BRANDVALLEY WIND FARM EIA

AGRICULTURAL AND SOIL ASSESSMENT

Prepared for:

Brandvalley Wind Farm (Pty) Ltd.

Prepared by:

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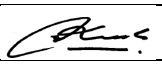
March 2016

REVISIONS TRACKING TABLE

EOH Coastal and Environmental Services

Report Title: Brandvalley Wind Farm EIA: Agricultural and Soil Assessment
Report Version: Draft for Client review
Project Number: 1299

Name	Responsibility	Signature	Date
Roy de Kock	Specialist author		7 March 2016

INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In terms of Appendix 6 of the Environmental Impact Assessment Regulations (G. NR. 982) as regulated by the National Environmental Management Act (Act nr. 107 of 1998 and amended in 2014; NEMA), a Specialist Report must contain all the information necessary for a proper understanding of the nature of issues identified, and must include–

Legislated information required	Location in report
1. (1) A specialist report prepared in terms of the NEMA 2014 Regulations must contain-	
(a) details of-	
(i) the specialist who prepared the report; and	Section 1
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Section 1
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 4
(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 4
(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 6
(g) an identification of any areas to be avoided, including buffers;	Section 8
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 8
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 9
(k) any mitigation measures for inclusion in the EMPr;	Section 9
(l) any conditions for inclusion in the environmental authorisation;	Section 10
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 10
(n) a reasoned opinion-	

Legislated information required	Location in report
(i) as to whether the proposed activity or portions thereof should be authorised; and	Section 10
(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 3
(q) any other information requested by the competent authority.	Section 3

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LIST OF ACRONYMS AND GLOSSARY

AGIS	Agricultural Geo-Referenced Information System
CARA	Conservation of Agricultural Resources Act
DAFF	Department of Agriculture, Forestry & Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EC	Eastern Cape
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
ha	hectare
kV	kilovolt
KZN	Kwazulu-Natal
Ma	Million years
masl	Meters above sea level
MW	Mega Watt
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
SDF	Spatial Development Framework

EXECUTIVE SUMMARY

Brandvalley Wind Farm (Pty) Ltd proposes to develop a Wind Energy Facility (WEF) on the border of the Northern Cape and Western Cape Provinces of South Africa. The proposed Brandvalley Wind Farm falls across eleven (11) farm portions, collectively referred to as the project area for the Brandvalley Wind Farm, that are currently used for animal husbandry, game farming and agriculture including grazing of sheep. EOH Coastal & Environmental Services (CES) was approached to conduct an Agricultural and Soil Assessment of all the properties impacted by the proposed Brandvalley Wind Farm

Laingsburg, the closest town to the Brandvalley Wind Farm site with a weather station, normally receives about 61mm of rain per year, with most rainfall occurring during mid-summer. The dominant geological feature consists of sedimentary deposits of the Abrahamskraal Formation, which forms part of the Adelaide Subgroup of rocks which is part of the Beaufort Group of rocks which in turn makes up part of Karoo Supergroup of geological formations. Soils consist mostly of rocks with limited soils grading in steep areas grading to soils with minimal development that are usually shallow, overlying rock of weathering rock, with or without intermittent diverse soils southwards. Lime may be present in parts of the landscape. Water holding capacity are considered as very low (<20mm) while the potential for water erosion is moderate throughout the site. The landscape is described as high hills and ridges in the north and central areas grading into open hills and ridges southwards.Vegetation consists of Central Mountain Shale Renosterveld and Koedoesberge-Moordenaars Karoo (both vegetation types classified as Least Threatened by SANBI). Various surface hydrology systems (streams, wetlands etc.) will be impacted by the proposed Brandvalley Wind Farm development but the levels of impact must be confirmed with the Aquatic Specialist.

The main land use within the Brandvalley Wind Farm is agriculture and includes:

- Rural agriculture consisting of extensive small stock grazing (Dorper and Dohne Merino)
- Recreational Hunting
- Concentrated irrigation for various cash crops is practised along rivers and streams in small areas.

Although various farmsteads are located onsite, none will be impacted by the proposed Brandvalley Wind Farm infrastructure.

The dominant soil forms were identified as:

- Mispah soil form (14 000ha)
- Glenrosa soil form (16 600ha)

The total final permanent footprint for the Brandvalley Wind Farm will be approx. 40ha. The construction footprint (including temporary footprints) should be approx. 55ha in size. The bulk of infrastructure (approx. 90%) will be located on Mispah soils (hard rock of shallow soils overlying rock). Only 2 turbines and approximately 10% of access roads will be located on Glenrosa soils (undifferentiated top soil layer overlying subsoil that merges into rock).

Mispah soils are not suitable for dryland cropping or irrigation and accommodate a limited variety of vegetation. Grazing capacity is considered as low (26-30 ha/Animal Unit according to AGIS).

Glenrosa soils are also not suitable for dryland cropping. Irrigation of cash crops is only possible along riverbeds, provided that irrigation dams are constructed to aid water availability. Less than 10% of the Brandvalley Wind Farm site is suitable for this. Glenrosa soils accommodate a variety of vegetation ranging from a variety of scrublands, savannah and succulents. Small stock farming (Dorper and Dohne Merino sheep) are practised, grazing capacity is considered as low to moderate (18-25 ha/Animal Unit according to AGIS).

The Brandvalley Wind Farm area is classified into the following agricultural potential classes:

- Non-arable land with a low potential for grazing
- Land capability classification class 7 and 8 only
- Land unsuitable for crops unless under irrigation.

Grazing capacity are between 18-25 hectare per large stock unit (ha/LSU) on low undulating landscapes and 26-30 ha/LSU on steep mountainous areas. Grazing capacity potential are between 41-80 ha/LSU increasing to 26-30 ha/LSU towards the eastern sections.

Soil pH is considered as optimum between 6.5 and 7 for the highest plant nutrient availability for most crops. Both soil types (Mispah & Glenrosa) falls within this range and are considered as suitable for most crops.

Soil samples collected on Glenrosa soil form (S1 & S2) occur mostly on sand with a low organic content. Calcium (Ca), Potassium (K) and Sodium (Na) all fall within the optimal rate for fertile soils (60-75% for Ca, 3-5% for K and 0.5-5% for Na), while magnesium (Mg) content is considered to high (10-20%)

Soil samples collected on Mispah soil form (S5) has a low organic content. Potassium (K), Calcium (Ca) and Sodium (Na) all fall within the optimal rate for fertile soils (3-5% for K, 60-75% for Ca and 0.5-5% for Na), while magnesium (Mg) content is considered too high (10-20%).

Soils within the Brandvalley Wind Farm may be considered as optimum for a wide variety of crops under minimal soil management. Glenrosa soils are considered as more optimal when compared to Mispah soils. However, due to the limiting factor being water availability (for both soil types) and soil depth (especially for Mispah soils), such crops can only be grown under irrigation in deeper alluviums next to river systems.

The following impacts were identified:

Planning & Design Phase.

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Issue 1: Increase in erosion potential		
During the planning and design phase inappropriate storm water design may lead to an increase in surface soil erosion.	**MODERATE**	**LOW**
Issue 2: Increase in renewable energy development in the local area		
During the planning and design phase the increase in renewable energy development in the local area will result in a gradual reduction of available agricultural land over time.	**MODERATE**	**LOW**

Construction Phase.

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Issue 3: Management of hazardous chemicals		
During the construction phase hazardous chemical spills and leakages could lead to soil contamination and a loss of fertile soils if not managed appropriately.	**MODERATE**	**LOW**
Issue 4: Increased risk of fires from construction activities		
During construction phase fires originating from the construction site could lead to the loss of grazing and game.	**HIGH**	**LOW**
During the construction phase incorrect stockpiling of soil could result in a decrease of agricultural viability/potential.	**MODERATE**	**LOW**
Issue 6: Soil profile disturbance and resultant decrease in soil agricultural capability		
During the construction phase excavations for the	**VERY HIGH**	**LOW**

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
construction of the turbines and associated infrastructure will disturb the soil profile. If topsoil becomes buried, or subsoil rock, that is less suitable for root growth, remains at the surface, the agricultural suitability of the soil, that will become available for agriculture again after decommissioning of the WEF, will be reduced.		
Issue 7: Establishment of renewable energy infrastructure on agricultural land		
During the construction phase the WEF infrastructure (permanent and temporary)will result in the loss of up to 5 ha of low agricultural land	**MODERATE**	**LOW**
Issue 8: Increase in erosion potential		
During the construction phase the increase in impacted areas and hard surfaces will increase run-off and potentially lead to soil erosion	**MODERATE**	**LOW**

Operation Phase.

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Issue 9: Increase in erosion potential		
During the operational phase an increase in hard surfaces (hardstands and roads) will increase run-off and potentially lead to soil erosion.	**MODERATE**	**LOW**
Issue 10: Establishment of renewable energy infrastructure on agricultural land		
During the operational phase the WEF infrastructure will result in the loss of up to 5 ha of low agricultural land	**MODERATE** .	**LOW**
Issue 11: Establishment of new access roads		
During the operational phase the new access roads will allow for an easier access to farm areas previously inaccessible or difficult to access.	**HIGHLY BENEFICIAL**	**HIGHLY BENEFICIAL**

Decommissioning Phase.

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Issue 12: Decommissioning and removal of renewable energy infrastructure on agricultural land		
During the decommissioning phase the decrease in renewable energy development in the local area will result in an increase of available agricultural land.	**BENEFICIAL**	**BENEFICIAL**

NO-GO alternative.

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Issue 13: Not constructing the WEF		
Not constructing the WEF will have no impact of agricultural land.	**BENEFICIAL**	**BENEFICIAL**

Cumulative Impacts

IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Issue 12: Change in local land use (for all phases)		
An increase wind farms in the local area may result in a shift in the local land use from agriculture to renewable energy.	**MODERATE**	**MODERATE**

The two (2) access route alternatives are considered equally preferred as both the alternatives are existing gravel roads and none of them will directly or indirectly impact on agricultural activities onsite. Although Access route alternative 1 transects 2 high agricultural areas (irrigated cropland), the footprint is existing and the new route will follow existing farm roads through these areas. None of the access routes alternatives (1 or 2) are considered as "*fatally flawed*" and therefore either one can be constructed.

Site camp alternative 1 is considered as the preferred alternative. Site camp alternatives 2 & 3 are both either located within a non-perennial stream or are immediately (less than 100m) surrounded on two (2) and more sides by a stream. This must be confirmed by the appointed aquatic specialist.

Substation site alternatives 1-3 are considered as equally preferred. Substation site alternative 4 is considered as least preferred as the site appears to be surrounded on three sides by a non-perennial streams. As water is a limiting factor onsite for agriculture, this increases the risk significantly. This must be confirmed by the appointed aquatic specialist.

The No-Go option will not impact on any agricultural land but construction of new access roads to turbines located in currently inaccessible farm areas will result in easy/easier access by the farmer into these areas. Not constructing the WEF will result in these areas remaining inaccessible to the farmer.

The agricultural impacts of all the aspects of the proposed Brandvalley Wind Farm were considered and deemed to be acceptable, provided that the mitigation measures provided in this report are implemented.

Although limited agricultural output (livestock, crop irrigation and game) within the affected area will be impacted by the proposed development, no problematic areas or fatal flaws were identified for the site. The proposed impacts on cultivated land are limited in that only access areas will transect cultivated land in existing impacted areas (existing farm roads through cultivated land). No new development must impact on cultivated land.

All the identified impacts on agriculture are considered to have high reversibility because the land will be able to be returned to agriculture after closure, with very little change in agricultural potential. Impacts on agriculture are also considered to have low irreplaceability of resource loss because:

1. of the small area of land involved,
2. low suitability for crops outside small areas along dry riverbeds that are currently under irrigation,
3. it is highly unlikely to be irreplaceably lost to agriculture,
4. of a low agricultural potential for livestock,
5. the proportion of surface area likely to be affected is minimal and therefore the overall impact on the carrying capacity/agricultural potential of the site will be minimal.

1 THE PROJECT TEAM

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(a) details of-
  (iii) the specialist who prepared the report; and
  (iv) the expertise of that specialist to compile a specialist report including a curriculum vitae;

(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;

1.1 Details of specialist

Mr Roy de Kock M.Sc., *Cand. Nat. Sci*.
(Agricultural and Soil Specialist)

Roy is a Senior Consultant holding a BSc Honours in Geology and an MSc in Botany from the Nelson Mandela Metropolitan University in Port Elizabeth. His MSc thesis focused on Rehabilitation Ecology using an open-cast mine as a case study. He has been working for CES since 2010, and is based at the East London branch where he focuses on Ecological and Agricultural Assessments, Geological and Geotechnical analysis, Environmental Management Plans, mining applications and various environmental impact studies. Roy has worked on numerous projects in South Africa, Mozambique and Malawi. Roy is registered with the South African Council for Natural Scientific Professional (SACNASP).

Dr Alan Carter *Pri. Nat Sci.*
(Report reviewer)

As Director of the East London Office Alan has extensive training and experience in both financial accounting and environmental science disciplines with international accounting firms in South Africa and the USA. He is a member of the American Institute of Certified Public Accountants and holds a PhD in Plant Sciences. He is also a certified ISO14001 EMS auditor with the American National Standards Institute. Alan is registered with both the South African Council for Natural Scientific Professional (SACNASP).

1.2 Expertise

Projects Roy and Alan have worked on include:

Name of project	Description of responsibility	Date completed
Triton ESHIA (Pemba, Mozambique)	Agricultural & Soil Assessment	October 2015
Umsobomvu WEF EIA (EC)	Agricultural & Soil Assessment	March 2015
Mainstream Waaihoek WEF EIA (KZN)	Agricultural, Soil & Land use Assessment	October 2014
Ecofarm Sugarcane ESHIA (Zambezi, Mozambique)	Agricultural & Soil Assessment	June 2014
Innowind Dassiesridge WEF EIA (EC)	Agricultural & Soil Assessment	November 2014
Zirco Minerals Mining EIA (NC)	Agricultural, Soil & Land use Assessment	February 2014
Baobab Iron Ore Mining ESHIA (Tete, Mozambique)	Agricultural, Soil & Land use Assessment	May 2014
Middelton WEF EIA (EC)	Agricultural & Soil Assessment	November 2013
Syrah Graphite Mining ESHIA (Montepuez, Mozambique)	Agricultural, Soil & Land use Assessment	August 2013

1.3 Declaration

I, Roy de Kock, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014;

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this report are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Refer to Appendix B for a signed DEA declaration of independence

2 INTRODUCTION

2.1 Location and Site Description of the Proposed Development

Brandvalley Wind Farm (Pty) Ltd proposes to develop a Wind Energy Facility (WEF) on the border of the Northern Cape and Western Cape Provinces of South Africa. In the Northern Cape, the proposed project falls within the Karoo Hoogland Local Municipality and within the Namakwa District Municipality. In the Western Cape, the WEF falls within the Witzenburg Local Municipality and the Laingsburg Local Municipality and within the Cape Winelands and the Central Karoo District Municipalities, respectively.

Sutherland is the closest town within the Northern Cape Province and is situated approximately 60km north of the project area. The closest town within the Western Cape Province is Matjiesfontein, situated 30km south of the project area. Laingsburg is a further 30km east of Matjiesfontein, along the N1 national road in the Western Cape Province.

The project area can be accessed via the R354 that connects to the N1 between Matjiesfontein and Laingsburg. The R354 is the main arterial road providing access to the project area, where there are a number of existing local, untarred roads providing access within the project area.

The proposed Brandvalley Wind Farm falls across eleven (11) farm portions, provided in Table 2.1 below. These land portions, collectively referred to as the project area for the Brandvalley Wind Farm, are currently used for animal husbandry, game farming and agriculture including grazing of sheep.

Table 2.1: Farm Portions on which the Proposed Development is Located.

Description of affected farm portions			
Farm Name and Number	21 digit SG Code	Municipality/ Province	Farm size (ha)
The Remainder of Barendskraal 76	C04300000000007600000	Laingsburg LM / Central Karoo DM / Western Cape	1,523.7
Portion 1 of Barendskraal 76	C04300000000007600001	Laingsburg LM / Central Karoo DM / Western Cape	2,828.6
The Remainder of Brandvalley 75	C04300000000007500000	Laingsburg LM / Central Karoo DM / Western Cape	1,981.9
Portion 1 of Brandvalley 75	C04300000000007500001	Laingsburg LM / Central Karoo DM / Western Cape	56.3
The Remainder of Fortuin 74	C04300000000007400000	Laingsburg LM / Central Karoo DM / Western Cape	2,454.98
Portion 3 Fortuin 74	C04300000000007400003	Laingsburg LM / Central Karoo DM / Western Cape	1,868.4
The Remainder of Kabeltouw 160	C01900000000016000000	Witzenberg (Ceres) LM/ Cape Winelands DM/ Western Cape	1,082.8
The Remainder of Muishond Rivier 161	C01900000000016100000	Witzenberg (Ceres) LM/ Cape Winelands DM/ Western Cape	4,051.8
Portion 1 of Muishond Rivier 161	C01900000000016100001	Witzenberg (Ceres) LM/ Cape Winelands	3391

Description of affected farm portions			
Farm Name and Number	21 digit SG Code	Municipality/ Province	Farm size (ha)
		DM/ Western Cape	
Portion 1 of Fortuin 74 (Ou Mure)	C04300000000007400001	Laingsburg LM / Central Karoo DM / Western Cape	408.9
The Farm Rietfontein 197	C07200000000019700000	Karoo Hoogland LM/ Namakwa DM/ Northern Cape	5,873.6
Total hectares			**25,521.98**

The location of the proposed land properties is provided in Figure 2.1 below.

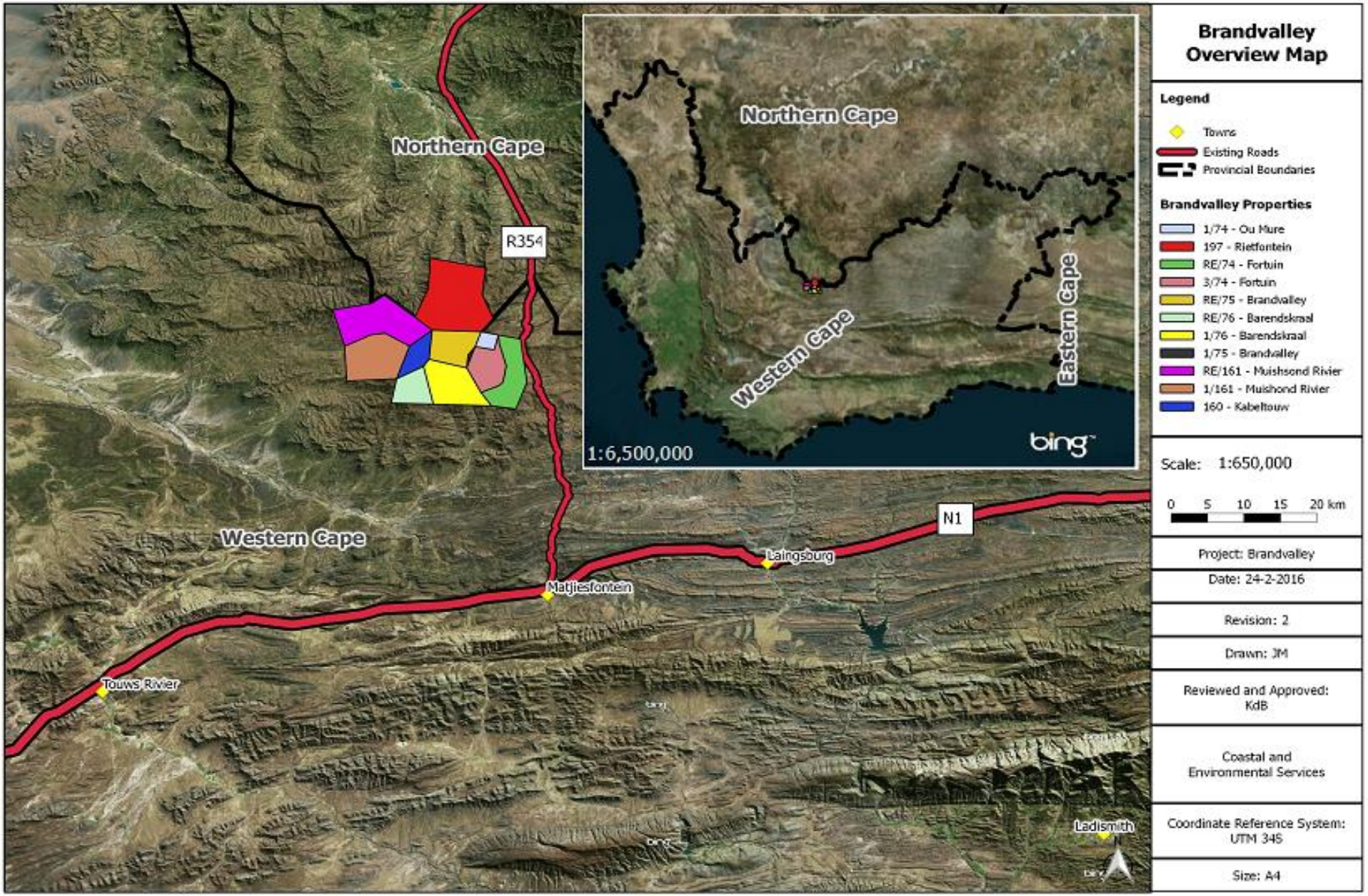


Figure 2.1: Proposed Location for the Brandvalley Wind Energy Facility.

3 BACKGROUND

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(c) an indication of the scope of, and the purpose for which, the report was prepared;

(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;

(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

(q) any other information requested by the competent authority.

3.1 Purpose of the report

EOH Coastal & Environmental Services (CES) was approached to conduct an Agricultural and Soil Assessment of all the properties impacted by the proposed Brandvalley Wind Farm in order to determine the impact of the proposed development on the existing agricultural environment and recommend suitable mitigation measures to reduce or avoid negative impacts and or enhance positive impacts.

3.2 Technology description

The Brandvalley Wind Farm will have an energy generation capacity (at point of grid feed-in) of up to 140 megawatt (MW), and will include the following:

- Up to 70 potential wind turbine positions (between 1.5MW and 4MW in capacity each), each with a foundation of 25m in diameter and 4m in depth.
- The hub height of each turbine will be up to 120m, and the rotor diameter up to 140m.
- Permanent compacted hard-standing laydown areas for each wind turbine (70mx50m, total 24.5ha) will be required during construction and for on-going maintenance purposes.
- Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m, but can be up to 10m x 10m at certain locations) would be required to increase the voltage to 33kV.
- Underground 33kV cabling between turbines buried along access roads, where feasible.
- Internal access roads up to 12m wide, including structures for storm-water control would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded.
- 33kV overhead power lines linking groups of wind turbines to onsite 33/132kV substation(s). A number of potential electrical 33kV powerlines will be required in order to connect wind turbines to the preferred onsite substation. The layout of the 33kV powerlines will be informed by sensitive features identified. The facility will consist of both above and below ground 33kV electrical infrastructure depending on what will require the shortest distance and result in the least amount of impacts to the environment.
- A number of potential 33/132kV onsite substation location(s) will be assessed. The footprint of these 33/132kV substation(s) will need to be assessed in both this EIA and the Basic Assessment process for electrical infrastructure as the applicant will remain in control of the low voltage components of the 33/132kV substation (including isolators, control room, cabling, transformers etc.) (assessed in this EIA), whereas the high voltage components of this substation (assessed in BA) will likely be ceded to Eskom. The total footprint of this onsite substation will be approximately 200m x 200m. The exact coordinates of the low voltage components footprint (to be assessed in this EIA) and high voltage components footprint (to be assessed in the basic assessment process) will be provided in the EIA phase.
- Up to 4 x 120m tall wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.

- Temporary infrastructure including a large construction camp (~10ha) and an on-site concrete batching plant (~1ha) for use during the construction phase.
- Borrow pits and quarries for locally sourcing aggregates required for construction (~4.5ha), in addition to onsite turbine excavations where required. All materials excavated will eventually be used on the compacting of the roads and hard-standing areas and no material will be sold to any third parties. The number and size of the borrow pits depends on suitability of the subsurface soils and the requirement for granular material for access road construction and other earthworks. Alternative borrow pit locations will be assessed in a separate Basic Assessment process.
- Fencing will be limited around the construction camp and the entire facility would not necessarily need to be fenced off. The height of fences around the construction camp is anticipated to be up to 4m.
- Temporary infrastructure to obtain water from available local sources/ new or existing boreholes. Water will potentially be stored in temporary water storage tanks. The necessary approvals from the DWS will be applied for separately to this EIA process.

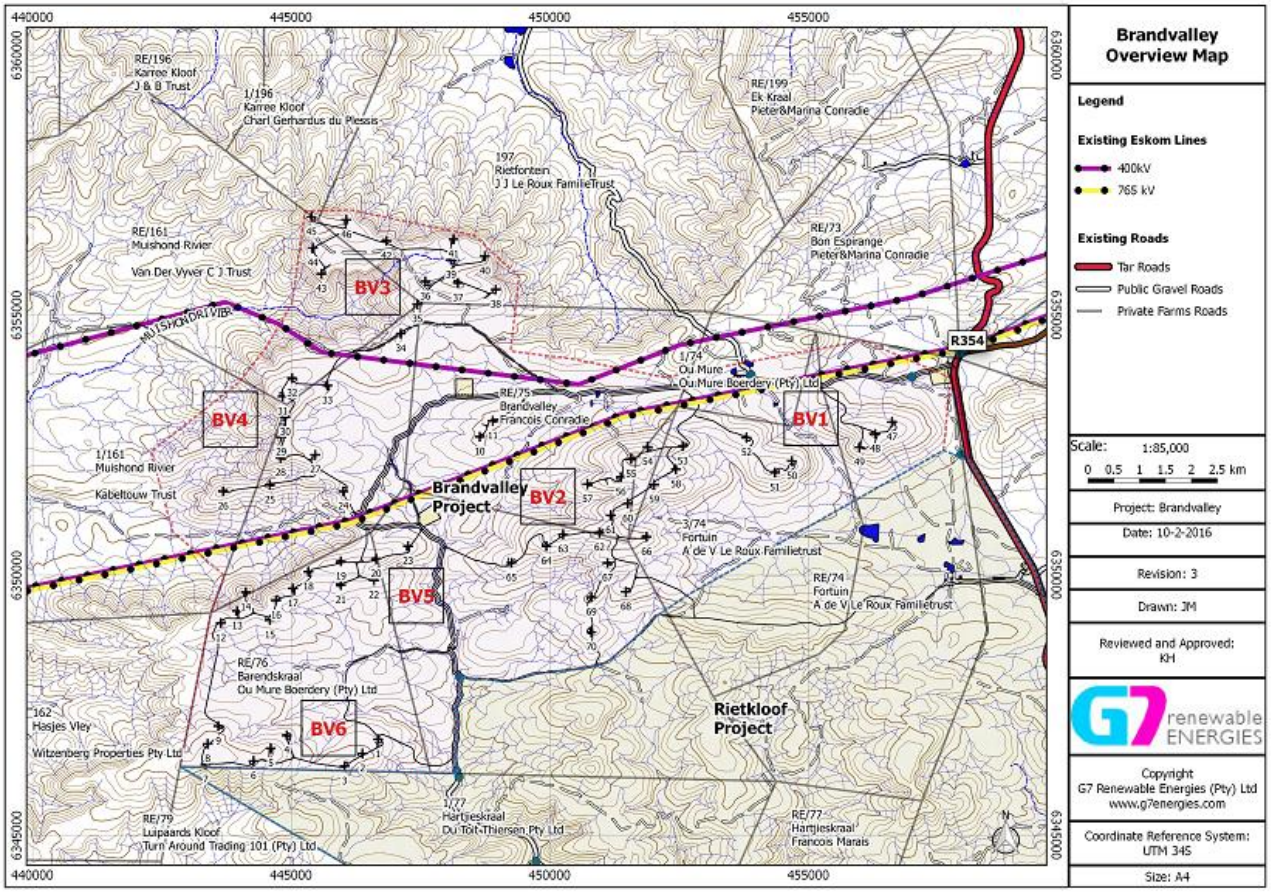


Figure 3.1: Layout map of the proposed Brandvalley Wind Farm

3.3 Brandvalley alternatives

Table 3.1 below shows the various alternatives that are assessed in this study.

Table 3.1: Various alternatives proposed for the Brandvalley Wind Farm.

Alternative	Description
Fundamental alternatives:	
Project area location alternatives:	One project location alternative namely Brandvalley Wind Farm are assessed. See Figure 2.1
Access road alternatives:	Two access road alternatives namely access road alternative 1 and access road alternative 2. A 200m buffer was placed on all access roads to allow

Alternative	Description
	the road to move within that buffer in areas that may be identified as sensitive in the specialist assessment. All internal access routes are assessed as part of the access route alternatives. Both alternatives will access form the R354. At the following GPS coordinates: ***Alternative 1***: 32°57'4.14"S; 20°32'55.84"E ***Alternative 2:*** 32°59'27.40"S; 20°33'59.61"E
Construction camp alternatives:	Three alternative construction camp & batching plant sites are assessed namely construction camp 1, 2, and 3. Each camp will be approximately 10ha in size and will be located at the following points onsite : ***Construction camp 1:*** 32°57'8.10"S; 20°32'32.55"E ***Construction camp 2:*** 32°57'21.74"S; 20°26'52.44"E ***Construction camp 3:*** 32°58'38.98"S: 20°26'18.64"E
Onsite substation location alternatives:	Four onsite substation location alternatives namely: **Substation alternative 1**: 32°57'12.99"S; 20°31'30.63"E **Substation alternative 2**: 32°57'21.20"S; 20°28'48.22"E **Substation alternative 3**: 32°58'5.03"S; 20°25'51.61"E **Substation alternative 4**: 32°58'31.87"S; 20°26'12.13"E
Incremental alternatives:	
Turbine layout alternatives	The outcome of the specialist assessment will recommend alternative turbine locations.
No-Go alternative:	
It is mandatory to consider the no-go (no development) alternative in the EIA process. The no development option assumes the site remains in its current state, i.e. agricultural land. The no-go alternative will be used as a baseline throughout the assessment process against which potential impacts will be compared in an objective manner.	

3.4 Consultation

No consultation was undertaken during this specialist study as all consultation was addressed in the Socio-economic Impact Assessment.

No issues were raised during both the EIA Public Participation Process (PPP) and the Socio-economic Impact Assessment that required input form an agricultural specialist.

To date, no issues were raised or additional agricultural information required by the competent authority.

4 APPROACH TO STUDY

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;

(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;

(i) a description of any assumptions made and any uncertainties or gaps in knowledge;

4.1 Terms of reference

An Agricultural Impact Assessment will be undertaken based on the following Terms of Reference:

- The *status quo* will be investigated to determine the agricultural potential based on:
  - The extent and quality of arable land (less than 12% slope) within the project area
  - The extent and quality of existing crops
  - The extent and quality of commercially unused land
  - The availability of irrigation water
  - The condition of the veld and other natural vegetation
  - Climate conditions
  - The percentage of usable land that will be utilised during construction
  - The percentage of usable land that will be utilised after construction.
- *Status Quo* of soils will also be informed by any identified erosion hazards, current and previous land use, surface and ground water resources and the vegetation. Specifically, the following will be investigated:
  - Compile a detailed desktop assessment for the proposed WEF and associated infrastructure;
  - The soil assessment must include the following as per DEAs requirements:
  - Identification of the soil forms present on site;
  - The size of the area where a particular soil form is found;
  - GPS reading of soil survey points;
  - The depth of the soil at each survey point;
  - Soil colour;
  - Limiting factors;
  - Clay content; and
  - Slope of the site.
- Provide shape files containing the soil forms and relevant attribute data as depicted on the maps.
- Undertake field verification which includes a soil survey. During this survey each soil sample point will be described to form and family level according to Soil Classification Working Group's Soil Classification"
- Combine the information in order to provide a spatial classification of the site based on its soil characteristics and associated agricultural potential.
- Compile a detailed soil and land use impact assessment based on the predicted impacts.
- Investigate direct and indirect impacts as well as the effect of cumulative impacts.
- Detailed mitigation measures will be proposed in order to reduce the soil and land use impacts identified.
- The report will meet the Department of Agriculture's requirements.

4.2 Approach

A desktop analysis and a field survey were undertaken. The methodology used is described below.

4.2.1 Desktop analysis

The desktop analysis was based on existing published data on soil and agricultural potential for the site. The source of data was the AGIS online database, produced by the Institute of Soil, Climate and Water of the Agricultural Research Council of South Africa (AGIS, 2007). This information was largely compiled from a nationwide survey of land types conducted since the 1970s. Satellite imagery of the site available on Google Earth™ was also used for evaluation.

The following specialist reports have been prepared as part of the EIA process and should also be read in conjunction with this report:

- Ecological Impact Assessment
- Socio-economic Impact Assessment

Where relevant, summary content sourced from these documents is provided in this report.

4.2.2 Field survey

A field survey was conducted from 15 to 18 February 2016 in order to assess land-use, current soil conditions and agricultural use onsite.

Soil samples were collected to a depth of 30-40 cm (where possible) and sent to Brookside Laboratories Inc. in Heidelberg, Mpumalanga for analysis (see Appendix A for results). Sample site were randomly chosen based on accessibility of the site.

The Soil Classification Working Group's Soil Classification: a Taxonomic System for South Africa was used to assess the soils data

.

4.2.3 Laboratory analysis

See Appendix A for laboratory results. The following correlation between sample numbering in this report and the laboratory results must be taken in consideration:

Laboratory sample #	Report sample #
S11	S1
S18	S2
S19	S3
S22	S4

The Total Exchange Capacity (TEC) measured in ME/100g (see Laboratory results) was used to compare soil characteristics of the different soil samples. This was done as TEC is an inherent soil characteristic and is difficult to alter.

TEC refers to the total capacity of a soil to hold exchangeable cations. It influences the soil's ability to hold onto essential nutrients and to provide a buffer against soil acidification therefore influencing soil structure stability, nutrient availability and soil pH. Soils with a higher clay and organic material content will have a higher TEC when compared to sandy soils. The following table reflects the TEC for different soil types.

Table 7.3: Total Exchange Capacity (TEC) for the different soil types (Moore *et al*, 1998).

Soil type	TEC (ME/100g)
Sand with low organic content	3-5
Sand with high organic content	10-20
Loam	10-15
Silty loam	15-25
Clay & clay loams	20-50
Peat	50-100

4.3 Limitations

This report is based only on currently available information and, as a result, the following limitations and assumptions are implicit –

- The report is based on a project description taken from design specifications for the proposed Brandvalley WEF project that have not yet been finalised, and which are likely to undergo a number of iterations and refinements before they can be regarded as definitive;
- Descriptions of the surrounding environment are based on limited fieldwork and available literature.
- The assessment was limited to a summer season observation only (February) as timelines are restricted by the Environmental Impact Assessment (EIA) process.

4.4 Assessment methodology

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

1. Relationship of the impact to **temporal scales** - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
2. Relationship of the impact to **spatial scales** - the spatial scale defines the physical extent of the impact.
3. The severity of the impact - the **severity/beneficial scale** is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.
4. The **severity** of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' does not just mean 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.
5. The **likelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

Each criterion is ranked with scores assigned as presented in Table 4.1 to determine the overall significance of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in Table 4.1, to determine the overall significance of the impact. The overall significance is either negative or positive.

Table 4.1: Ranking of Evaluation Criteria

EFFECT	**Temporal Scale**		
	Short term	Less than 5 years	
	Medium term	Between 5-20 years	
	Long term	Between 20 and 40 years (a generation) and from a human perspective also permanent	
	Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there	
	Spatial Scale		
	Localised	At localised scale and a few hectares in extent	
	Study Area	The proposed site and its immediate environs	
	Regional	District and Provincial level	
	National	Country	
	International	Internationally	
	Severity	**Severity**	**Benefit**
	Slight	Slight impacts on the affected system(s) or party(ies)	Slightly beneficial to the affected system(s) and party(ies)
	Moderate	Moderate impacts on the affected system(s) or party(ies)	Moderately beneficial to the affected system(s) and party(ies)
	Severe/ Beneficial	Severe impacts on the affected system(s) or party(ies)	A substantial benefit to the affected system(s) and party(ies)
	Very Severe/ Beneficial	Very severe change to the affected system(s) or party(ies)	A very substantial benefit to the affected system(s) and party(ies)
LIKELIHOOD	**Likelihood**		
	Unlikely	The likelihood of these impacts occurring is slight	
	May Occur	The likelihood of these impacts occurring is possible	
	Probable	The likelihood of these impacts occurring is probable	
	Definite	The likelihood is that this impact will definitely occur	

**** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know***

Table 4.2: Description of Environmental Significance Ratings

Significance Rate	Description
Low	An acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in either positive or negative medium to short term effects on the social and/or natural environment.
Moderate	An important impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.
High	A serious impact, if not mitigated, may prevent the implementation of the project (if it is a negative impact). These impacts would be considered by society as constituting a major and usually a long-term change to the (natural &/or social) environment and result in severe effects or beneficial effects.
Very High	A very serious impact which, if negative, may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are unmitigable and usually result in very severe effects, or very beneficial effects.

The environmental significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

4.5 Sensitivity assessment

This section of the report explains the approach to determining the ecological sensitivity of the study area on a broad scale. The approach identifies zones of high, moderate and low sensitivity according to a system developed by EOH and used in numerous agricultural studies. It must be noted that the sensitivity zonings in this study are based solely on agricultural characteristics and social and economic factors have not been taken into consideration. The sensitivity analysis described here is based on 6 criteria which are considered to be of importance in determining agricultural sensitivity. The method predominantly involves identifying agricultural use, topography and land use (Table 4.3).

Although very simple, this method of analysis provides a good, yet conservative and precautionary assessment of the agricultural sensitivity.

Table 4.3: Criteria used for the analysis of the agricultural sensitivity of the area.

CRITERIA		LOW SENSITIVITY	MODERATE SENSITIVITY	HIGH SENSITIVITY
1	**Topography –** Lay of the land	Level or even	Undulating; fairly steep slopes	Complex and uneven with steep slopes
2	**Soil –** Suitability of soils for crops	Low suitability (shallow soils, low/high pH, etc.)	Moderate suitability (area limited, input required, etc.)	Optimal soils
3	**Land use** – Current use of the land	Non-agricultural use, Natural veld (no grazing & browsing), urban areas etc.	Minimal agricultural use	All farmland
4	**Agricultural use -** leading to loss of viable land	No agricultural practices	Subsistence and informal farming (occasional farming)	Commercial farming & irrigation
5	**Erosion potential** or instability of the region	Very stable and an area not subjected to erosion	Some possibility of erosion or change due to episodic events	Large possibility of erosion, change to the site or destruction due to climatic or other factors
6	**Water use –** Availability of surface water for agricultural use	No surface water onsite	NA	Surface water onsite

A sensitivity map was drawn up with the aid of a satellite image so that the sensitive regions and agricultural types could be plotted (see Section 8).

5 RELEVANT LEGISLATION

The following legislation and other regulatory instruments are directly relevant when considering impacts on the existing soil and agricultural uses identified for the Brandvalley Wind Farm project.

Table 5.1: Legislation and other regulatory instruments considered in the preparation of the Brandvalley Wind farm Soil and Agricultural Report.

Title of relevant legislation, policy or guideline	Date	Implications for proposed Brandvalley Wind Farm project
The National Environmental Management Act (NEMA) (107 of 1998)	1998	The developer must apply the NEMA principles, the fair decision-making and conflict management procedures that are provided for in NEMA. The developer must apply the principles of Integrated Environmental Management and the consideration, investigation and assessment of the potential impact of existing and planned activities on the environment, socio-economic conditions; and the cultural heritage.
Conservation of Agricultural Resources Act (CARA)(No. 43 of 1983) and Regulations 15 & 16	1983	The proposed project must conserve natural agricultural resources; • Must assess the impacts of the proposed development on the existing agricultural environment; • Must maintain the production potential of the land by:- o Combating and preventing erosion; o Preventing the weakening or destruction of water sources; o Protecting vegetation; o Combating weeds and invader plants. o Cultivation of virgin soil. o Protection of cultivated land. o Utilisation and protection of the veld. o Control of weed and invader plants. o Prevention and control of veld fires and the restoration and reclamation of eroded land.
National Environmental Management Biodiversity Act (NEMBA)(No. 10 of 2004); Aliens & Invasive Species (AIS) Regulations	2004	Lists invasive species that are: • Restricted activities and are prohibited in terms of Section 71A(1) • Exempted in terms of Section 71(3) • Require a permit in terms of Section 71(1)
National Water Act (No. 36 of 1998)	1998	Provides details of measures intended to ensure the comprehensive protection of all water resources, including the ecological reserve (quantity and quality) for surface and underground water.
The Subdivision of Agricultural Land Act (No. 70 of 1970)	1970	This Act controls the subdivision of all agricultural land in South Africa and prohibits certain actions relating to agricultural land. In terms of the Act, the owner of agricultural land is required to obtain consent from the Minister of Agriculture in order to subdivide agricultural land. The purpose of the Act is to prevent uneconomic farming units from being created and degradation of prime agricultural land. The Act also regulates leasing and selling of agricultural land as well as registration of servitudes.

6 BASELINE DESCRIPTION

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;

This section provides a brief of the current state of the natural environment of the proposed Brandvalley Wind Farm project.

6.1 Climate

Laingsburg, the closest town to the Brandvalley Wind Farm site with a weather station, normally receives about 61mm of rain per year, with most rainfall occurring during mid-summer. Laingsburg receives its lowest annual rainfall (0mm) in December and the highest (9mm) in March. The average midday temperatures for Laingsburg range from 16.6°C in July to 30.1°C in January. The region is the coldest during July when the temperature drops to 2.9°C on average during the night (www.saexplorer.co.za).

6.2 Geology

The dominant geological feature within the affected farm portions of the proposed Brandvalley Wind Farm consists of sedimentary deposits of the Abrahamskraal Formation, which forms part of the Adelaide Subgroup of rocks which is part of the Beaufort Group of rocks which in turn makes up part of Karoo Supergroup of geological formations (Johnson *et al*, 2006).

The Abrahamskraal Formation consists of alternating bluish-grey, greenish-grey, or greyish-red mudrock and grey, very fine to medium grained, lithofeldspathic sandstones. Sandstones usually constitute 20-30% of the total thickness but may vary locally. Individual sandstones average a thickness of 6m with a maximum of 60m. Calcareous concretions 20-100cm in diameter are present in some sandstone layers.

Sandstone units usually form fining upwards cycles. These cycles vary from a few meters to tens of meters in thickness and were probably formed by the lateral migration of meandering rivers during the second major tectonic paroxysm of the Cape Fold Belt approx. 258Ma. The mudstones represent depositions in a flood plain and lacustrine environment.

6.3 Soils

Soils consist mostly of rocks with limited soils grading in steep areas grading to soils with minimal development that are usually shallow, overlying rock of weathering rock, with or without intermittent diverse soils southwards. Lime may be present in parts of the landscape.

Water holding capacity are considered as very low (<20mm) while the potential for water erosion is moderate throughout the site.

Below is a table of generalised soil status for the Brandvalley Wind Farm. This information will be compared to the laboratory analysis of soil samples collected onsite during the site visit (Section 7).

Table 6.1: Generalised soil status for the Brandvalley Wind Farm (Source: www.agis.agric.za)

Soil condition	Classification
Potential for soil regeneration	Very low potential
Natural soil organic carbon content	<5 % C

Soil condition	Classification
pH	7.5 – 8.4 (alkaline)
Acidification	Not susceptible to acidification
Cation exchange capacity	6.1 – 10 cmolc.kg^{-1} of soil
Soil zinc status	6.1 mg.kg^{-1}
Soil copper status	1 – 2 mg.kg^{-1}
Soil cobalt status	2 – 10 mg.kg^{-1}

6.4 Topography

The Brandvalley Wind Farm site is described as high hills and ridges in the north and central areas grading into open hills and ridges southwards (Figure 6.1).

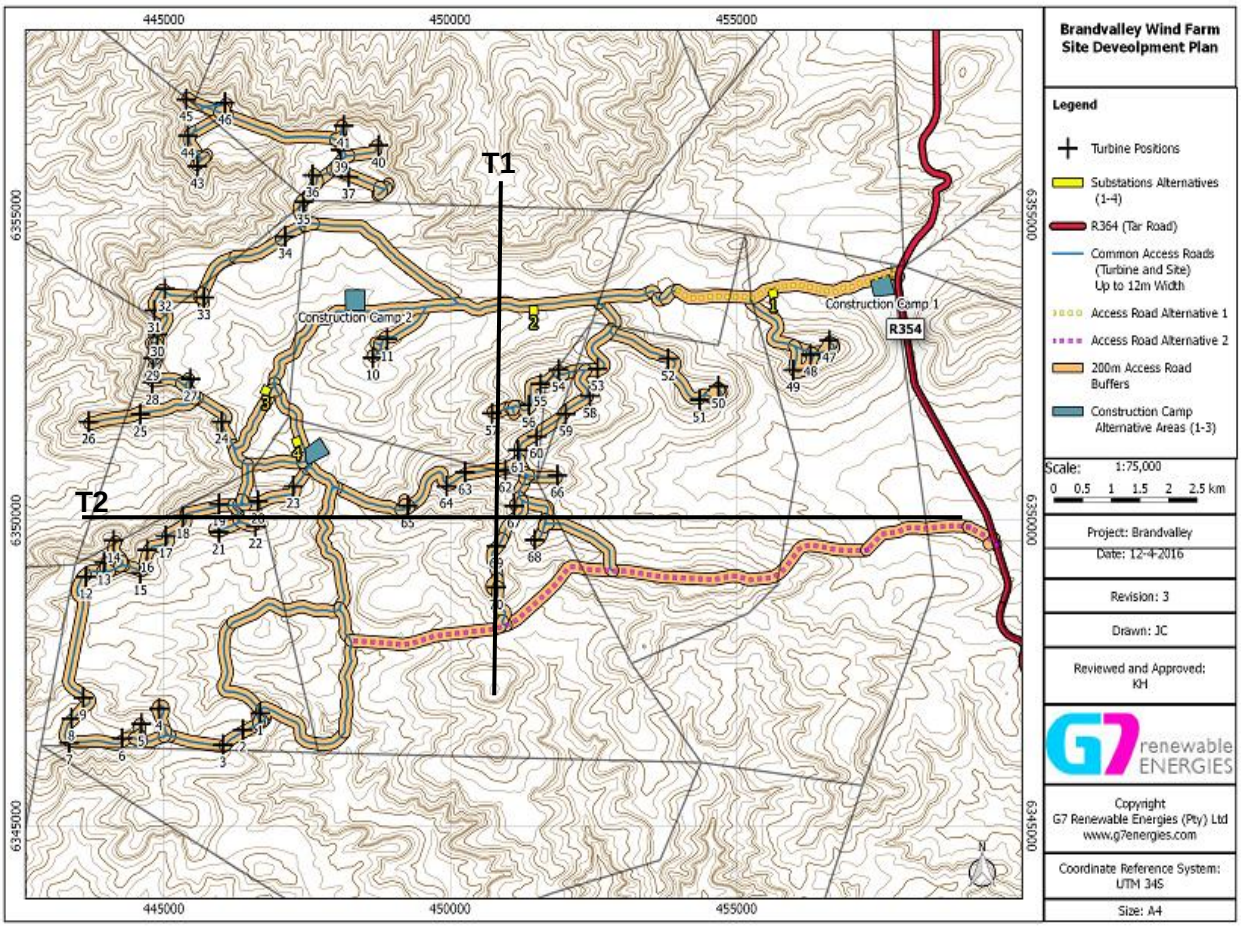


Figure 6.1: Topography map of the Brandvalley Wind Farm area

This can be seen in the profile transects (Figures 6.2 & 6.3) below where Figure 6.2 shows a north to south profile along line T1 (seen in Figure 6.1) and Figure 6.2 represents an east to west profile along line T2 (seen in Figure 6.1).

The profiles along the north to south transect (Figure 6.2) shows that the overall landscape decreases in height from 1 073 meters above sea level (masl) in the north to 885masl in the southern sections of the Brandvalley Wind farm. The highest point is in the central area of the Brandvalley Wind farm at 1 313masl and the lowest at the southernmost point at 885 masl. The landscape changes from undulating hills in the north to a flat, open valley in the south.

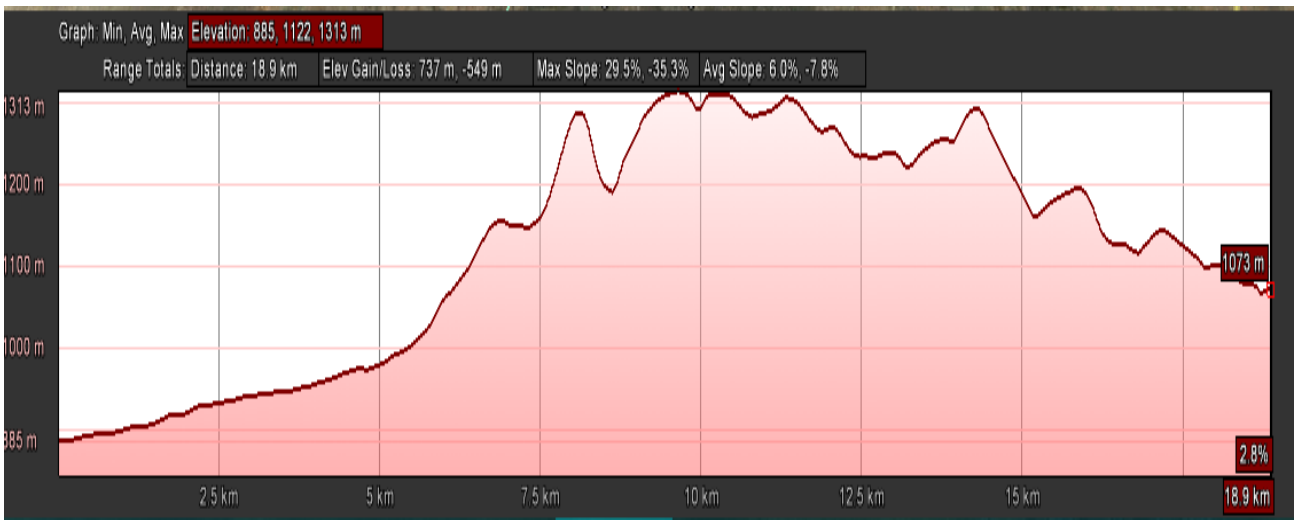


Figure 6.2: North-south transect profile along line T1 as shown in Figure 6.1

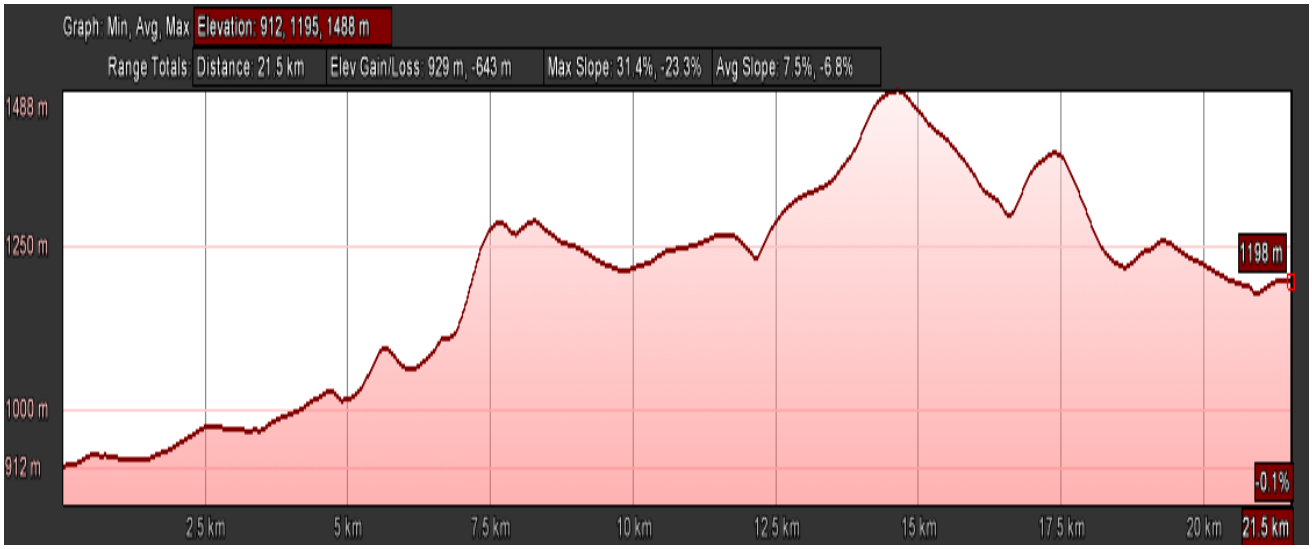


Figure 6.3: An east-west transect profile along line T2 as shown in Figure 6.1

The east to west profile (Figure 6.3) illustrates a similar landscape change as the north to south profile where the undulating hill landscape changes in the east to open valley plains in the west. The overall landscape decreases westward form 1 158 masl in the east to 912 masl in the west with the highest point at 1 488 masl in the central area.

6.5 Vegetation

Mucina and Rutherford (2006) define the following vegetation types that occur within the Brandvalley Wind Farm site and associated infrastructure:

6.5.1 Central Mountain Shale Renosterveld

This vegetation type forms part of the Fynbos Biome and is found in both the Western and Northern Cape Provinces. Its range extend from the southern and south-eastern slopes of the Klein-Roggeveldberge and Komsberg below the Roggeveld section of the Great Escarpment (facing the Moordenaars Karoo) as well as farther east below Besemgoedberg and Suurkop west of Merweville and in the west in the Karookop area between Losper-se-Berg and high points around Thyshoogte. All wind farm infrastructure will be located on this vegetation type.

The site is dominated by renosterbos and larges suites of mainly non-succulent Karoo scrubs with a rich geophytic flora in the undergrowth in more open, wetter or rocky habitats. SANBI classified this vegetation type as **Least Threatened** although none is conserved in statutory or private conservation areas while only about 1% is currently transformed.

6.5.2 Koedoesberge-Moordenaars Karoo

This vegetation type forms part of the Succulent Karoo Biome and occurs in the Western and Northern Cape Provinces. Koedoesberge-Moordenaars Karoo occurs in the broader Laingsburg and Merweville area between the Koedoesberge and Pienaar-se-Berg low mountain ranges and the southern Tankwa Karoo. It is separated by the Moordenaars Karoo by the Klein Roggeveld Mountains. The unit also includes the Doesberg region east of Laingsburg as well as the piedmonts of the Elandsberg and beyond the Gamkapoort Dam at Excelsior (west of Prince Albert).

This vegetation unit occurs on slightly undulating to hilly landscapes that is covered by low succulent scrub and dotted by scattered tall scrubs. Patched of lighter coloured grasses are visible on the plains with *Pteronia, Drosanthemums and Galenia* spp. being most dominant. This vegetation unit is classified as **Least Threatened** although only a small portion (>5%) is conserved in the Gankapoort Nature Reserve with only a small portion considered as transformed. No wind farm infrastructure will be located on Koedoesberge-Moordenaars Karoo.

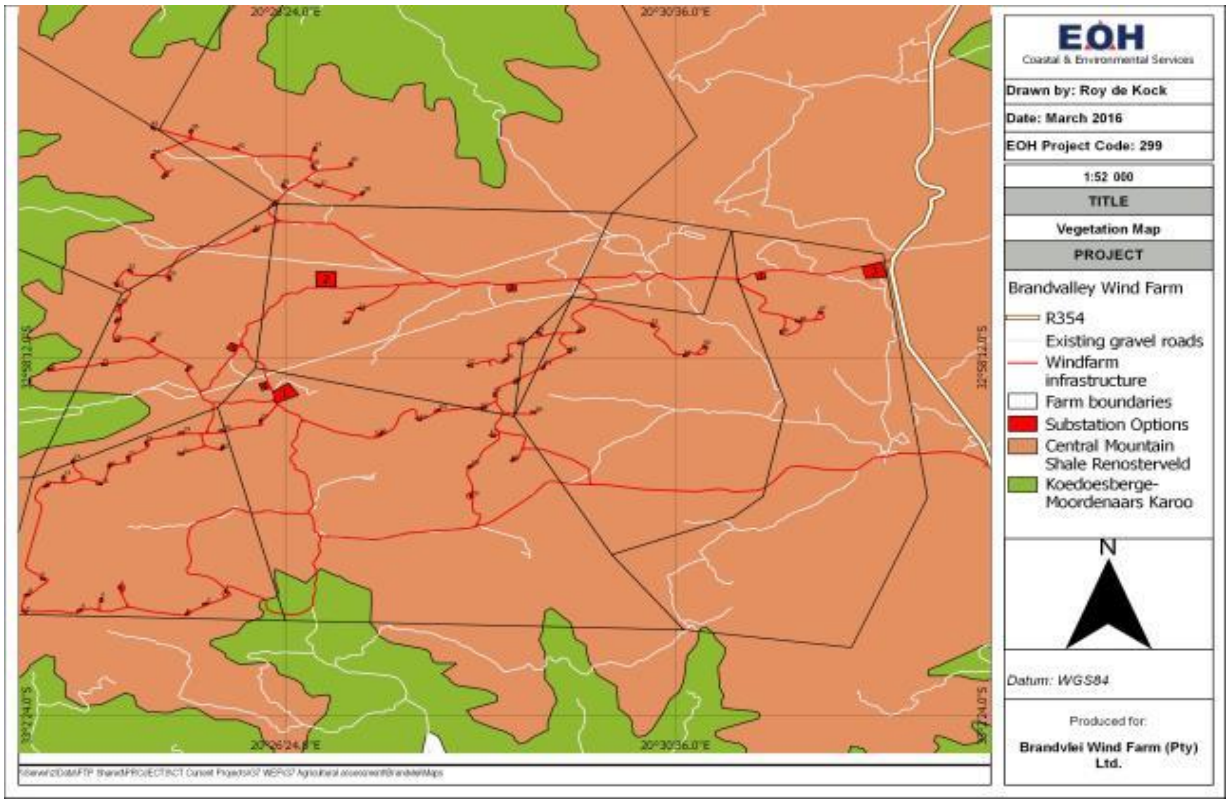


Figure 6.4: Vegetation map of the Brandvalley Wind Farm area

6.6 Surface hydrology

Surface hydrology refers to all surface waters found onsite and includes overland flows, rivers, lakes, wetlands, estuaries and oceans, excluding atmospheric and groundwater (NFEPA).

The rivers, streams and drainage systems as well as wetlands are described below.

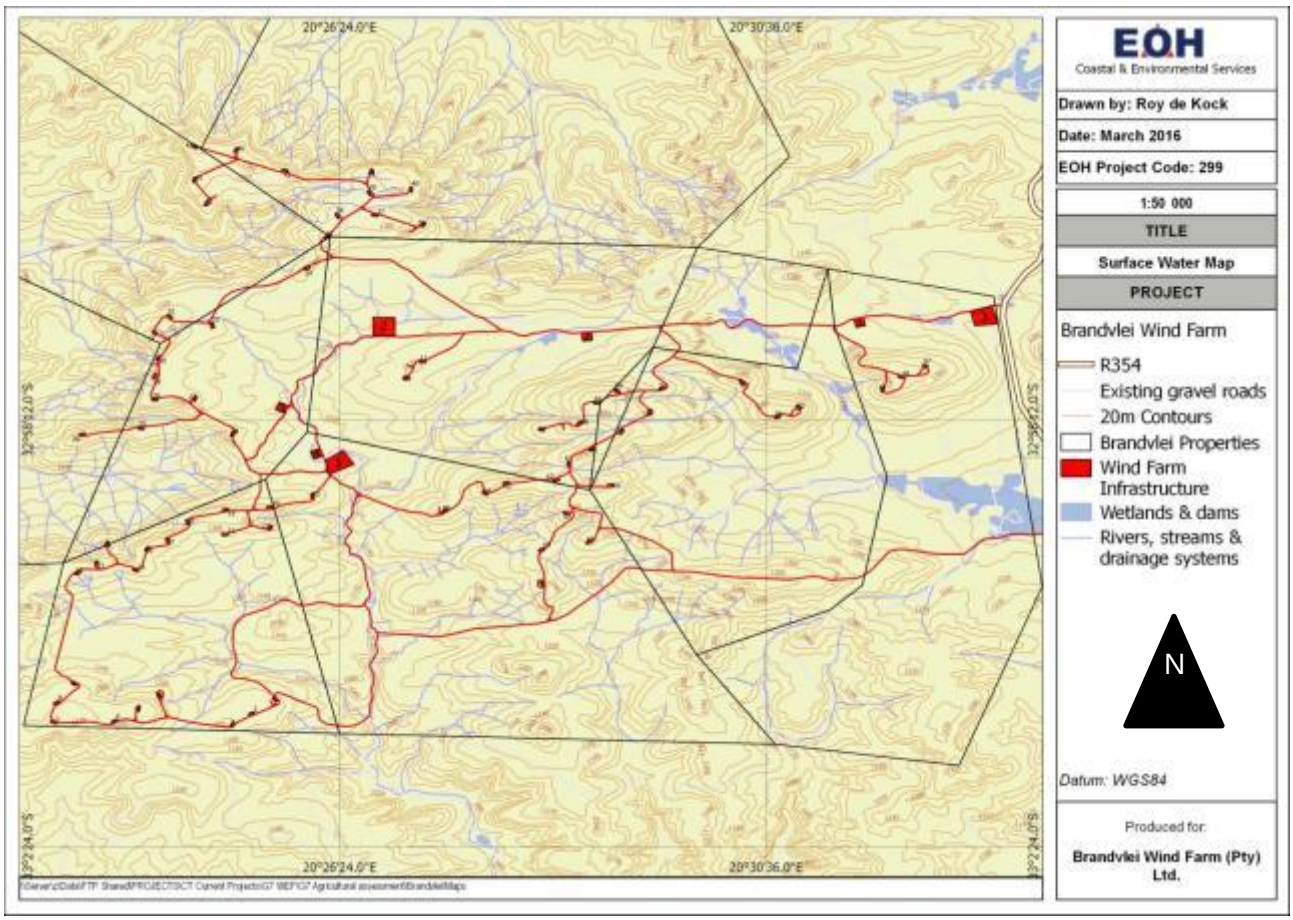
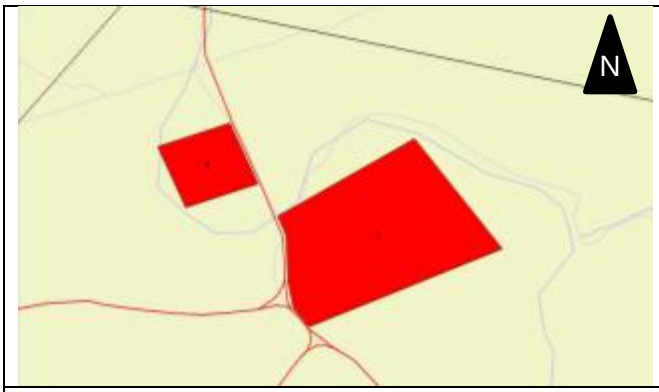


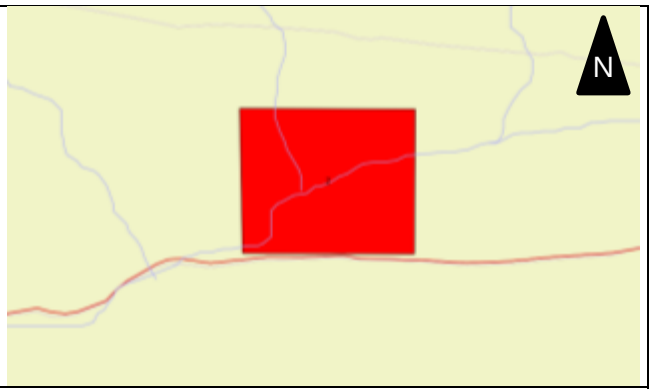
Figure 6.5: Surface water map of the Brandvalley Wind Farm area

6.6.1 Rivers, streams and drainage systems

Various systems will be impacted by the proposed Brandvalley Wind Farm development. Various access roads transect streams and drainage systems at various points within the proposed site. Most of these crossings are existing road crossings. Both site camp alternative 3 and substation alternative 4 sites will be surrounded at two or more sides by streams while site camp alternative 2 will be located within two drainages systems (Figure 6.6). This will however be confirmed by the aquatic specialist.



Substation alternative 4 (left) and Site camp alternative 1 (right) will be surrounded by streams on 2 or more sides.



Site camp alternative 2 will be located within 2 drainages systems.

Figure 6.6: Infrastructure located close to or within water bodies.

6.6.2 Wetlands

No turbine sites will be located within 500m of any priority wetland or artificial farm or irrigation dam. Some access roads however appears to transect dry Karoo wetland systems as defined by the National Freshwater Ecosystem Priority Area (NFEPA) and might require authorisation from the Department of Water & Sanitation (DWS). This will be confirmed by the aquatic specialist.

6.7 Current land use

The main land use within the Brandvalley Wind Farm is agriculture.

Agricultural land uses in the landscape within and adjacent to the proposed Brandvalley Wind Farm includes:

- Rural agriculture consisting of extensive small stock grazing (Dorper and Dohne Merino)
- Hunting
- Concentrated irrigation for various cash crops is practised along rivers and streams in small areas.

Although various farmsteads are located onsite, none will be impacted by the proposed Brandvalley Wind Farm infrastructure.

Various existing farm roads exists onsite and are in good condition (good surface with little or no erosion). Some of these roads will be upgraded to accommodate construction vehicles as well as the large trucks transporting turbine components.

The natural veld is considered to be in good condition with little or no evidence of erosion and overgrazing.

6.7.1 Livestock

Agricultural practices in the area consist mainly of small stock farming (Dorper and Dohne Merino sheep). Small amounts of wool are also produced. No other livestock were observed.

Rangeland within the Brandvalley Wind Farm area requires low input costs and are located of large area farms (2000-3000 ha) with low population density, resulting in productive livestock farming, mostly with sheep. Although goats and cattle are also viable options, they were not observed in any of the affected farms. Rotational grazing camps are practised allowing grazed land to “rest” for periods of time.

As rangelands are vast with low carrying capacity, developing a Wind Farm in the area will have minimal impact on livestock farming.

6.7.2 Hunting

Game is now also considered to be an agricultural product as defined in the Marketing of Agricultural Products Act, 1996 (Act 47 of 1996). Game ranching (and hunting) in South Africa is one of the fastest-growing sectors of the agricultural industry. Since the 1970’s, there has been a huge shift from cattle & sheep farming to game ranching. Provided they observe approved game-fencing rules, registered game ranches have permission to hunt throughout the year.

Lange game occurring within the Brandvalley Wind Farm site includes:

- Kudu (not observed)
- Springbok

Recreational hunting occurs on all Brandvalley properties. As game is scattered over large areas, construction and operation of the proposed new Brandvalley Wind Farm will not impact on hunting in the area.

6.7.3 Irrigation & crops

As the area only receives about 61mm of rainfall per year, dryland cropping is not viable. Irrigation is intensively practiced in areas along dry riverbeds where irrigation dams can be erected and soils are suitable (Figure 8.1). Approximately 5% of all the farm areas affected by the proposed Brandvalley Wind Farm is currently under irrigation

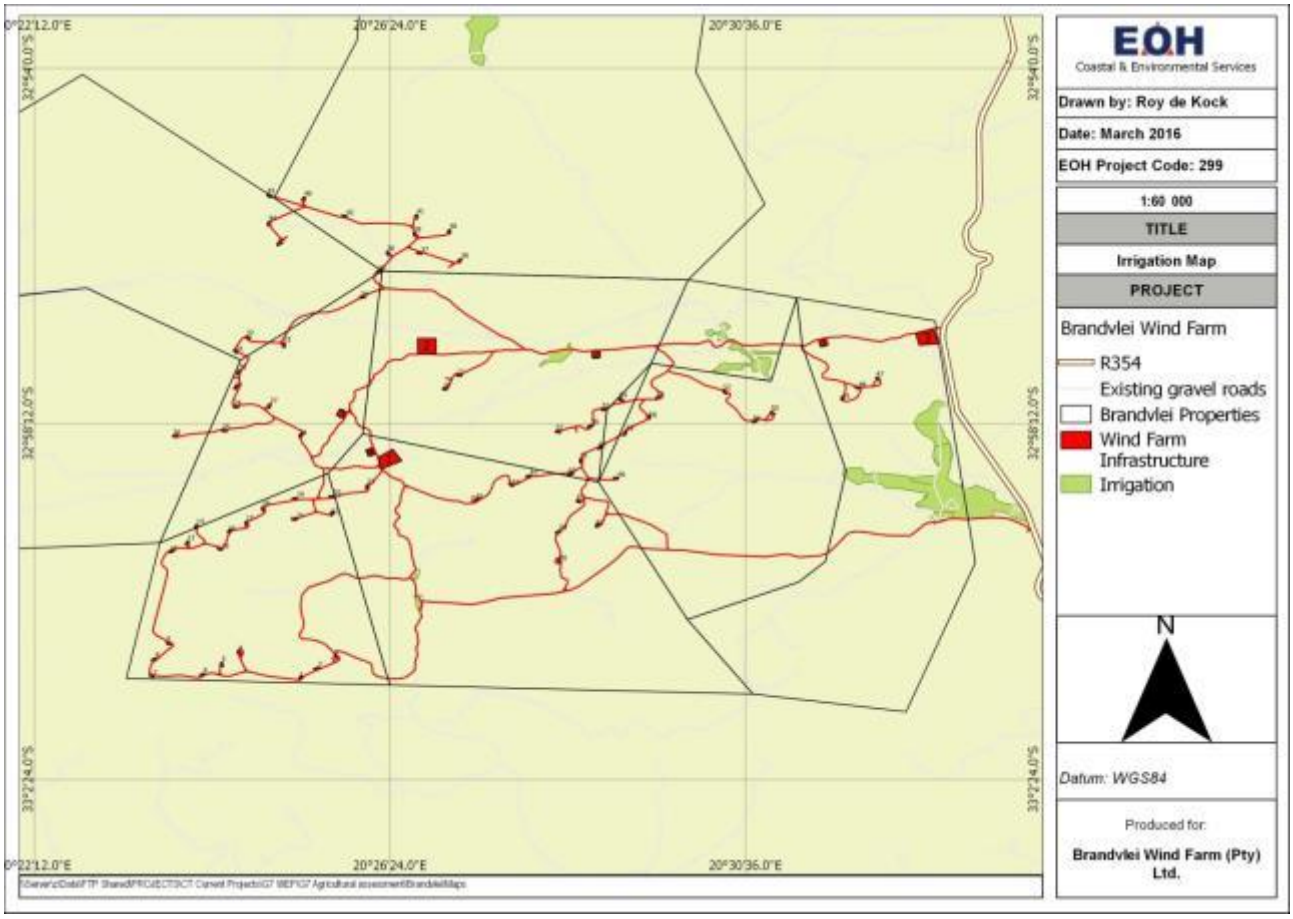


Figure 8.1: Irrigation map of the Brendvalley Wind Farm area

Various cash crops like apricots, dried yellow peaches, pears, plums, quinces and tomatoes are produced under irrigation (Laingsburg LM SDF) but are restricted to small areas along dry riverbeds. At the time of the site assessment, most of the identified irrigation areas were growing winterfeed.

7 SOILS

This section presents the procedure to describe the different morphological and other characteristics of soils found within the Brandvalley Wind Farm site. Four random points (shown in Figure 7.1 and Table 7.1) were identified within the Brandvalley Wind Farm area. These site selections were based on accessibility to the site.

Soil samples were collected from each of these sites for laboratory assessment while the sites were visually assessed. The following procedure was followed during the field assessment:

1. Soil families were identified as per the Soil Classification workbook, 1991.
2. The master horizons present in the profile were demarcated.
3. Diagnostic horizons or materials were identified.
4. The texture class of the A horizons were determined and added to the name or code of the soil family as per the Soil Classification workbook, 1991.

Table 7.1: Coordinated of the 4 x soil sample sites

Site #	GPS coordinates	
	Latitude	Longitude
S1	32°58'29.29"S	20°21'50.80"E
S2	32°57'21.66"S	20°30'41.00"E
S3	32°57'23.73"S	20°28'16.89"E
S4	32°54'55.26"S	20°28'18.05"E

7.1 Soil classification

Based on a visual survey conducted during the site visit (Table 7.2) as well as soil samples collected from each area that was visually classified, the dominant soil forms (as per the Soil Classification workbook, 1991) were identified within the Brandvalley Wind Farm site (Figure 7.2) as:

- Mispah soil form (14 000ha)
- Glenrosa soil form (16 600ha)

It has been calculated that the total final permanent footprint for the Brandvalley Wind Farm will be approx. 5ha. The construction footprint (including temporary footprints) should be approx. 10-15ha in size. The bulk of infrastructure (approx. 90%) will be located on Mispah soils. The remainder which includes only 2 turbines and associated access roads will be located on Glenrosa soils.

Table 7.2: Visual description of the 4 sites sampled within the Brandvalley Wind Farm

Sample #	Photo	Description
1		Thick (>0.5m) reddish-brown orthic surface horizon overlying partly weathered rock. Soils have a hard consistency. Very low organic matter. Found on Glenrosa Soil Form.

2		Light brown to bleached soils. Crustal hardening present. Smaller size pebbles (± 30mm) at places overlying hard rock. Low organic matter. Found on Mispah Soil Form.
3		Bark brown to light brownish orange soils on weathered mudrock. Found on Mispah Soil Form.
4		Alluvial deposits in a dry river bed. Large grained sands interspersed with angular parent material. Found on Glenrosa Soil Form.

As indicated in Figure 7.1, the majority of the project area consists of Mispah soil form.

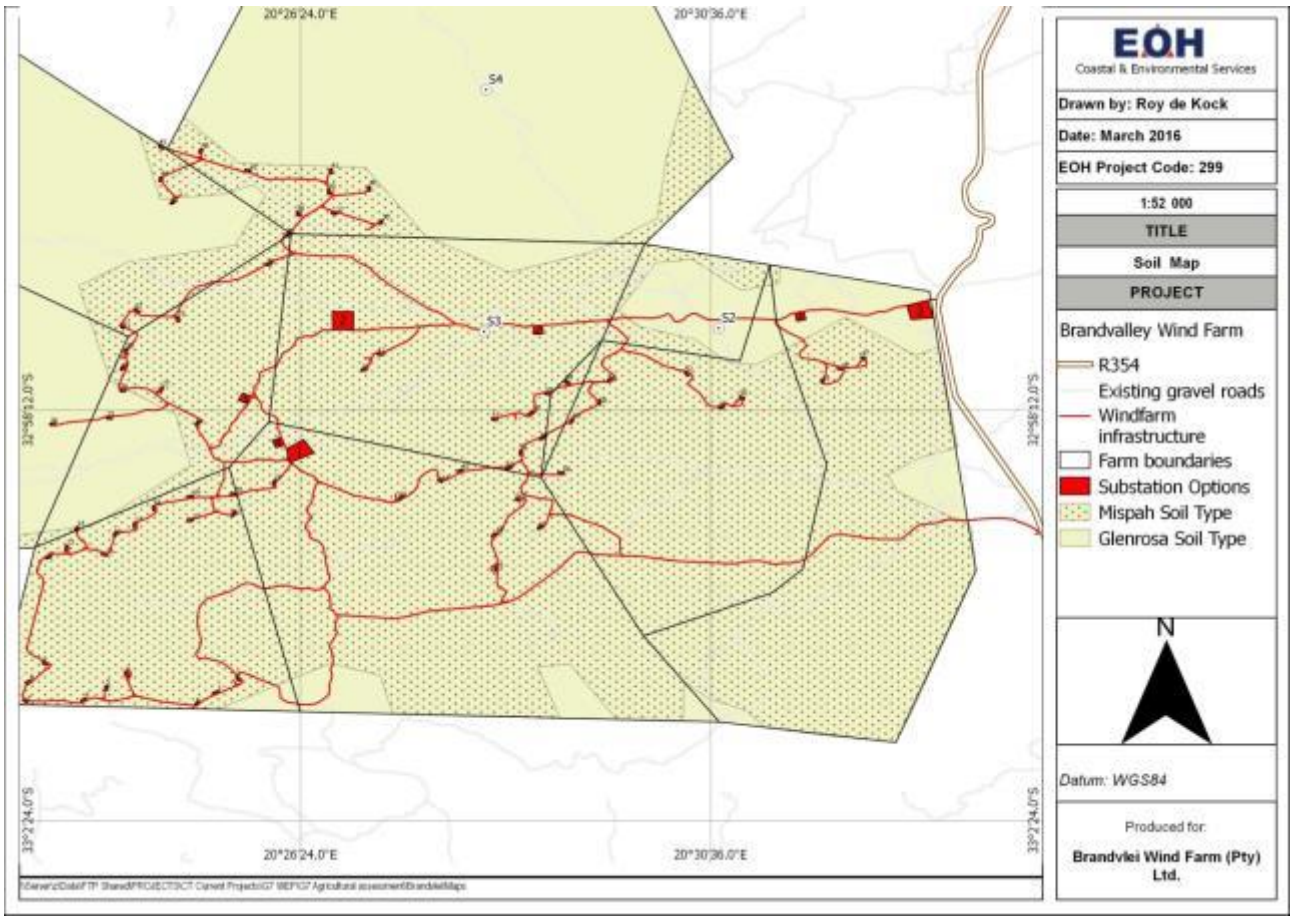


Figure 7.1: Soil distribution map for the Brandvalley Wind Farm

7.1.1 Mispah soil form

This soil form consists of a shallow orthic A horizon overlying hard rock, or surface bare rock with no soil horizon.

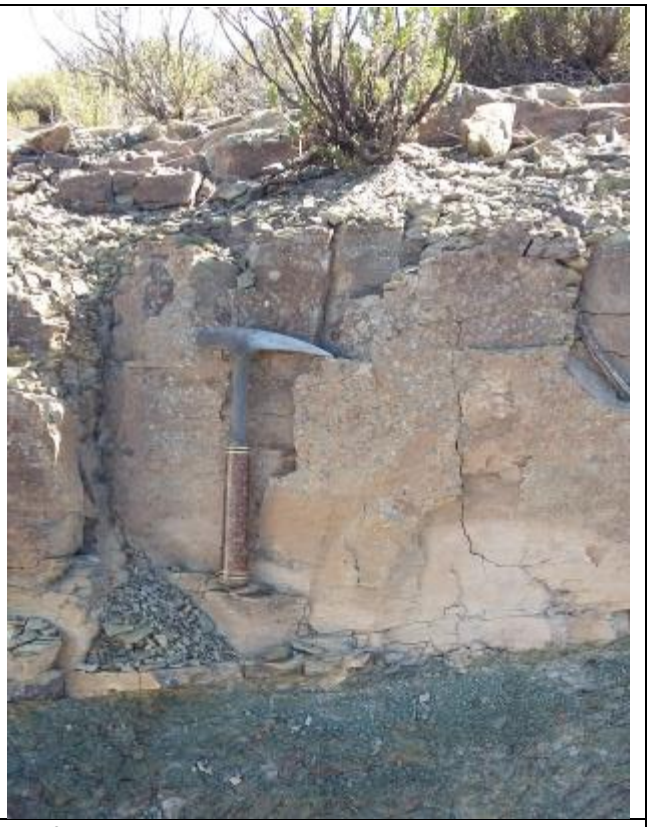
In this case, hard rock is classified as horizontally orientated, hard, fractured sediments which do not have any distinct vertical channels containing soil material, and bedrock.

The A horizon is mostly non-calcareous and not bleached and are therefore classified as Myhill soil family. Localised areas however reflect calcareous a horizons and therefore are classified as Carnarvon soil family.

Up to 90% of infrastructure (turbines and access roads) will be located on this soil type.

Plate 7.1 below illustrates typical Mispah soil forms observed onsite.

Highly fractured mudrock with no soil



Solif mudrock with limited soils

Orange undifferentiated soil with pebbles

Bleached undifferentiated soil with rock fragments and rocks

Plate 7.1: Photos of Mispah soil forms found onsite

7.1.2 Glenrosa foil form

This soil form consists of a surface horizon that cannot be classified as organic, humic, vertic or melanic although it is sometimes darkened by organic matter. It is therefore classified as an orthic A horizon.

Subsoil directly underlies the orthic A horizon and merges into the underlying rock. This layer consists mostly of fresh or weathered parent rock and therefore is classified as a lithocutanic B horizon.

The A horizon is bleached most of the time while the B horizon are hard, non-calcareous with no sign of wetness, and therefore are classified as Bergsig soil family.

Only 2 turbines and approximately 10% of access roads will be located on this soil type.

Plate 7.2 below illustrates typical Glenrosa soil form observed onsite.

	
Bleached soils with a well-defined plant root layer over a meter thick.	Redish-orange soil up to 90cm thick.

Plate 7.2: Photos of Glenrosa soil forms found onsite

7.2 Suitability for agriculture

7.2.1 Mispah form

Cropping: due to limited soil profiles, Mispah soils are not suitable for dryland cropping or irrigation.

Natural veld: Mispah soils accommodate a limited variety of vegetation and only range between Karoo scrub and succulent vegetation. Although small stock farming (Dorper and Dohne Merino sheep) are practised, grazing capacity is considered as low (26-30 ha/Animal Unit according to AGIS).

Water capacity: Due to the low rainfall soils contribute to hydrology only by overland flow and evapotranspiration.

7.2.2 Glenrosa form

Cropping: due to limited water availability, Glenrosa soils are not suitable for dryland cropping. Irrigation of cash crops is only possible along riverbeds, provided that irrigation dams are constructed to aid water availability. Less than 10% of the Brandvalley Wind Farm site is suitable for this.

Natural veld: Glenrosa soils accommodate a variety of vegetation ranging from a variety of scrublands, savannah and succulents. Small stock farming (Dorper and Dohne Merino sheep) are practised, grazing capacity is considered as low to moderate (18-25 ha/Animal Unit according to AGIS).

Water capacity: Due to the low rainfall soils contribute to hydrology only by overland flow and evapotranspiration.

7.2.3 Agricultural potential

Agricultural potential in the Brandvalley Wind Farm area is classified according to the land potential classification system of the Department of Agriculture (part of the Department of Agriculture, Forestry and Fisheries). This classification system takes factors such as climate, soil and slope into consideration to determine agricultural potential. Although it provides only a macro perception of the agricultural potential in the region, it is still a fair indication of what the broader agricultural potential of the area is.

DAFF (Agriculture) has classified the Brandvalley Wind Farm area into the following agricultural potential classes:

- Non-arable land with a low potential for grazing
- Land capability classification class 7 and 8 only
- Land unsuitable for crops unless under irrigation.

Based on the agricultural potential onsite, DAFF (Agriculture) has determined the grazing capacity to be between 18-25 hectare per large stock unit (ha/LSU) on low undulating landscapes and 26-30 ha/LSU on steep mountainous areas. Grazing capacity potential was determined in 1995 by DAFF (Agriculture) to be:

- Between 41-80 ha/LSU increasing to 26-30 ha/LSU towards the eastern sections.

This indicates that, grazing onsite is not utilised to its fullest potential capacity, but this is as a result of water availability. The area is currently also in a drought cycle.

7.3 Laboratory results

Soil samples S1 & S4 (See Figure 7.1) were collected on Glenrosa soil form which contains a hard orthic A horizon occurring on a fine lithocutanic B horizon while soil samples S2 & S3 were collected from a shallow orthic A horizon overlying hard rock (called Mispah soil form).

All soils within the Brandvalley Wind Farm site occur on sand with a low organic content (When only considering S1-S3). Soils to the west of the site (S4) have higher TEC reflecting clay & clay loams.

Table 7.4 summarises average conditions of soils found onsite:

Table 7.4: Average soil conditions within the Brandvalley Wind Farm site

Measured condition	Mispah Soils	Glenrosa Soils
pH	6.2	6.9
Organic content	1.94%	1.29%
Ca	47.75%	61.73%

Measured condition	Mispah Soils	Glenrosa Soils
Mg	27.16%	27.34%
K	3.89%	4.55%
Na	2.42%	1.82

Soil pH is considered as optimum between 6.5 and 7 (very slightly acidic) for the highest plant nutrient availability for most crops. Mispah soils falls within this range while Glenrosa soils are slightly more acidic and may require lime addition for certain crops like asparagus, onion, sweet clover and afalfa. Most other crops are considered as tolerant for both soil pH rates.

7.3.1 Mispah soils

Potassium (K) and Sodium (Na) falls within the optimal rate for fertile soils (3-5% for K and 0.5-5% for Na), while Ca content is considered too low (60-75%) and Mg too high (10-20%).

7.3.2 Glenrosa soils

Potassium (K), Sodium (Na) and Ca falls within the optimal rate for fertile soils (3-5% for K; 0.5-5% for Na and 60-75% for Ca), while Mg too high (10-20%).

7.3.3 Conclusion on agricultural suitability

Based on these levels, soils within the Brandvalley Wind Farm may be considered as optimum for a wide variety of crops under minimal soil management. Glenrosa soils are considered as more optimal when compared to Mispah soils. However, due to the limiting factor being water availability (for both soil types) and soil depth (especially for Mispah soils), such crops can only be grown under irrigation in deeper alluviums next to river systems.

8 SENSITIVITY ASSESSMENT

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(g) an identification of any areas to be avoided, including buffers;

(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

A sensitivity map was developed based on the allocations made in Section 4.5, for the Brandvalley Wind farm (Figure 8.1).

The following sensitive areas were identified:

Area type	Sensitivity allocation
Crop areas under irrigation	High
Water bodies	High
Drainage systems	High
Shallow soils on sloped areas	Moderate

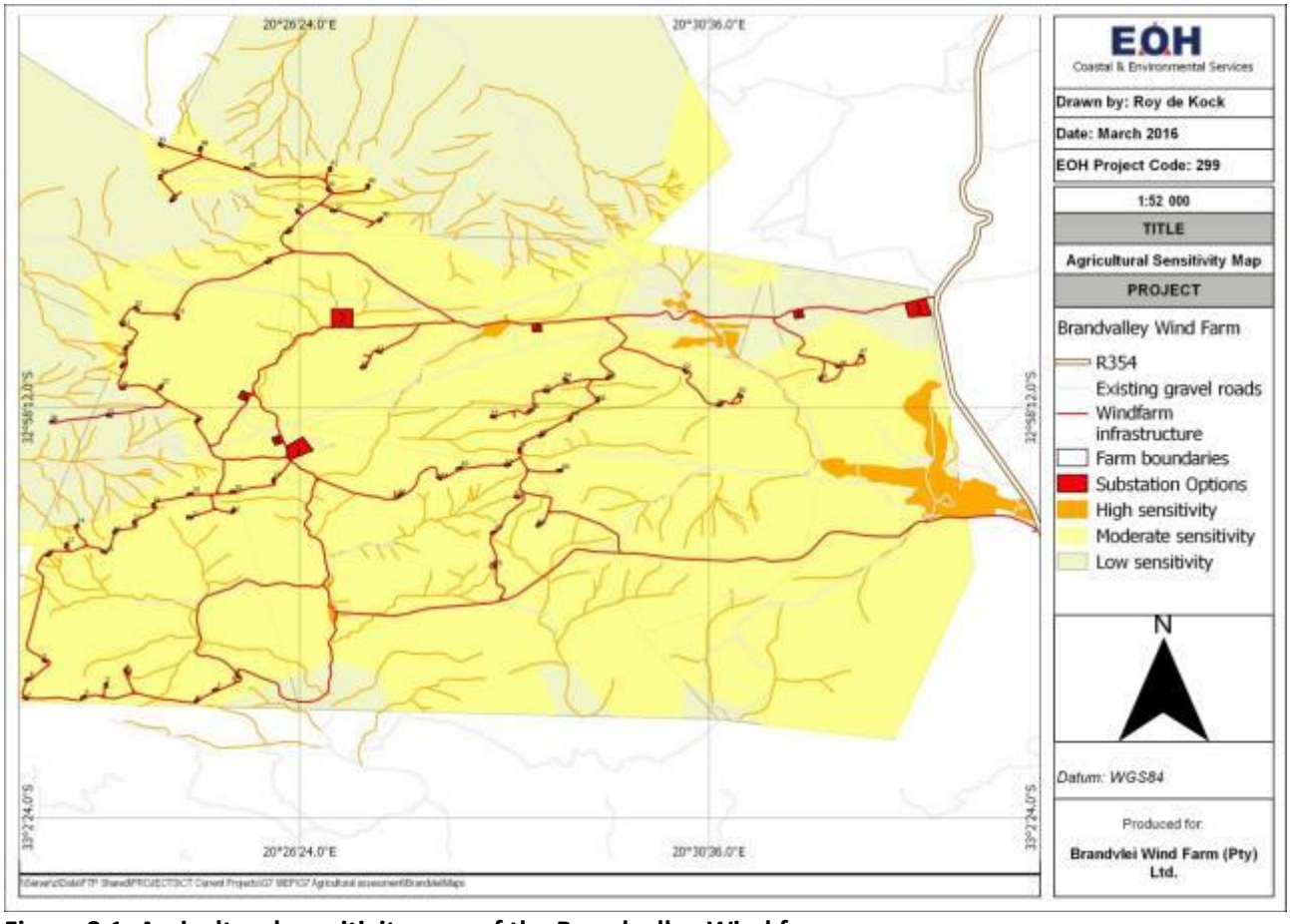


Figure 8.1: Agricultural sensitivity map of the Brandvalley Wind farm area

9 IMPACT IDENTIFICATION AND ASSESSMENT

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;

(k) any mitigation measures for inclusion in the EMPr;

9.1 Introduction

This chapter details the potential soils and agricultural impacts identified. For each issue identified, details are provided, followed by the mitigation measures required to minimise the negative impacts associated with the issue.

9.2 Impacts on soils and agriculture

Impacts on the agricultural potential of the affected land are anticipated to occur during the Planning & Design, Construction, Operational and Decommissioning Phase of the proposed Brandvalley Wind Farm project and are described below (Table 9.1). These included the consideration of direct, indirect and cumulative impacts that may occur for all alternatives as well as the No-Go alternative.

Table 9.1: Impacts to soil and agriculture associated with different phases of the proposed Brandvalley Wind Farm

Development Phase	Issue	Nature of Impact	Description of Impact
Planning & Design (for all project components and all alternatives)	**Issue 1:** Increase in erosion potential	Direct Indirect Cumulative **(Negative impact)**	During the planning and design phase inappropriate stormwater design may lead to an increase in surface soil erosion.
	Issue 2: Increase in renewable energy development in the local area	Cumulative **(Negative impact)**	During the planning and design phase the increase in renewable energy development in the local area will result in a gradual reduction of available agricultural land over time.
Construction (for all project components and all alternatives)	**Issue 3:** Management of hazardous chemicals	Direct **(Negative impact)**	During the construction phase hazardous chemical spills and leakages could lead to soil contamination and a loss of fertile soils if not managed appropriately.
	Issue 4: Increased risk of fires from construction activities	Direct Cumulative **(Negative impact)**	During construction phase fires originating from the construction site could lead to the loss of grazing and game.
	Issue 5: Soil stockpiling management	Direct Indirect Cumulative **(Negative impact)**	During the construction phase incorrect stockpiling of soil could result in a decrease of agricultural viability/potential.

Development Phase	Issue	Nature of Impact	Description of Impact
	Issue 6: Soil profile disturbance and resultant decrease in soil agricultural capability	Direct Cumulative **(Negative impact)**	During the construction phase excavations for the construction of the turbines and associated infrastructure will disturb the soil profile. If topsoil becomes buried, or subsoil rock, that is less suitable for root growth, remains at the surface, the agricultural suitability of the soil, that will become available for agriculture again after decommissioning of the WEF, will be reduced
	Issue 7: Establishment of renewable energy infrastructure on agricultural land	Direct Cumulative **(Negative impact)**	During the construction phase the WEF infrastructure (permanent and temporary)will result in the loss of up to 5 ha of low agricultural land
	Issue 8: Increase in erosion potential	Direct Indirect Cumulative **(Negative impact)**	During the construction phase the increase in impacted areas and hard surfaces will increase run-off and potentially lead to soil erosion
Operation (for all project components and all alternatives)	**Issue 9:** Increase in erosion potential	Direct Indirect Cumulative **(Negative impact)**	During the operational phase an increase in hard surfaces (hardstands and roads) will increase run-off and potentially lead to soil erosion.
	Issue 10: Establishment of renewable energy infrastructure on agricultural land	Direct Cumulative **(Negative impact)**	During the operational phase the WEF infrastructure will result in the loss of up to 5 ha of low agricultural land
	Issue 11: Establishment of new access roads	Direct Indirect Cumulative **(Positive impact)**	During the operational phase the new access roads will allow for an easier access to farm areas previously inaccessible or difficult to access.
Decommissioning (for all project components and all alternatives)	**Issue 12:** Decommissioning and removal of renewable energy infrastructure on agricultural land	Cumulative **(Positive impact)**	During the decommissioning phase the decrease in renewable energy development in the local area will result in an increase of available agricultural land.
No-Go option	**Issue 13:** Not constructing the WEF	Direct Cumulative **(Positive impact)**	Not constructing the WEF will result in no change in the current agricultural landscape.

9.3 Impact Assessment

The impacts identified in Section 9.2 are assessed in terms of the criteria described in Section 4.4 and are summarised below.

Table 9.2: Assessment and mitigation of impacts identified in the Planning & Design Phase.

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Issue 1: Increase in erosion potential							
During the planning and design phase inappropriate storm water design may lead to an increase in surface soil erosion.	**Localised**	**Medium-term**	**Definite**	**Moderately negative**	**MODERATE**	• Appropriate stormwater structures must be designed and implemented for all new infrastructure (e.g. roads, turbine bases etc.). • All roads situated on slopes must incorporate stormwater diversions.	**LOW**
Issue 2: Increase in renewable energy development in the local area							
During the planning and design phase the increase in renewable energy development in the local area will result in a gradual reduction of available agricultural land over time.	**Regional**	**Long-term**	**Probable**	**Moderately negative**	**MODERATE**	• Avoid developing on high potential agricultural land (like irrigated areas, croplands, etc.). • If unavoidable, ensure that all development footprints are kept at a minimum.	**LOW**

Table 9.3: Assessment and mitigation of impacts identified in the Construction Phase.

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Issue 3: Management of hazardous chemicals							
During the construction phase hazardous chemical spills and leakages could lead to soil contamination and a loss of fertile soils if not managed appropriately.	**Study area**	**Long-term**	**Probable**	**Moderately negative**	**MODERATE**	• Machinery must be properly maintained to keep oil leaks in check. • If a spill occurs on a permeable surface (e.g. Soil), a spill kit must be used to immediately reduce the potential spread of the spill. • If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained. • Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of hazardous chemicals to the environment, and stored in adequate containers until appropriate disposal in a licenced	**LOW**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						landfill site.	
Issue 4: Increased risk of fires from construction activities							
During construction phase fires originating from the construction site could lead to the loss of grazing and game.	**Regional**	**Long-term**	**May Occur**	**Very severe**	**HIGH**	• Ensure that all personnel are aware of the fire risk and the need to extinguish cigarettes before disposal, in appropriate waste disposal containers. • Smoking will only be allowed in demarcated areas with easy access to firefighting equipment. • Welding and other construction activities requiring open flames shall be done in a designated area containing firefighting equipment. • The risk of fire is highest in the late summer and autumn months, during high wind velocities and dry periods. To avoid and manage fire risk	**LOW**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						the following steps should be implemented: ○ Have on site fire-fighting equipment and ensure that all personnel are educated how to use it and procedures to be followed in the event of a fire. ○ Identify the relevant authorities and structures responsible for fighting fires in the area and shall liaise with them regarding procedures should a fire commence. ○ Ensure that	

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						all the necessary telephone numbers (including local Farmers Association Fire Marshall) to use in a case of an emergency are displayed at conspicuous and relevant locations. ○ No open fires shall be allowed on site for the purpose of cooking or warmth. Cooking fires must only be lit in designated cooking areas. • The contractor shall take all reasonable steps to prevent the accidental	

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						occurrence or spread of fire. • The contractor shall appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire. • The contractor shall ensure that all site personnel are aware of the procedure to be followed in the event of a fire. The appointed fire officer shall notify the Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his / her control. • The contractor shall ensure that there is basic fire-fighting equipment on site at all times. This equipment shall include fire	

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						extinguishers and beaters. • Any work that requires the use of fire may only take place within designated areas. Fire-fighting equipment shall be available in these areas.	
Issue 5: Soil stockpiling management							
During the construction phase incorrect stockpiling of soil could result in a decrease of agricultural viability/potential.	**Localised**	**Medium-term**	**Probable**	**Severe**	**MODERATE**	• Develop and implement a Rehabilitation and Monitoring Plan to monitor rehabilitated areas. • Ensure that topsoil does not get buried by subsoil during stockpiling. Failure to comply may result in topsoil sterilisation. • Implement measures such as wind-breaks, swales and watering as required aiding the initial grown of primary vegetation. • Fertile topsoil must not be stockpiled for	**LOW**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						periods exceeding 12 months or exceeding 2m in height to avoid topsoil sterilization. If unavoidable, the appointed ECO must monitor topsoil stockpile fertility to avoid sterility of soils. • Topsoil may be supplemented with an indigenous seed mix.	
Issue 6: Soil profile disturbance and resultant decrease in soil agricultural capability							
During the construction phase excavations for the construction of the turbines and associated infrastructure will disturb the soil profile. If topsoil becomes buried, or subsoil rock, that is less suitable for root growth, remains at the surface, the agricultural suitability of the	**Study area**	**Permanent**	**Definite**	**Very severe**	**VERY HIGH**	• The upper 15-20 cm of top soil must be stripped and stockpiled as topsoil where possible. It should be retained for re-spreading over disturbed surfaces during rehabilitation. • All other soil excavated will be stockpiled separately from topsoil as subsoil. • Ensure that topsoil does not get buried by subsoil during backfilling. Failure to	**LOW**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
soil, that will become available for agriculture again after decommissioning of the WEF, will be reduced.						comply may result in topsoil sterilisation. • An ECO must monitor all excavations to ensure backfilling with subsoil first and then topsoil afterwards takes place. • An ECO must monitor depth and cover of topsoil spreading during rehabilitation to ensure a 20cm depth in valleys. Rocky areas do not require topsoil but must be monitored by the ECO during rehabilitation. • Topsoil allocated for rehabilitation must not be mixed with other materials, such as building rubble, rock, subsoil, etc. • Topsoil stockpiles are to be handled only twice – once during clearing and stockpiling and once during	

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						rehabilitation/backfilling unless input is required as advised by the ECO.	
Issue 7: Establishment of renewable energy infrastructure on agricultural land							
During the construction phase the WEF infrastructure (permanent and temporary)will result in the loss of up to 5 ha of low agricultural land	**Study area**	**Medium term**	**Definite**	**Slight**	**MODERATE**	• Construction activities must only occur within the demarcated construction footprint. • The construction footprint must be approved by the landowner/occupier prior to commencement of construction activities.	**LOW**
Issue 8: Increase in erosion potential							
During the construction phase the increase in impacted areas and hard surfaces will increase run-off and potentially lead to soil erosion	**Study area**	**Long term**	**Definite**	**Severe**	**MODERATE**	• All run-off water from hard surface areas (e.g. roads, hardstands etc.) and construction impacted areas must be collected, channelled and disposed of in an appropriate manner to prevent erosion. • Anti-erosion features	**LOW**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						must be installed where required. • Ensure that all cleared and impacted land is rehabilitated and re-vegetated.	

Table 9.4: Assessment and mitigation of impacts identified in the Operation Phase.

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Issue 9: Increase in erosion potential							
During the operational phase an increase in hard surfaces (hardstands and roads) will increase run-off and potentially lead to soil erosion.	**Study area**	**Long term**	**Definite**	**Severe**	**MODERATE**	• Stormwater runoff must be controlled to manage erosion through appropriate measures • Anti-erosion features must be installed where required. • Ensure that all cleared and impacted land is rehabilitated and re-vegetated.	**LOW**
Issue 10: Establishment of renewable energy infrastructure on agricultural land							
During the operational phase the WEF infrastructure will result in the loss of up to 5 ha of low	**Localised**	**Long-term**	**Definite**	**Slight**	**MODERATE**	• Fencing of WEF infrastructure should be limited as far as possible to allow for maximum grazing and movement of livestock and game	**LOW**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
agricultural land						within the site.	
Issue 11: Establishment of new access roads							
During the operational phase the new access roads will allow for an easier access to farm areas previously inaccessible or difficult to access.	**Study area**	**Long-term**	**Definite**	**Beneficial**	**HIGHLY BENEFICIAL**	• None	**HIGHLY BENEFICIAL**

Table 9.5: Assessment and mitigation of impacts identified in the Decommissioning Phase.

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Issue 12: Decommissioning and removal of renewable energy infrastructure on agricultural land							
During the decommissioning phase the decrease in renewable energy development in the local area will result in an increase of available agricultural land.	**Regional**	**Long term**	**Probable**	**Beneficial**	**BENEFICIAL**	• All impacted agricultural land should be rehabilitated for future agricultural use.	**BENEFICIAL**

Table 9.6: Assessment and mitigation of impacts identified in the NO-GO alternative.

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Issue 13: Not constructing the WEF							
Not constructing the WEF will have no impact of agricultural land.	**Study area**	**Permanent**	**Definite**	**Beneficial**	**BENEFICIAL**	• None	**BENEFICIAL**

Table 9.7: Change in local land use (for all phases).

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Issue 16: Not constructing the WEF							
An increase wind farms in the local area may result in a shift in the local land use from agriculture to renewable energy.	**Regional**	**Long-term**	**May Occur**	**Severe**	**MODERATE**	• Development of renewable energy projects on agricultural land in the region should be limited to ensure that agriculture remains the main land use. It is unclear how this will be accomplished at this stage. • Renewable energy designs for current & potential future projects must limit its impact on local agriculture, especially the potential loss of moderate to high	**MODERATE**

IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
						potential agricultural land	

10 IMPACT STATEMENT, CONCLUSION AND RECOMMENDATIONS

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(I) any conditions for inclusion in the environmental authorisation;

(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;

(n) a reasoned opinion-

(i) as to whether the proposed activity or portions thereof should be authorised; and

(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;

10.1 Environmental management programme

The following actions must be included in the Construction and Operational EMPr:

- All mitigations identified and listed in Section 10.2 below
- The site must be monitored by a qualified Environmental Control Office (ECO) at least once a month for the duration of the construction phase.

10.2 Recommendations for the proposed Brandvalley Wind Farm

10.2.1 Alternatives

The two (2) access route alternatives are considered equally preferred as both the alternatives are existing gravel roads and none of them will directly or indirectly impact on agricultural activities onsite. Although Access route alternative 1 transects 2 high agricultural areas (irrigated cropland), the footprint is existing and the new route will follow existing farm roads through these areas. None of the access routes alternatives (1 or 2) are considered as "*fatally flawed*" and therefore either one can be constructed.

Site camp alternative 1 is considered as the preferred alternative. Site camp alternatives 2 & 3 are both either located within a non-perennial stream or are immediately (less than 100m) surrounded on two (2) and more sides by a stream. This must be confirmed by the appointed aquatic specialist.

Substation site alternatives 1-3 are considered as equally preferred. Substation site alternative 4 is considered as least preferred as the site appears to be surrounded on three sides by a non-perennial streams. As water is a limiting factor onsite for agriculture, this increases the risk significantly. This must be confirmed by the appointed aquatic specialist.

The No-Go option will not impact on any agricultural land but construction of new access roads to turbines located in currently inaccessible farm areas will result in easy/easier access by the farmer into these areas. Not constructing the WEF will result in these areas remaining inaccessible to the farmer.

10.2.2 Mitigation measures

All the mitigation measures provided below are to be implemented in the Planning & Design, Construction and Operation Phases of the proposed Brandvalley Wind Farm.

Planning and Design phase

- Appropriate stormwater structures must be designed and implemented.
- All infrastructure situated on slopes must incorporate stormwater diversions.
- Develop a Rehabilitation and Monitoring Plan to monitor stockpiles.
- Avoid developing on high potential agricultural land (like irrigated areas, croplands, etc.).If unavoidable, ensure that all development footprints are kept at a minimum.

Construction phase

- Machinery must be properly maintained to keep oil leaks in check.
- If a spill occurs on a permeable surface (e.g. Soil), a spill kit must be used to immediately reduce the potential spread of the spill.
- If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent materials.
- Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of hazardous chemicals to the environment, and stored in adequate containers until appropriate disposal in a licenced landfill site.
- Ensure that all personnel are aware of the fire risk and the need to extinguish cigarettes before disposal, in appropriate waste disposal containers.
- Smoking will only be allowed in demarcated areas with easy access to firefighting equipment.
- Welding and other construction activities requiring open flames shall be done in a designated area containing firefighting equipment.
- The risk of fire is highest in the late summer and autumn months, during high wind velocities and dry periods. To avoid and manage fire risk the following steps should be implemented:
    - Have on site fire-fighting equipment and ensure that all personnel are educated how to use it and procedures to be followed in the event of a fire.
    - Identify the relevant authorities and structures responsible for fighting fires in the area and shall liaise with them regarding procedures should a fire commence.
    - Ensure that all the necessary telephone numbers (including local Farmers Association Fire Marshall) to use in a case of an emergency are displayed at conspicuous and relevant locations.
    - No open fires shall be allowed on site for the purpose of cooking or warmth. Cooking fires must only be lit in designated cooking areas.
- The contractor shall take all reasonable steps to prevent the accidental occurrence or spread of fire.
- The contractor shall appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire.
- The contractor shall ensure that all site personnel are aware of the procedure to be followed in the event of a fire. The appointed fire officer shall notify the Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his / her control.
- The contractor shall ensure that there is basic fire-fighting equipment on site at all times. This equipment shall include fire extinguishers and beaters.
- Any work that requires the use of fire may only take place within designated areas. Fire-fighting equipment shall be available in these areas.
- Develop and implement a Rehabilitation and Monitoring Plan to monitor rehabilitated areas.
- Ensure that topsoil does not get buried by subsoil during stockpiling. Failure to comply may result in topsoil sterilisation.
- Implement measures such as wind-breaks, swales and watering as required aiding the initial grown of primary vegetation.
- Fertile topsoil must not be stockpiled for periods exceeding 12 months or exceeding 2m in height to avoid topsoil sterilization. If unavoidable, the appointed ECO must monitor topsoil stockpile fertility to avoid sterility of soils.
- Topsoil may be supplemented with an indigenous seed mix.

- The upper 15-20 cm of top soil must be stripped and stockpiled as topsoil where possible. It should be retained for re-spreading over disturbed surfaces during rehabilitation.
- All other soil excavated will be stockpiled separately from topsoil as subsoil.
- Ensure that topsoil does not get buried by subsoil during backfilling. Failure to comply may result in topsoil sterilisation.
- An ECO must monitor all excavations to ensure backfilling with subsoil first and then topsoil afterwards takes place.
- An ECO must monitor depth and cover of topsoil spreading during rehabilitation to ensure a 20cm depth in valleys. Rocky areas do not require topsoil but must be monitored by the ECO during rehabilitation.
- Topsoil allocated for rehabilitation must not be mixed with other materials, such as building rubble, rock, subsoil, etc.
- Topsoil stockpiles are to be handled only twice – once during clearing and stockpiling and once during rehabilitation/backfilling unless input is required as advised by the ECO.
- Construction activities must only occur within the demarcated construction footprint.
- The construction footprint must be approved by the landowner/occupier prior to commencement of construction activities.
- All run-off water from hard surface areas (e.g. roads, hardstands etc.) and construction impacted areas must be collected, channelled and disposed of in an appropriate manner.
- Anti-erosion features must be installed where required.
- Ensure that all cleared and impacted land is rehabilitated and re-vegetated.

Operational phase

- Stormwater runoff must be controlled to manage erosion through appropriate measures
- Anti-erosion features must be installed where required.
- Ensure that all cleared and impacted land is rehabilitated and re-vegetated.
- Fencing of WEF infrastructure should be limited as far as possible to allow for maximum grazing and movement of livestock and game within the site.

Decommissioning phase

- All impacted agricultural land should be rehabilitated for future agricultural use.

10.3 Conclusions

The Brandvalley wind farm only receives about 61mm of rainfall per year, and therefore dryland cropping is not viable. Irrigation is intensively practiced in small areas along dry riverbeds where irrigation dams can be erected and soils are suitable. Various cash crops and winterfeed are produced under irrigation, but are restricted to small areas along dry riverbeds. The area supports some hunting practices and livestock farming.

The following table 10.1 summarises the change in impacts from pre- to post- mitigation for the Brandvallei Wind Farm.

Table 10.1. Assessment of pre- and post-mitigation impact significance.

	PRE-MITIGATION					POST-MITIGATION				
	POSITIVE	LOW	MODERATE	HIGH	UN-KNOWN	LOW	MODERATE	HIGH	UN-KNOWN	POSITIVE
Planning and Design	0	0	2	0	0	2	0	0	0	0
Construction	0	0	4	2	0	6	0	0	0	0
Operational	1	0	2	0	0	2	0	0	0	1

	PRE-MITIGATION					POST-MITIGATION				
	POSITIVE	LOW	MODERATE	HIGH	UN-KNOWN	LOW	MODERATE	HIGH	UN-KNOWN	POSITIVE
Decommis-sioning	1	0	0	0	0	0	0	0	0	1
NO-GO	1	0	0	0	0	0	0	0	0	1
TOTAL	3	0	8	2	0	10	0	0	0	3

Agricultural statement and Opinion of the Specialist

The agricultural impacts of all the aspects of the proposed Brandvalley Wind Farm were considered and deemed to be acceptable, provided that the mitigation measures provided in this report are implemented.

Although limited agricultural output (livestock, crop irrigation and game) within the affected area will be impacted by the proposed development, no problematic areas or fatal flaws were identified for the site The proposed impacts on cultivated land are limited in that only access areas will transect cultivated land in existing impacted areas (existing farm roads through cultivated land). . No new development must impact on cultivated land.

All the identified impacts on agriculture are considered to have high reversibility because the land will be able to be returned to agriculture after closure, with very little change in agricultural potential. Impacts on agriculture are also considered to have low irreplaceability of resource loss because:

6. of the small area of land involved,
7. low suitability for crops outside small areas along dry riverbeds that are currently under irrigation,
8. it is highly unlikely to be irreplaceably lost to agriculture,
9. of a low agricultural potential for livestock,
10. the proportion of surface area likely to be affected is minimal and therefore the overall impact on the carrying capacity/agricultural potential of the site will be minimal.

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12 APPENDIX A – SOIL LABORATORY RESULTS

kg/ha

BROOKSIDE LABORATORIES, INC.

70733-6

SOIL AUDIT AND INVENTORY REPORT

Name De Kock Roy City Heidelberg State GP

Independent Consultant Vermi Solutions Date 03/03/2016

Sample Location			S1	S2	S6	S7	S11
Sample Identification							
Lab Number			0348-1	0349-1	0350-1	0351-1	0352-1
Total Exchange Capacity (ME/100 g)			12.61	11.84	15.56	20.15	23.89
pH (H_2O 1:1)			a 7.9	a 7.6	a 7.4	a 8.5	5.8
Organic Matter (humus) %			1.03	1.16	0.99	0.95	2.16
Estimated Nitrogen Release		kg/ha	46	48	45	43	71
ANIONS	SOLUBLE SULFUR*	ppm	6	7	7	12	11
ANIONS	PHOSPHORUS MEHLICH III	kg/ha P as P_2O_5	103	400	236	390	169
		ppm of P	20	78	46	76	33
	PHOSPHORUS BRAY II	kg/ha P as P_2O_5	354	626	349	718	128
		ppm of P	69	122	68	140	25
	PHOSPHORUS OLSEN	kg/ha P as P_2O_5					
		ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*	kg/ha	3786	3105	3485	6294	3830
		ppm	1690	1386	1556	2810	1710
	MAGNESIUM*	kg/ha	833	970	1651	1172	2079
		ppm	372	433	737	523	928
	POTASSIUM*	kg/ha	206	549	455	847	484
		ppm	92	245	203	378	216
	SODIUM*	kg/ha	199	116	258	99	334
		ppm	89	52	115	44	149
BASE SATURATION PERCENT							
	Calcium	%	67.01	58.53	50.00	69.73	35.79
	Magnesium	%	24.58	30.48	39.47	21.63	32.37
	Potassium	%	1.87	5.31	3.35	4.81	2.32
	Sodium	%	3.07	1.91	3.21	0.95	2.71
	Other Bases	%	3.50	3.80	4.00	2.90	5.80
	Hydrogen	%	0.00	0.00	0.00	0.00	21.00
EXTRACTABLE MINORS							
	Boron* (ppm)		0.30	0.43	0.40	0.76	0.32
	Iron* (ppm)		61	106	87	78	104
	Manganese* (ppm)		111	197	179	223	38
	Copper* (ppm)		1.02	2.08	1.64	2.07	1.24
	Zinc* (ppm)		0.62	2.03	1.17	1.59	0.96
	Aluminum* (ppm)		302	447	484	217	668
OTHER TESTS	Soluble Salts (mmhos/cm)						
	Chlorides (ppm)						

a - alkaline soil

* Mehlich III Extractable

13 APPENDIX B – SIGNED SPECIALIST DECLARATION FORM