limited. In general the soils are either very stony and/or sandy with low water retention capacity or poorly drained, inducing water logged conditions during winter leading into spring. There is however a significant supply of irrigation water, which allows for intensive production of high value perennial crops, the scale of which are presented below.

The water requirement of a plant has two components: (i) **evaporation** from the soil or other wetted surfaces and (ii) **transpiration** of water through the plant – taken up by the roots and...
transpired (evaporated) through the leaves. Therefore the amount of water needed by all crops is correlated with the evaporation at the site, which in turn is driven by humidity, temperature and wind. This correlation or ratio (also known as a crop coefficient or crop factor - $K_c$) varies between crop types and growth stage, but when known, can be used to estimate the water (irrigation) requirement of a crop in a specific climate where the evaporation has been measured. When using the La Plaisante rainfall and evaporation data, the following water requirements are calculated for a number of dominant crop types.

Table 5: Theoretical irrigation requirements$^{10}$ of key crops, grown at Wolseley.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Irrigation Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Req less Eff Rain</td>
</tr>
<tr>
<td></td>
<td>mm/a $^A$</td>
</tr>
<tr>
<td>Planted pastures</td>
<td>942</td>
</tr>
<tr>
<td>Wine Grapes</td>
<td>360</td>
</tr>
<tr>
<td>Table Grapes</td>
<td>746</td>
</tr>
<tr>
<td>Olives</td>
<td>564</td>
</tr>
<tr>
<td>Stone Fruit</td>
<td>700</td>
</tr>
<tr>
<td>Pome Fruit</td>
<td>700</td>
</tr>
<tr>
<td>Citrus</td>
<td>688</td>
</tr>
<tr>
<td>Tomato/Peppers</td>
<td>778</td>
</tr>
<tr>
<td>Vegetable Seed</td>
<td>385</td>
</tr>
<tr>
<td>Potatoes</td>
<td>375</td>
</tr>
<tr>
<td>Maize</td>
<td>566</td>
</tr>
<tr>
<td>Wheat</td>
<td>82</td>
</tr>
<tr>
<td>Figs</td>
<td>390</td>
</tr>
<tr>
<td>Pecan Nuts</td>
<td>700</td>
</tr>
<tr>
<td>Pomegranates</td>
<td>746</td>
</tr>
</tbody>
</table>

A Crop water requirement, without allowance for irrigation system inefficiency  
B Total irrigation requirement under most suited irrigation system for crop type

From this data, it is obvious that all crops would require at least some supplementary irrigation to fully meet their water requirement. Determining the best crop types for any area is the result of many variables, but availability of irrigation water and profitability are often the main considerations. In the case of the Wolseley Wind Farm study area, it appears that deciduous fruit (nectarines, peaches, plums, pears), citrus and wine grapes are the favoured crop types. Given the areas per crop type as determined in the land use mapping procedure, the total volume of required irrigation water can be calculated as follows:

Table 6: Calculation of the total irrigation water requirement at Wolseley Wind Farm.

<table>
<thead>
<tr>
<th>Crop type</th>
<th>Area planted ha</th>
<th>Irrigation requirement m³/ha/a</th>
<th>Total water requirement m³/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vineyards</td>
<td>106</td>
<td>4003</td>
<td>424 318</td>
</tr>
<tr>
<td>Deciduous fruit</td>
<td>223</td>
<td>8755</td>
<td>1 952 365</td>
</tr>
<tr>
<td>Citrus</td>
<td>33</td>
<td>8598</td>
<td>283 734</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>2 660 417</td>
</tr>
</tbody>
</table>
This volume marginally exceeds the estimated supply of irrigation water of 2 621 000 m³/a (see paragraph 3.3.2 above), suggesting that the farms in the study area are largely developed to their full capacity in terms of irrigated crop production.

3.4.2 Dry land cultivation

Dry land or rain fed cultivation refers to the practice of growing a crop without irrigation, thus fully depending on the rainfall to supply in the water requirement of the crop. During the warm summer months, when the water requirement of a summer crop would be at its highest, the rainfall is only ±180 mm. This volume is not sufficient to grow any cash crop and also constrains the provision of good summer grazing for livestock. The production of a cash crop is therefore limited to the cool winter rainy season when a rainfall of 445 mm (La Plaisante station) can be expected. A semi quantitative assessment of the suitability of the area for the production of a rain fed cash crop can be done by comparing the water requirement of the crop with the supply from rainfall when evaporation data is also available. Wheat is the dominant cash crop in the Western Cape and will be evaluated here, using the evaporation data of the La Plaisante weather station.

(a) Winter cereals

The following example provides an indication of the degree to which rainfall at the study area (La Plaisante) can supply in the water requirement of wheat grown on medium deep (60 cm) sandy loam soils, with a plant available water retention capacity (PAW) of 54 mm in the root zone, based on an effective rooting depth for cereals of only 60 cm and a soil water retention capacity of 90 mm/m between -10 and -100 kPa. Figure 14 gives a graphical representation of the water supply, demand and deficit for this scenario (based on the data presented in Table 7) in comparison with Malmesbury as an example of a high potential small grain area. At Wolseley, during March and April the effective rainfall will contribute towards raising the water content in the soil. During May (the planting month), June, July, August and the first part of September, the crop requirement is supplied from stored soil moisture and effective rainfall, but from then until harvest the plant will experience moderate to significant water stress, as its demand exceeds the supply from rainfall and the stored soil moisture has already been depleted. The total shortfall in water supply is 63 mm, implying that approximately 70% of the theoretical water requirement of wheat to achieve optimum yield is supplied by the natural rainfall. This scenario has a long term expected average wheat yield of 2.1 t/ha, whilst yields above 2.5 t/ha can be expected in good rainfall years.

| Table 7: Calculation of ETcrop, soil water balance and crop water deficit. |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                                | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| Rain (mm)                      | 12  | 16  | 20  | 44  | 81  | 102 | 84  | 83  | 51  | 36  | 25  | 19  | 572  |
| Effective Rain (mm)            | 0   | 0   | 0   | 12  | 30  | 41  | 32  | 32  | 15  | 8   | 2   | 0   | 173  |
| Reference ET₀ (mm)             | 299 | 252 | 212 | 132 | 84  | 62  | 66  | 82  | 116 | 185 | 243 | 282 | 2013 |
| Crop Factor                    | 0   | 0   | 0   | 0.25| 0.35| 0.5 | 0.65| 0.4 | 0.2 | 0   | 0   | 0   | 0    |
| Crop PET₀ (mm)                 | 0   | 0   | 0   | 21  | 22  | 33  | 53  | 46  | 37  | 0   | 0   | 0   | 212  |
| Surplus Rainfall (mm)          | 0   | 0   | 0   | 12  | 10  | 19  | 0   | 0   | 0   | 0   | 2   | 0   | 43   |
| Soil PAW (mm)                  | 0   | 0   | 0   | 12  | 22  | 41  | 40  | 19  | 0   | 0   | 2   | 2   | 63   |
| Crop water deficit (mm)        | 0   | 0   | 0   | 0   | 0   | 0   | 3   | 31  | 29  | 0   | 0   | 0   | 63   |

Proposed Wolseley Windfarm
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Date: 15 October 2012
The above analysis also illustrates the limited contribution of the soil's ability to store water in the root zone, towards higher yields. In other words the amount of rainfall and its distribution during the growing season is of much higher significance, under these moderately low rainfall conditions, than soil potential. Any soil with a plant available water retention capacity of 42 mm or more will theoretically produce similar wheat yields. Shallow, stony soils as well as poorly drained duplex soils may however result in lower yields.

These findings are in agreement with the wheat potential analysis of the Western Cape, conducted by the provincial Department of Agriculture (Wallace, 2011) of, making use of averaged Modis NDVI data, for the month of August over a 10 year period. This data (Figure 15) reflects the vegetation index of dry land cultivated areas and correlates well with typical yield levels.
(b) Planted pastures

The high wind conditions, marginal soil properties, dry summer season and limited availability of water, severely limits the feasibility of planted pastures under irrigation. As discussed above, the available water would rather be used for higher value crops, thus resulting in the arable but uncultivated land being used for semi extensive grazing, rather than planted pastures – with the exception of a few small paddocks. There is no grain stubble and the vegetation cover and species composition limits the grazing capacity to no better than 2 ha per SSU, provided that supplementary feeding is available during late summer and fall.

3.4.3 Livestock farming

The combined area of the old fields and dry land pastures is about 424 ha. At a grazing capacity of 2 ha per SSU – or 10 to 12 ha per LSU – the potential for livestock farming on these fields is limited to ±200 ewes OR ±40 cows. Larger stock numbers may be accommodated for short periods during winter and spring. The grazing capacity of the natural fynbos mountain veld is even lower at 5 ha/SSU and 39 ha/LSU. Therefore another ±200 ewes OR 25 cows can be kept on this veld.

3.4.4 External factors

The economic viability of a farm with sufficient resources is largely determined by the difference between input cost and producer prices – driven by supply and demand. Other factors that can have a significant impact on viability can include distance to market – in which case the study area is moderately far from the Cape Metropole but well serviced by the N2 normal logistical infrastructure. Security issues, such as stock theft has forced many farmers
near urban settlements to abandon small stock farming. This is expected to also be prevalent in the study area, but was not confirmed in this study. Predation by mainly caracal in the mountain veld is also deemed possible.

3.4.5 Resulting agricultural potential

The availability of irrigation water compensates largely for the low to medium potential of the soils and the sub-optimal climate. When special measures – such as net housing, wind breaks, full irrigation and meticulous management – are implemented, sustainable production can be achieved. The extent will however be limited by the supply of water on each farm.

3.5 Study area sensitivity analysis

The sensitivity of the receiving environment depends largely on the following:
- Erodibility of the soils – which in turn, is the result of slope gradients, soil properties and exposure of the soil surface;
- The agricultural potential of the site;
- Present and potential future agricultural activities; and
- Design specifications, installation and operational procedures of the wind turbines and appurtenant structures.

Table 8: The sensitivity analysis entailed a GIS procedure based on the following parameters, to compile a sensitivity map.

<table>
<thead>
<tr>
<th>Features</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Slope gradient</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Cultivated areas*</td>
<td>Net houses; Perennial crop orchards; Vineyards</td>
</tr>
<tr>
<td>Non-cultivated areas</td>
<td>Natural vegetation; Fall out areas; Eucalyptus stands; Road reserves</td>
</tr>
</tbody>
</table>

* In terms of the guidelines of DAFF, all cultivated areas should be treated as no-go areas for renewable energy structures.
Although this map provides a first approximation of the sensitivity of the study area, the possible impacts of each of the wind turbines and their associated infrastructure, as described in Chapter 4, was based more on the source data used to produce the map, rather than the map itself.

Figure 16: Sensitivity of the Wolseley receiving agricultural environment with respect to the placement of renewable energy structures.
4 IMPACTS IDENTIFICATION AND ASSESSMENT

4.1 Introduction

Worldwide, the generation of more electricity from renewable sources is imperative, to meet the reduction in CO$_2$-emission targets. In South Africa coal fired power stations not only produce vast amounts of CO$_2$, but also threaten to convert thousands of hectares of productive farmland into coal mines.

Furthermore, the electricity supply of the Western Cape is highly dependent upon the generation capacity at the Koeberg nuclear power plant, as the national grid is unable to supply the local (Western Cape) demand from the northern provinces. Additional generation capacity is therefore essential to:

- Contribute to green energy targets;
- Ensure adequate power supply for the present demand; and
- Provide for growth in future demand.

Local wind conditions provide an ideal opportunity to generate part of this additional capacity through wind farms.

Globally there are many examples of wind farms on agricultural land with minimal, if any impact on the agricultural production of the land. In most cases it can be assumed that the revenue earned through lease agreements are used in support of the farming enterprise and therefore contributing to the viability of the farm.

The construction of a wind energy facility on farm land also provides an opportunity for the upgrading of farm roads and water runoff infrastructure. Examples of poorly maintained water runoff infrastructure are common on farm land in the Western Cape. This can perhaps be partly addressed through strict requirements attached to the approval of a renewable energy facility on agricultural land.

Photo set 3 (following page)
Examples of wind turbines in productive farm land.
4.2 Identification of Impacts

Poor planning, design and installation of wind turbines and appurtenant structures can induce unacceptable impacts on the natural resources, agricultural production and ultimately on food security. The following photos are examples of undesired impacts which can mostly be prevented or adequately mitigated when considered properly during the design and construction stages (NOTE: Photos were not taken in the study area):

The area demarcated by the red line was previously cultivated, but cultivation was abandoned due to impracticality of working “over” the access road to the turbines. The impact could have been reduced by placing the road to the left of the turbines, but ideally the turbines should have been placed in the non-cultivated land left of the drainage line.

Turbines should preferably be placed at the edges of fields. The impact of a turbine in the middle of a field is much higher than merely the land lost due to the access road, as it interferes with tractor and implement movement, often resulting in shorter rows and downtime due to more turns required to cultivate the field.
During construction, the site office and lay down area can occupy large tracts of land. The old mining area, used in the photo is ideal, but on farms the site needs to be carefully selected, not to interfere with farming activities.

Steep slopes require large cut-and-fill and should be avoided on productive farm land. Steep slopes are also more prone to water erosion.

Excessive working areas around turbine positions should be avoided.
Contour banks and waterways are a special case relative to potential impact of turbine placement and deserve particular attention at micro-siting time. Contour banks have been constructed in most cultivated fields with moderate to steep slopes in the Western Cape, mostly under guidance of a soil conservation technologist of the Department of Agriculture and often partly funded through government subsidies. The contour banks and waterways have been designed to control surface runoff and dissipate the energy of the flowing water to minimise soil erosion. The maintenance and integrity of the system is essential to ensure proper functioning. A broken contour bank will spill into the next, mostly with catastrophic consequences (see photo), as each contour is designed to contain only the runoff in its own “catchment”. Any disturbance of contour banks is therefore not ideal and should be limited as far as possible during micro-siting. Where it is inevitable, careful mitigation is essential (Figure 15).

Figure 17: In this example of another wind farm the integrity of contours 2 and 3 has been compromised by the hard standing area of the wind turbine (red lines), spilling the runoff water along the access road into contour 4. Without proper mitigation, contour 4 may not be able to accommodate all the water during a flash flood.
An integral part of a contour bank system is the waterway into which the contour banks spill their water. Waterways need to be protected by a permanent vegetation cover or concrete lining to prevent excessive erosion, as shown in Figure 16, below.

![Figure 16: Contour banks on the left spill into a concrete waterway [1], without any erosion. Contours bank on the right spill into an unprotected waterway [2], resulting in severe donga erosion. (NOTE: Photo not taken in the study area.)](image)

Thus, the two main potential impacts associated with wind farms on agricultural land, are:

- Degradation or occupation of agricultural resources
- Interference with or prevention of agricultural activities

Secondary impacts include:

- Impact on Agri-tourism
- Contribution to farm income (positive impact)
4.2.1 Degradation or occupation of agricultural resources

The infrastructure of a wind energy facility, namely the wind turbines, hard set areas, access roads, cable trenches, overhead power lines for grid connection, the control room, site construction office, lay down areas and/or spoil stock piling areas may have a temporary (during construction), long term (during operation) or permanent (concrete structures remaining after decommissioning) impact on the natural resource base to the disposal of agricultural production, through:

- occupation of land that has a high potential for future production;
- interference with natural or artificial drainage lines or structures (contour banks & waterways);
- inducing additional runoff from hard set areas or access roads;
- erosion (wind and water) due to increased runoff and/or removal of vegetation cover;
- disturbance to the soil (i.e. for temporary roads or cable trenches) with inappropriate reclamation afterwards; and
- deterioration of grazing capacity.

4.2.2 Interference with agricultural production

Agricultural production and eventually food security can potentially be compromised, especially through the cumulative effect of renewable energy structures on productive farm land, through:

- occupation of productive agricultural land by the turbine, hard standing area, access roads, other infrastructure and storage area for spoil/top soil;
- complicating workability of or access to some cultivated fields;
- disrupting farming activities during the construction phase; and
- complicating or preventing the use of aircraft for crop spraying.

The specific design, construction procedure and operation of the wind farm, can have a very significant effect on the anticipated impacts on the agricultural resources and farming activities. Sagit Energy Ventures has opted for a design which entails:

- All laydown and construction areas, to be fully rehabilitated after construction.
- No permanent hard standing area for cranes, post construction.
- Where existing farm roads does not provide access to turbines, the access road will be rehabilitated to a farm type track after construction.
- All cable trenches will follow access roads and will be sufficiently deep to allow for normal farming activities at the surface.
- Turbine foundations to be well below the surface, effectively limiting the above ground footprint of the turbine base to less than 30 m².

This design and operational procedure practically limits the potential impact of a turbine on agricultural activities and the natural resources to the construction phase.
4.2.3 **Impact on agri tourism**

Agri tourism can contribute significantly to farm income and, in some cases, form an integral part of the marketing strategy of agricultural enterprises. In the BreedeKloof, wine tasting and restaurant facilities are well known examples of the latter. This aspect however, is more of socio-economic nature and falls beyond the scope of this study which has the pure agricultural production and protection of natural agricultural resources as focus. It should however receive proper consideration in the full impact assessment of the proposed wind facility, as a number of farms in the vicinity of the study area are actively involved in agri tourism.

4.3 **Impacts during Construction**

During the construction phase a site office will be set up, farm roads will be upgraded, some additional temporary access roads will be constructed, temporary laydown areas and storage areas for topsoil/spoil will be prepared, trenches and turbine foundations will be made and construction and assembly will take place. Thereafter all temporary access roads, laydown areas and crane standing areas will be rehabilitated to a better or equal condition prior to construction.

The potential impacts associated with these activities, specific to the Wolseley Wind Farm, are:

- Degradation of the natural resource: soil erosion;
- Disturbance to the soil profile and structure;
- Disturbance to surface drainage works;
- Disruption of farming activities; and
- Occupation of cultivated land.

4.3.1 **Impact 1: Degradation of the natural resource: Soil Erosion**

Removal of vegetation cover on moderate to steep slopes during the rainy season may induce higher runoff and soil erosion. This will be aggravated by increased runoff from road surfaces and hard standing or lay down areas. Full mitigation is possible by limiting construction during winter to “safe” sites only, by controlling the movement of traffic in sensitive areas and construction of appropriate runoff control structures.

In a few specific areas, where the soils are of fine sandy nature, wind erosion may be problematic and will require control measures.

4.3.2 **Impact 2: Disturbance to the soil profile and structure**

The movement of heavy vehicles and excavations for trenching and foundations could induce compaction, break down of soil structure and will disturb the natural soil profile. Dry soil is less sensitive to compaction and disturbance and wet or waterlogged soil conditions should therefore be avoided during construction. During excavation the top soil (A-horizon) should be kept apart to allow for proper rehabilitation post construction.
4.3.3 Impact 3: Disturbance to surface drainage works
In uncultivated areas, the natural surface flow of water should be left undisturbed. Access roads, stock pile and laydown areas and turbine construction sites should be designed not to disturb water flow or should incorporate structures to accommodate the flow. In cultivated areas, water runoff is often channelled by contour banks or drainage trenches. The integrity of these structures should be protected throughout the construction phase and beyond.

4.3.4 Impact 4: Disruption of farming activities
Construction will bring many large and slow moving trucks and equipment into the farming area. Some seasons in the growth cycle of crops are more critical than others, like harvest time. Careful planning of access roads, traffic flow and timing of construction at each site can largely mitigate the potential disruptions.

Possible damage to farm infrastructure, such as irrigation main lines or electricity supply should be avoided at all cost.

4.4 Impacts during Operation

Based on the design, construction and operation procedure chosen by Sagit Energy the potential impacts, normally associated with wind turbines on farm land are almost fully mitigated. During the operational phase the small footprint of the wind turbine will become a fixed feature around which normal farming activities can continue unhindered, similar to a boulder, tree or pylon of a power line.

The access roads will either follow existing farm roads or will be rehabilitated to a farm track post construction. Similarly will all laydown and hard standing areas be rehabilitated. The potential for increased runoff from road or other surfaces due to the wind farm operation is therefore very small.

Traffic to the turbines during operation, will also be very limited and should not impact on farming activities.

The only anticipated impacts during operation of the wind farm are:
- Occupation of high potential arable land;
- Visual impact;
- Increased security; and
- Additional farm income.

4.4.1 Impact 1: Occupation of high potential arable or cultivated land
This impact assessment included consultation with the developer to refine the turbine layout in an effort to minimise any anticipated impacts. During this process a site visit was done with Mr. Cor van der Walt of the Department of Agriculture: Western Cape, which resulted in an alternative wind turbine layout being proposed as to mitigate the potential impact of the turbines, access roads and associated infrastructure to a negligible level.
All the amendments proposed in the alternative layout were accommodated by Sagit Energy, with the exception of turbine nr 12. The position of this turbine is confined by various offset buffers and no suitable alternative location could be offered. Installing this turbine at the presently proposed site will imply a significant disruption of an existing citrus orchard that is part of a land reform project. In mitigation hereof, the developer has offered to replace the affected citrus orchard (±4.3 ha) with a more viable deciduous fruit orchard and also compensate the owner for loss of income. This procedure will allow the installation of this turbine in a manner that will not negatively impact on future productivity of the land. This offering is deemed very favourable to the beneficiaries of the land reform project, as it not only will provide them a more profitable orchard, but also contribute to farm income from the lease of the land.

None of the other turbine positions will occupy high potential or cultivated land.

4.4.2 Impact 2: Visual impact
The visual impact associated with 30 turbines in a picturesque farm landscape is probably significant and may negatively impact on especially agri tourism activities. This impact is well covered in two parallel studies, namely the visual impact assessment and the socio-economic assessment.

4.4.3 Impact 3: Increased security
It is expected that additional security will be put in place for the duration of the operational phase, which should also be to the benefit of the general farm security.

4.4.4 Impact 4: Additional farm income
In terms of the lease agreement, each land owner will receive compensation in the form of a substantial rental amount for each turbine. Although this arrangement cannot replace the loss of natural resources or production (where such impacts do occur), it will enable all affected land owners to either reduce possible debt or invest in measures to enhance the productivity of the land.

In all well designed and properly constructed wind farms, this impact – from an agricultural viewpoint – is anticipated to be the most significant of all.

4.4.5 Decommissioning phase
No specific impacts relative to agriculture is expected after decommissioning, provided that the guidelines pertaining to the construction and operation phases are followed.

4.4.6 Cumulative Impacts
There is no known other wind farm developments proposed for the Wolseley area and therefore no macro scale cumulative impacts are anticipated. At a micro scale however, each turbine or access road may induce small impacts that may escalate when repeated at more turbines.
4.5 Potential Mitigation Measures

4.5.1 DAFF prescribed mitigation measures

The following mitigation measures, applicable to the Wolseley WEF are prescribed by the DAFF regulations for renewable energy facilities on agricultural land:

- Every care should be taken before, during and after the construction and future maintenance of the renewable energy structure, supporting infrastructure or access routes to protect the vegetation and veld condition against deterioration and destruction.
- It is the responsibility of the owner of the renewable energy project to ensure that suitable soil conservation works be established on the site to limit or restrict the loss of soil.
- No renewable energy structure, supporting infrastructure or access routes shall in any manner divert any run-off water from a water course to any other water course or obstruct the natural flow pattern of runoff water, except with the permission from DAFF.
- All access routes, existing or newly constructed and utilized during the construction and/or maintenance of the renewable energy structures should be restore to its original state after completion of the establishment of the structures. Every care should be taken not to damage or degrade the status of the natural resources base of the farm during the construction phase of the mentioned or to impact negatively on the farming or production practices on the farm.
- All service routes that will be used to gain access to the renewable energy structures for maintenance purposes have to be covered in gravel, tarred or compressed in order to limit the possibility of degradation and erosion.
- The installation of the underground power cables should not negatively impact on the resource base of the site. During the installation no soil conservation structure should be disturbed, the soil texture should be restored, the work area should not be wider than 5 m, should not be directed through existing or future cultivated land nor impact negatively on existing farming infrastructure or any farming activity.
- The lease agreement should be transferred to the new land owner, should the farmer decide to sell the property during the time period of the current lease agreement. DAFF needs to be informed of the transfer of the lease agreement upon which a new approval number will be issued. Supporting documentation should be provided that the new land owner concurs with the specifications of the existing lease agreement.

4.5.2 Site specific mitigation measures

The following general siting considerations can drastically reduce the impact of wind turbines on agricultural land, when adhered to:

- Locate wind turbines and support structures along field edges so as to minimise negative impacts on agricultural land and farming operations.
- Limit permanent road widths to 5 m or less, and where possible, follow field edges to minimise loss of productive agricultural land.
- Where it is unavoidable to have roads that cross agricultural fields, remain on ridge tops and high ground. The advantages of this are:
  - it allows farming along the contours;
• it requires no cut and fill or ditching that would take additional land out of production; and
• it avoids potential drainage and erosion problems.

- Avoid cutting existing fields into smaller irregularly shaped fields which are more difficult to farm, by locating access roads along the edges of agricultural fields where possible.
- Locate parking areas, construction lay down areas, and other temporary and permanent support facilities outside of active agricultural fields as far as possible.
- Overhead electrical connecting lines should have as wide a span as possible to minimise the number of poles that are used in agricultural areas.
- Avoid disturbance of surface and subsurface drainage features (contour banks, water ways, ditches, diversions, drainage lines, etc.).
- Consult with landowners during the siting of access roads that cross/intersect active agricultural lands.
- All construction activities (i.e. vehicle movement) in cultivated fields should be minimised and contained within clearly demarcated areas (see photo).
- No vehicular access to the tower sites should be permitted until permanent access roads have been constructed.
- Top soil (±300 mm) should be stored at an appropriate site on each farm for future rehabilitation after decommissioning.
- Subsoil can be used – if suitable – for road construction and fills.

When constructing roads through productive agricultural land, the final road surface should be level with the adjacent field surface. If drainage or other issues preclude a level surface, the road should not be elevated more than 150 mm above the surrounding field. Topsoil should be used after construction to create a smooth transition between the road surface and surrounding agricultural land, so as not to impede crossing by farm equipment.

- Where necessary, culverts or gutters should be installed to assure uninterrupted natural surface water drainage patterns. Such culverts or gutters should be installed in a manner that prevents concentration of water runoff and soil erosion.
- To prevent damage to adjacent agricultural land, all vehicle traffic and parking should be confined to the access roads, designated work areas at the tower sites, and/or designated parking and lay down areas. Any necessary pull-offs and parking areas should be developed outside of active agricultural fields. If this is not possible, all topsoil should be stripped from agricultural areas used for vehicle and equipment traffic and parking. Such areas should then be restored at the end of construction, under supervision of a competent soil scientist.
- Excavated subsoil and rock should not be stockpiled or spoiled on active agricultural land.
- Excess excavated subsoil and rock, or that which is not suitable as backfill should be removed from the site. On-site disposal should only occur with permission from the environmental manager and the landowner. Such disposal should not impact active agricultural land.
- Open excavation areas in active pasture land should be temporarily fenced to protect livestock.
• Buried electric lines in active agricultural fields should be at least 1200 mm deep, unless bedrock is encountered prior to reaching this depth. If bedrock is encountered, the buried lines must be placed completely below the bedrock surface.
• No rock backfill is allowed in the top 400 mm in active agricultural fields.
• The establishment of a ground cover (vegetation) on disturbed land soon after construction is essential to reduce the risk of water erosion. Sowing of oats at the onset of the winter rainfall is suggested.
• The impact of groundwater abstraction for dust control and/or concrete mixing during the construction period, may significantly impact on the availability of water for livestock watering. It is therefore recommended that alternative (off-site) sources of water be used.
• The implementation of a sloped turbine foundation rather than a flat surface is preferred, to assist soil water drainage after decommissioning (see Figure 20).

![Figure 20: A sloped and buried turbine foundation (right) will allow cultivation closer to the base and also assist external drainage of water in the soil.](image)

Possible benefits to agriculture from the wind energy facility, apart from the projected revenue stream to the lessor of the land, include:
• Increased farm security;
• Upgrading of certain farm roads (access roads) and drainage infrastructure; and
• Clearing of aliens.

### 4.6 Impact Assessment Methodology

Impacts are to be described and then evaluated in terms of the criteria given below.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating Scales</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td></td>
<td>This is an evaluation of the type of effect the construction, operation and management of the proposed development would have on the affected environment. Would it be positive, negative or neutral?</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria</td>
<td>Rating Scales</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Extent</td>
<td>Low: Site-specific, affects only the development footprint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium: Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High: Regional (beyond a 10 km radius) to national</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>Low: Short-term: 0-5 years, typically impacts that are quickly reversible within the construction phase of the project</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium: Medium-term, 6-10 years, reversible over time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High: Long-term, 10-60 years, and continue for the operational life span of the development</td>
<td></td>
</tr>
<tr>
<td>Intensity</td>
<td>Low: Where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium: Where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High: Where natural, cultural or social functions and processes are altered to the extent that the impact will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected</td>
<td></td>
</tr>
<tr>
<td>Degree of Reversibility</td>
<td>Low: Impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium: Impacted natural, cultural or social functions and processes will return to their pre-impacted state within the medium to long term.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High: Impacted natural, cultural or social functions and processes will never return to their pre-impacted state.</td>
<td></td>
</tr>
<tr>
<td>Potential for impact on irreplaceable resources</td>
<td>Low: No irreplaceable resources will be impacted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium: Resources that will be impacted can be replaced, with effort.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High: There is no potential for replacing a particular vulnerable resource that will be impacted.</td>
<td></td>
</tr>
</tbody>
</table>
| Consequence                  | Low: A combination of any of the following  
|                              | - Intensity, duration, extent and impact on irreplaceable resources are all rated low  
<p>|                              | - Intensity, duration and extent are rated low but impact on |</p>
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating Scales</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>resources.</td>
<td>irreplaceable resources is rated medium to high</td>
<td>• Intensity is low and up to two of the other criteria are rated medium • Intensity is medium and all three other criteria are rated low</td>
</tr>
</tbody>
</table>

| Medium | • Intensity is medium and one other criteria is rated high, with the remainder being rated low • Intensity is low and at least two other criteria are rated medium or higher • Intensity is rated medium and at least two of the other criteria are rated medium or higher • Intensity is high and at least two other criteria are medium or higher • Intensity is rated low, but irreplaceability and duration are rated high |

| High | • Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration • Intensity is rated high, with all of the other criteria being rated medium or higher |

**Probability**
The probability of the impact actually occurring, based on professional experience of the specialist with environments of a similar nature to the site and/or with similar projects. It is important to distinguish between probability of the impact occurring and probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact. The fact that an activity will occur does not necessarily imply that an impact will occur. For instance, the fact that a road will be built does not necessarily imply that it will impact on a wetland. If the road is properly routed to avoid the wetland, the impact may not occur at all, or the probability of the impact will be low, even though it is certain that the activity will occur.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Low</th>
<th>Improbable. It is highly unlikely or less than 50 % likely that an impact will occur.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td></td>
<td>Distinct possibility. It is between 50 and 70 % certain that the impact will occur.</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>Most likely. It is more than 75 % certain that the impact will occur or it is definite that the impact will occur.</td>
</tr>
</tbody>
</table>

**Significance**
Impact significance is defined to be a combination of the consequence (as described below) and probability of the impact occurring. The relationship between consequence and probability highlights that the risk (or impact significance) must be evaluated in terms of the seriousness

<table>
<thead>
<tr>
<th>Significance</th>
<th>Low</th>
<th>• Low consequence and low probability • Low consequence and medium probability • Low consequence and high probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to medium</td>
<td></td>
<td>• Low consequence and high probability • Medium consequence and low probability</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>(consequence) of the impact, weighted by the probability of the impact actually occurring. The following analogy provides an illustration of the relationship between consequence and probability. The use of a vehicle may result in an accident (an impact) with multiple fatalities, not only for the driver of the vehicle, but also for passengers and other road users. There are certain mitigation measures (e.g. the use of seatbelts, adhering to speed limits, airbags, anti-lock braking, etc.) that may reduce the consequence or probability or both. The probability of the impact is low enough that millions of vehicle users are prepared to accept the risk of driving a vehicle on a daily basis. Similarly, the consequence of an aircraft crashing is very high, but the risk is low enough that thousands of passengers happily accept this risk to travel by air on a daily basis. In simple terms, if the consequence <strong>and</strong> probability of an impact is high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.</td>
<td></td>
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</tr>
<tr>
<td><strong>Medium</strong></td>
<td></td>
<td>• Medium consequence and low probability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Medium consequence and medium probability</td>
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<tr>
<td></td>
<td></td>
<td>• Medium consequence and high probability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High consequence and low probability</td>
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<tr>
<td><strong>Medium to high</strong></td>
<td></td>
<td>• High consequence and medium probability</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td></td>
<td>• High consequence and high probability</td>
</tr>
</tbody>
</table>

**Degree of confidence in predictions**

Specialists are required to provide an indication of the degree of confidence (low, medium or high) that there is in the predictions made for each impact, based on the available information and their level of knowledge and expertise. Degree of confidence is not taken into account in the determination of consequence or probability.

4.7 Impact Assessment – Wolseley Wind Farm

The single most critical impact associated with all proposed wind farm developments in the Western Cape is the potential loss of arable land. In most areas the landscape has almost entirely been converted to cultivated fields or orchards, thereby placing a high conservation value on all remaining natural vegetation, often demarcated as critical biodiversity areas (CBA’s). The placement of turbines and access roads in these areas are mostly not compatible with the conservation priorities attached to these areas, and therefore wind energy developers often turn to cultivated land as the only alternative sites to place wind turbines.
This was also the case with the earlier iterations for the turbine layout of the Wolseley WEF. A process of refining the turbine layout, under guidance of the agricultural specialist and with input from officials of the Department of Agriculture: Western Cape was however followed to ensure a turbine layout plan that minimises all the potential negative impacts. The impact assessment below, therefore already reflects significant mitigation incorporated in the siting of the turbines.

### 4.7.1 Construction phase

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Extent</th>
<th>Duration</th>
<th>Intensity</th>
<th>Reversibility</th>
<th>Impact on Irreplaceable Resources</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impact 1</strong>: Degradation of the natural resource: Soil Erosion:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Impact Description:</strong></td>
<td></td>
<td></td>
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<tr>
<td>Loss of soil due to water or wind erosion</td>
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<tr>
<td><strong>Mitigation Description:</strong></td>
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</tr>
<tr>
<td>Full mitigation is possible by limiting construction during winter to “safe” sites only, by controlling the movement of traffic in sensitive areas and construction of appropriate runoff control structures.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Mitigation</td>
<td>-</td>
<td>Local</td>
<td>Short-term</td>
<td>Negligible</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

**Cumulative Impact:**
When significant erosion occurs (without mitigation) at various turbines and/or access roads the cumulative impact will be high.

| Impact 2: Disturbance to the soil profile and structure | | | | | | | | | | |
| **Impact Description:** | | | | | | | | | | |
| Vehicle traffic on wet soils or improper backfill of trenches will induce compaction, loss of soil structure and poor internal and external drainage | | | | | | | | | | |
| **Mitigation Description:** | | | | | | | | | | |
| Wet or waterlogged soil conditions should therefore be avoided during construction. During excavation the top soil (A-horizon) should be kept apart to allow for proper rehabilitation post construction. | | | | | | | | | | |
| With Mitigation | - | Local | Short-term | Negligible | Low | Low | Low | Low | Low | High |

**Cumulative Impact:**
Indiscriminate treatment of the soil at all trenches and turbine sites will result in significant degradation of the resource.

| Impact 3: Disturbance to surface drainage works | | | | | | | | | | |
| **Impact Description:** | | | | | | | | | | |
| Damage to runoff control structures such as contour banks or structures designed to drain excess soil water like cut-off drains . | | | | | | | | | | |
| **Mitigation Description:** | | | | | | | | | | |
| Keep integrity of structures intact during construction and operation | | | | | | | | | | |
| With Mitigation | - | Local | Short-term | Negligible | Low | Low | Low | Low | Low | High |

**Cumulative Impact:**
Cumulative occurrence will escalate the impact.
### Impact 4: Disruption of farming activities

**Impact Description:**
Prevention or disruption of important farming activities, such as planting or harvesting or damage to important infrastructure such as main irrigation lines or electricity supply.

**Without Mitigation**
- Neg
- Local
- Short-term
- Med
- High
- Low
- Med
- Low
- Med
- Med

**Mitigation Description:**
Careful planning of access roads, traffic flow and timing of construction at each site can largely mitigate the potential disruptions. Damage to main farm infrastructure should be avoided at all cost.

**With Mitigation**
- Neg
- Local
- Short-term
- Negligible
- Low
- Low
- Low
- Low
- Low
- High

**Cumulative Impact:**
No cumulative impact is anticipated.

## 4.7.2 Operational phase

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Extent</th>
<th>Duration</th>
<th>Intensity</th>
<th>Reversibility</th>
<th>Impact on Irreplaceable Resources</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Occupation of high potential arable or cultivated land</td>
<td>Neg</td>
<td>Local</td>
<td>Medium-term</td>
<td>Medium</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td>High</td>
<td>Med</td>
<td>High</td>
</tr>
<tr>
<td>Impact Description:</td>
<td>Loss of production due to the positioning of wind turbine Nr 12 in a citrus orchard.</td>
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<td></td>
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</tr>
<tr>
<td>Mitigation Description:</td>
<td>Replacement of the citrus orchard with higher income crop, after construction plus compensation for loss of income</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>With Mitigation</td>
<td>Neg</td>
<td>Local</td>
<td>Short-term</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Cumulative Impact:</td>
<td>No cumulative impact is anticipated.</td>
<td></td>
<td></td>
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</tbody>
</table>

**Impact 2: Visual impact on Agri tourism** (Covered by separate study – only listed here)

**Impact 3: Increased farm security**

**Impact Description:**
Security measures of wind farm may positively impact on farm security in general.

**Without Mitigation**
- Pos
- Local
- Medium-term
- Low
- N/A
- N/A
- Med
- Probable
- Med
- Low

**Mitigation Description:**
Not applicable

**Impact 4: Additional farm income**

**Impact Description:**
Additional farm income generated through lease agreement with wind operator.

**Without Mitigation**
- Pos
- Local
- Medium-term
- Medium
- Med
- Med
- Med
- Med
- High
- Med
- High

**Mitigation Description:**
Not applicable
5 MONITORING PROGRAMME

In order to ensure that the mitigation measures and good agricultural practice guidelines are followed and appropriately applied, it is strongly recommended that an agricultural specialist in natural resources be part of the installation team and periodically visit the site to recommend specific measures as may be required during the construction phase. No specific monitoring guidelines are required during the operational phase, other than monitoring adherence to the guidelines.

In their guidelines the Department of Agriculture, Forestry and Fisheries also reserves the right to visit the renewable energy site at any time without prior arrangement to review the status of the natural resource base and the impact of the renewable energy structures. During restoration, after decommissioning, an agricultural specialist in natural resources should once again be contracted as part of the rehabilitation team.
6 CONCLUSION

The agricultural potential of the land of the Wolseley wind farm varies considerably over short distances, but is generally marginal to low due to one or more of the following constraints:

- Low water retention capacity due to high stone/gravel content and/or low clay content;
- Poor external drainage inducing water logging of lower lying areas in mid-winter to early spring;
- Low summer rainfall;
- High evaporation in summer leading to high water requirement of crops;
- High incidence of wind, causing crop damage or poor quality (low pack out percentage);
- Low grazing capacity of natural veld.

The reliable supply of irrigation water however allows some perennial crop production, but this often requires a high skill and management level and a high establishment and production cost. Based on the calculations of water supply and demand, the study area is already fully developed in terms of perennial crops. The production of annual small grain crops is presumably not viable and therefore the land not used for perennial crops are mostly used for permanent pastures or left under natural vegetation.

The development of a wind farm in an area of intensive crop production would normally appear unsound. In the case of Wolseley, there are large tracts of low potential land between fruit orchards or vineyard blocks which can be used for the placement of wind turbines and appurtenant structures without detriment to agricultural resources or activities. The placement of some turbine in close proximity to intensively cultivated areas is however only possible due to the construction and operational design proposed by the wind farm developer, as there will be no permanent hard standing or laydown areas and all new access roads will be rehabilitated to minor farm tracks after construction. The proposed turbine layout has also been modified with the input of the agricultural specialist to ensure minimum impact during construction and full agricultural production during the operational phase.

It is therefore only turbine 12 that will have a temporary negative impact on the agricultural activities in its immediate surrounding area. The proposed mitigation measures will however ensure more profitable production after the installation of the wind turbine, compared to the status quo.
7 REFERENCES

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