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LAND CAPABILITY ASSESSMENT: MARALLA EAST WIND SITE

BIOTHERM ENERGY (PTY) LTD

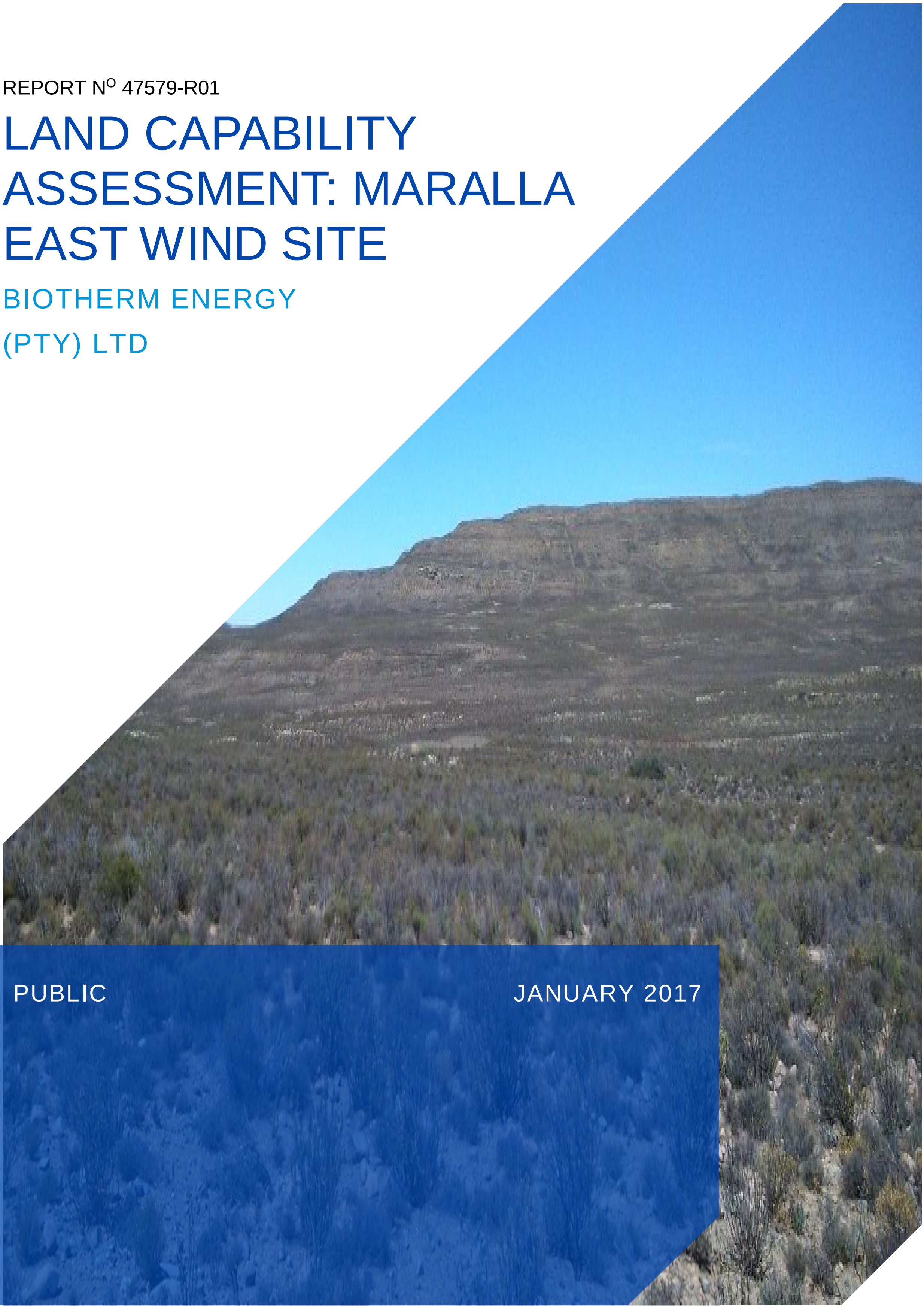

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

BioTherm Energy (Pty) Ltd (BioTherm) have proposed the development for a renewable energy complex Maralla East in the Western Cape Province. As part of the application process for Environmental Authorisation, WSP Environmental (Pty) Ltd (WSP | Parsons Brinckerhoff) was appointed by BioTherm to undertake a Social and Environmental Impact Assessment (SEIA).

The SEIA is divided into two phases, the Scoping Phase and the Environmental Impact Assessment (EIA) Phase. This report will follow from the scoping phase, addressing the land capability implications, and providing a high-level assessment of the potential environmental impacts associated with the proposed development.

1.1 OBJECTIVES OF THE REPORT

The objective associated with the assessments include the following:

- Describe the background of the project and contextualise it in the natural environment. This will include defining the land capability and appraisal of the area within the project footprint;
- List and assess the potential environmental impacts associated with the proposed project to the environs identified; and
- Conclude the finding of the report, highlighting any significant impacts and their corresponding mitigation and management measures, which must be considered as conditions in the authorisation.

1.2 STUDY APPROACH AND METHODOLOGY

The scope of work covered within this report, which entails a land capability assessment, forms part of the process required for BioTherm to apply as a Preferred Bidder to the Department of Environmental Affairs (DEA). The study therefore focuses on the identification and assessment of sensitive environments that maybe impacted on by the proposed project.

The purpose of this report was to conduct a high-level study that defines the land capability of the area of the proposed Maralla East Site. The potential impacts to the land were defined at a generic and high level. This entailed a desktop review and site visit from which an initial the scoping report was developed. The desktop review utilised available information at the time, including the following spatial information resources:

- Google Earth Pro;
- Agricultural Geo-Referenced Information System (AGIS);
- National Freshwater Ecosystem Priority Areas (NFEPA);
- The U.S. Geological Survey (USGS);
- The Soil Maps of Africa: European Digital Archive of Soil Maps (EuDASM);
- Hydrological features including rivers and, catchments and water management areas, and
- Existing maps and detailed project information provided by BioTherm which were available at the onset of the project.

Preliminary maps and figures were developed to use during the site visit to verify the information collected during the desktop review, through a ground-truthing exercise.

The site investigation comprised of a three-day site visit conducted between the 1st and 3rd of March 2016. The site assessments entailed a drive through of the property on which the proposed Maralla East is located. The area covered during the site visit was the operational footprint of the proposed project as well as a 500m boundary buffer. The following tasks were undertaken as part of the site investigation:

- Verification of desktop review information;
- Soil profile characterisation and sample collection, including:
  - Soil depth and profile description (i.e. subjective moisture estimation, effective rooting depth, presence of mottling, gleying, pedocretes and soil structure);
  - Classification of soil form and family based on the Taxonomic Soil Classification System for South Africa (Macvicar, 1991);
  - Permeability based on in-situ estimation and texture properties;
  - Underlying lithology; and
- Soil sample collection for laboratory analyses of pH, electrical conductivity, exchangeable sodium and soil texture.

A handheld Global Positioning System (GPS) and camera were used in conjunction with the maps produced in the desktop review, to conduct the ground-truthing exercise. The GPS was used to delineate areas as well as verify and mark all relevant points with exact co-ordinates. Representative soil samples were collected using a hand-operated auger, where holes were drilled until the parent material/refusal was reached. The representative soil samples were sent for analyses to the SGS Soil Laboratory situated in Somerset West in the Western Cape, to determine the pH, electrical conductivity, exchangeable sodium and texture.

LAND CAPABILITY

The land capability for the proposed Maralla East project footprint was assessed according to the Land Capability Classification described in the Chamber of Mines Guidelines (Chamber of Mines of South Africa/Coaltech, 2007). The physical and chemical data from the soils laboratory analyses, in conjunction with the climatic, topographical, vegetation and land use information, was used to classify the Land Capability of the farm property into 4 broad categories:

- Class 1 Wetland - It is made up of vleis, swamps, marshes, peat-bogs and the like. There is usually a water table present at shallow depth in the soil with the result that it is difficult or impossible to recover soil material for later use because heavy machinery becomes bogged down, unless the soils are drained;
  - Wetland, has one of the following characteristics:
  - a diagnostic organic (O) horizon at the surface;
  - horizon that is gleyed throughout more than 50 percent of its volume and is significantly thick, occurring within 75 cm of the surface;
- Class 2 Arable land - Land which conforms to all of the following requirements: Does not qualify as a wetland;
  - has soil that is readily permeable to the roots of common cultivated plants throughout a depth of 0.75 m from the surface;
  - has a soil pH value between 4,0 and 8,4. Has electrical conductivity of the saturation extract less than 400mS/m at 25°C, and an exchangeable sodium percentage less than 15 through the upper 0,75 m of soil;
  - has a permeability of at least 1,5 mm per hour in the upper 0.5 m of soil;

  - has less than 10 percent by volume of rocks or pedocrete fragments larger than 100 mm in diameter in the upper 0,75 m of soil;
  - the product of the slope (in percent) and erodibility factor (K) is less than 2.0;
  - occurs under a climate regime which permits, from soils of similar texture and adequate effective depth (0,75 m), the economic attainment of yields of adapted agronomic or horticultural crops that are at least equal to the current national average for those crops. Or is either currently being irrigated successfully or has been scheduled for irrigation by the Department of Water Affairs;
- Class 3 Grazing Land - Grazing land conforms to all of the following requirements;
  - does not qualify as wetland or as arable land;
  - has soil or soil-like material, permeable to the roots of native plants, that is more than 0.25 m thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter;
  - supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis;
- Class 4 Wilderness land - This is land which has little or no agricultural capability by virtue of being too arid, too saline, too steep or too stony to support plants of economic value. Its uses lie in the fields of recreation and wildlife conservation. It does, however, also include watercourses, submerged land, built-up land and excavations. Wilderness land is defined by exclusion, namely land which does not qualify as wetland, arable land or grazing land.

In addition to the above four classes, the land capability was also defined by the eight land capability classes based on the original USDA work and adapted for SA conditions by ARC. This was done at a desktop level, based on the GIS information provided on the Department of Agriculture, Forestry, and Fisheries (DAFF) Agricultural Geo-Referenced Information System website (AGIS, 2007).

IMPACT METHODOLOGICAL FRAMEWORK

The impact valuation uses a methodological framework used by WSP | Parsons Brinckerhoff to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014 (GN No. 982) (the “EIA Regulations”). As required by the EIA Regulations (2014), the determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact;
- Significance of the Impact;
- Consequence of the Impact;
- Extent of the impact;
- Duration of the Impact;
- Probability if the impact;
- Degree to which the impact:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- **Magnitude** to what extent environmental resources are going to be affected;
- **Sensitivity** of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- **Severity** of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Impacts are assessed in terms of the following criteria:

- The nature, a description of what causes the effect, what will be affected and how it will be affected (**Table 1**);
- The physical extent, wherein it is indicated whether (**Table 2**);
- The duration, wherein it is indicated whether the lifetime of the impact will be (**Table 3**);
- The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned (**Table 4)**; and
- The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where (**Table 5**):

Table 1: Nature or Type of Impact

NATURE OR TYPE OF IMPACT	DEFINITION
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

Table 2: Physical Extent of Impact

SCORE	DESCRIPTION
1	The impact will be limited to the site.
2	The impact will be limited to the local area.
3	The impact will be limited to the region.
4	The impact will be national.
5	The impact will be international.

Table 3: Duration of Impact

SCORE	DESCRIPTION
1	A very short duration (0 to 1 years).

SCORE	DESCRIPTION
2	A short duration (2 to 5 years).
3	A medium term (5–15 years).
4	A long term (> 15 years).
5	Permanent.

Table 4: Magnitude of Impact on Ecological Processes

SCORE	DESCRIPTION
0	Small and will have no effect on the environment.
2	Minor and will not result in an impact on processes.
4	Low and will cause a slight impact on processes.
6	Moderate and will result in processes continuing but in a modified way.
8	High (processes are altered to the extent that they temporarily cease).
10	Very high and results in complete destruction of patterns and permanent cessation of processes.

Table 5: Impact Probability of Occurrence

SCORE	DESCRIPTION
1	very improbable (probably will not happen.
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

- The significance, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- The status, which is described as either positive, negative or neutral;
- The degree to which the impact can be reversed;
- The degree to which the impact may cause irreplaceable loss of resources; and
- The degree to which the impact can be mitigated.

The significance is determined by combining the criteria in the following formula:

$$S = (E + D + M) \times P$$

S = Significance weighting;

E = Extent;

D = Duration;

M = Magnitude, and

P = Probability.

The significance weightings for each potential impact are as follows (**Table 6**):

Table 6: Significance Weightings for Each Impact

OVERALL SCORE	SIGNIFICANCE RATING	DESCRIPTION
< 30 points	Low	where this impact would not have a direct influence on the decision to develop in the area
31-60 points	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated

Overall Score	Significance Rating	Description
> 60 points	High	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the Project's actual extent of impact, and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures, and is thus the final level of impact associated with the development of the Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this EIA Report.

1.3 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations were identified as part of the assessment:

- The various published data sources (i.e. aerial imagery, mapping and previous reports) have been assumed to be accurate at the time of use.
- At the time of the site investigation, the final layout routes of the powerlines and substations was not made available, and as such could not be investigated as part of the site assessment.

1.4 DECLARATION OF INDEPENDENCE

Bruce Wickham is a Hydrologist with an MSc from the University of KwaZulu-Natal in 2015. He joined WSP | Parsons Brinckerhoff in 2015 and has worked on various soil and wetland related projects. He is registered as a Candidate Natural Scientist – Water Resources Science with the South African Council for Natural Scientific Professions (SACNASP).

Colin Holmes is a Senior Environmental Consultant at WSP | Parsons Brinckerhoff with an MSc in Applied Environmental Science. He has also completed wetland management courses with the University of Free State. He has completed and managed numerous projects relating to wetland and riparian delineations, Present Ecological State and Ecological Importance and Sensitivity assessments, and the compilation of IWWMPs. He is registered with the South African Council for Scientific Professions – Professional Natural Scientist (Environmental Scientist) and is a SETA accredited Carbon Footprint Analyst.

Greg Matthews has 17 years of professional experience and is registered with the South African Council for Scientific Professions – Professional Natural Scientist (Environmental Scientist and Hydrological Scientist). He has been involved in numerous projects associated with the assessment of activities on both soil and water resources.

WSP | Parsons Brinckerhoff has no financial or other interest in the proposed development and will derive no benefits other than fair remuneration for consulting services provided.

I, Greg Matthews, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;

- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in 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 potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offense in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Name: Greg Matthews **Sign:**  **Date:** 29/11/2016

2 DESCRIPTION OF THE PROJECT

The Maralla East, is located within the Western Cape Province, approximately 28 km north-west of the town of Laingsburg (**Figure 1**). Other nearby towns include Matjiesfontein and Sutherland. The site falls within the Central Karoo District Municipality DC5 and stretches over three farm properties viz. Drie Roode Heuvels RE/180; Schalkwykskraal RE/204 and Welgemoed RE/268, occupying a total area of 42.3km^2. The Komsberg-Kareendoringkraal" district road off the R354 serves at the primary access route to the Maralla East Site (**Figure 1**).

This report is primarily focused towards potential activities and impacts associated with the Maralla East Site, however there are also proposed infrastructure options associated with the development (i.e. substations and power transmission lines). The associated infrastructure has been assessed in separate reports.

The Maralla East will house up to 70 wind turbines which will produce electrical energy that will be fed directly into the national grid. The characteristics of the wind turbines includes the following:

- Up to 70 Wind Turbines, with a maximum 120 m hub height and 150 m rotor diameter;
- Generating capacity between 1.5 to 4 MW;
- Tower footprint of 0.5 ha;
- Operational and Maintenance building occupying an area of 0.038 ha;
- Connection cables;
- Access roads (up to 6 m wide);
- Sub-station (up to 132 kV), occupying an area of 2.25 ha;
- Powerlines (up to 132 kV);
- Servitude (up to 65 m);
- Fences;
- Permanent laydown area for turbine cranes (0.3 ha); and

- Temporary laydown areas, involved during the construction phase (12 ha).

In addition to the proposed Maralla East project, there are several potential wind energy developments earmarked in the surrounding area (**Figure 2**). This area falls within the Komsberg Wind Renewable Energy Development Zone (REDZ). These zones were identified throughout South Africa in a Strategic Environmental Assessment (SEA), as part of the Department of Environmental Affairs Strategic Integrated Project National Infrastructure Plan.

In a separate SEA - Electrical Grid Infrastructure (EGI), national power corridors were delineated for the efficient and effective expansion of the transmission infrastructure throughout South Africa. The location of the BioTherm sites (Esizayo and Maralla East and West), as well as the proposed neighbouring renewable energy developments, are strategically placed to overlap with the REDZs and EGI demarcated zones (**Figure 2**). The neighbouring developments will be factored into the EIA as part of the cumulative impact assessment. These renewable energy developer entities include:

- Mainstream Renewable Power SA (Pty) Ltd;
- Networx Renewables (Pty) Ltd;
- African Clean Energy Developments (Pty) Ltd; and
- G7 Renewable Energies (Pty) Ltd.

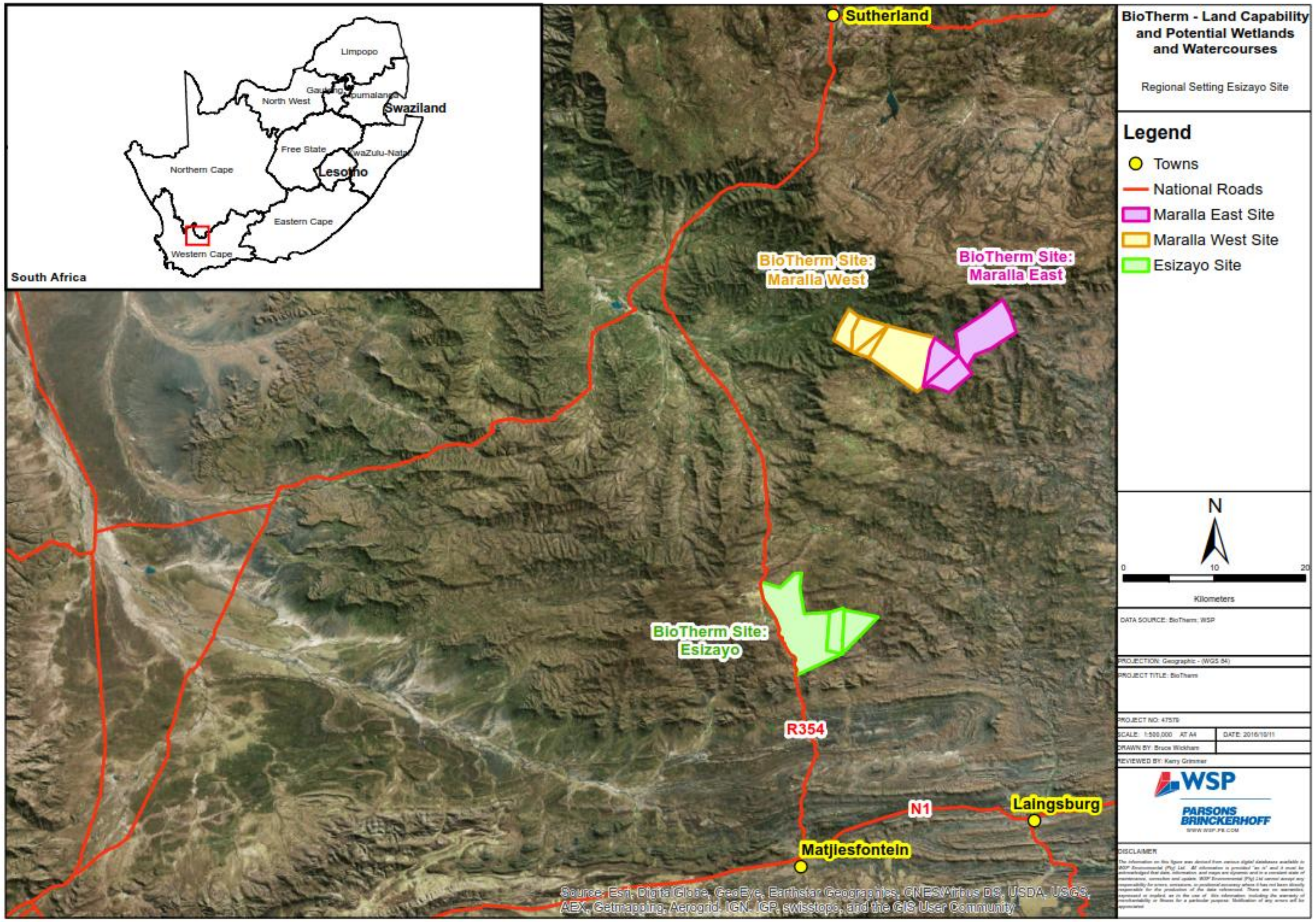

Figure 1: Regional Setting of the Maralla East Site in relation to the entire BioTherm Project

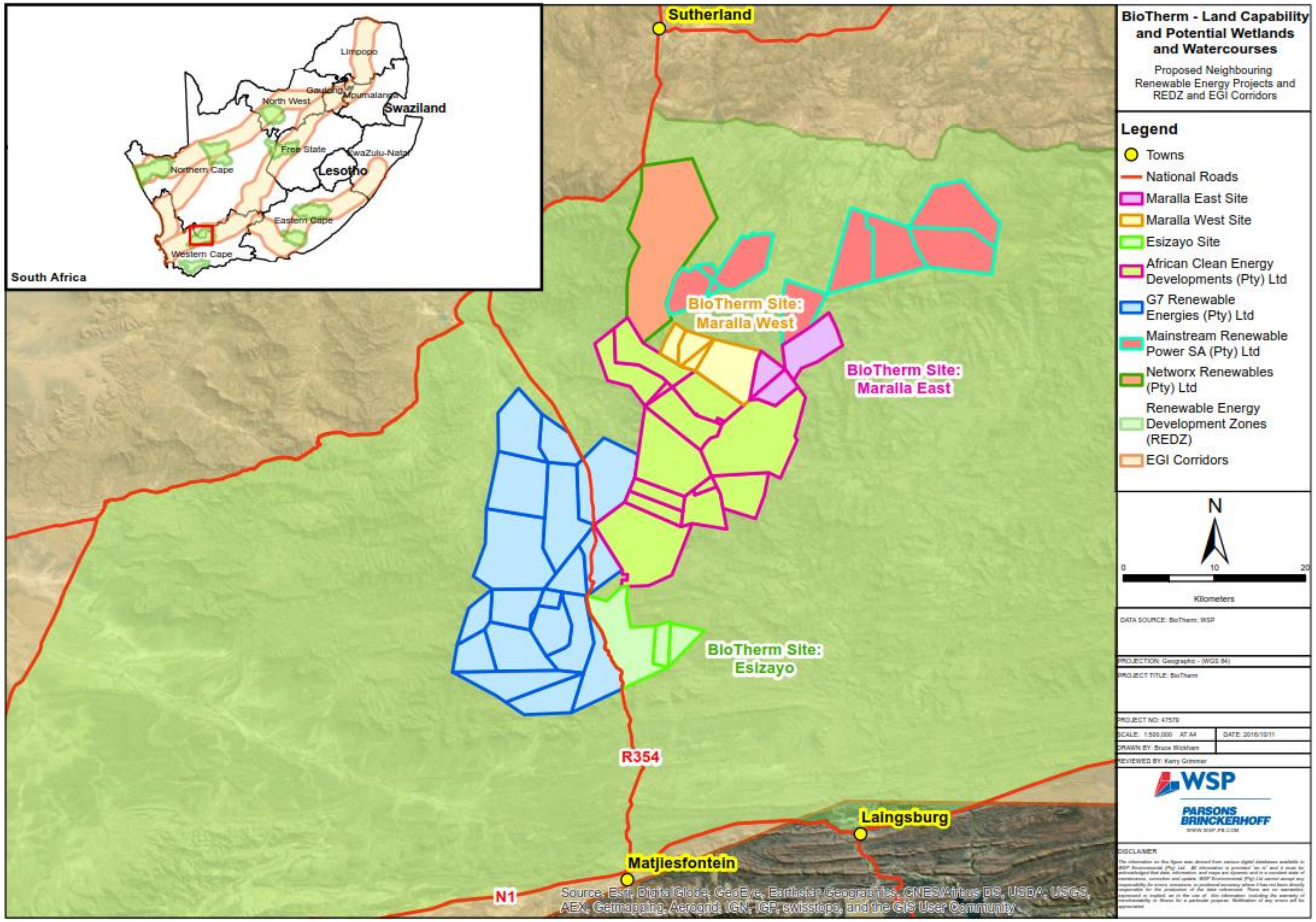

Figure 2: Proposed Neighbouring Renewable Energy Projects, REDZ and EGI

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The local natural environment within which the proposed Maralla East project is located is summarised in the following section. This will include the local hydrology, natural vegetation and land use, soil type and characterisation, and a simple geological description. This will serve as basic description of the present natural conditions in the area of the proposed Maralla East project.

3.1 HYDROLOGY

South Africa is divided into nine Water Management Areas (WMAs), where the proposed Maralla East wind power sites are situated in the Breede-Gouritz WMA 6 (**Figure 3**). The topography of the area comprises of mountainous hillslopes (part of the Roggeveld Mountain Range) with small patches of open rocky ground in between, and numerous watercourses and drainage channels. The hillslopes have an average gradient of 33.8 % and 1.2% on the open flat ground. The elevation of the Maralla East Site ranges from 1 103 m to 1 596 m above mean sea level (amsl) (**Figure 4**).

The Maralla East Site lies within tertiary catchment J11, in the quaternary J11A (**Figure 4**). The J11A quaternary hydrological characteristics are summarised in **Table 7**, including catchment area, Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) and Mean Annual Runoff (MAR). The MAE largely exceeds the MAP, reinforcing the arid conditions of the region.

Table 7: Quaternary J11A Catchment Hydrological Characteristics

QUATERNARY	CATCHMENT AREA (km^2)	MAP (mm)	MAE (mm)	MAR (million m^3/a)
J11A	438	295	1965	5.86

Source: WRC/DWA, 2012

Upon the site visit, there were several watercourses/drainage channels present within the Maralla East Site, the main river being the Kamberg which runs through the site (**Figure 4**). However, a few of the watercourses that were visited within the site were dry and only the Kamberg River exhibited small pools of water at intermittent section along the watercourse. Given the arid climatic condition of the region, majority of the watercourses are ephemeral and are likely to only convey water during infrequent high rainfall events.

Figure 3: Location of BioTherm Sites In Relation to New WMA

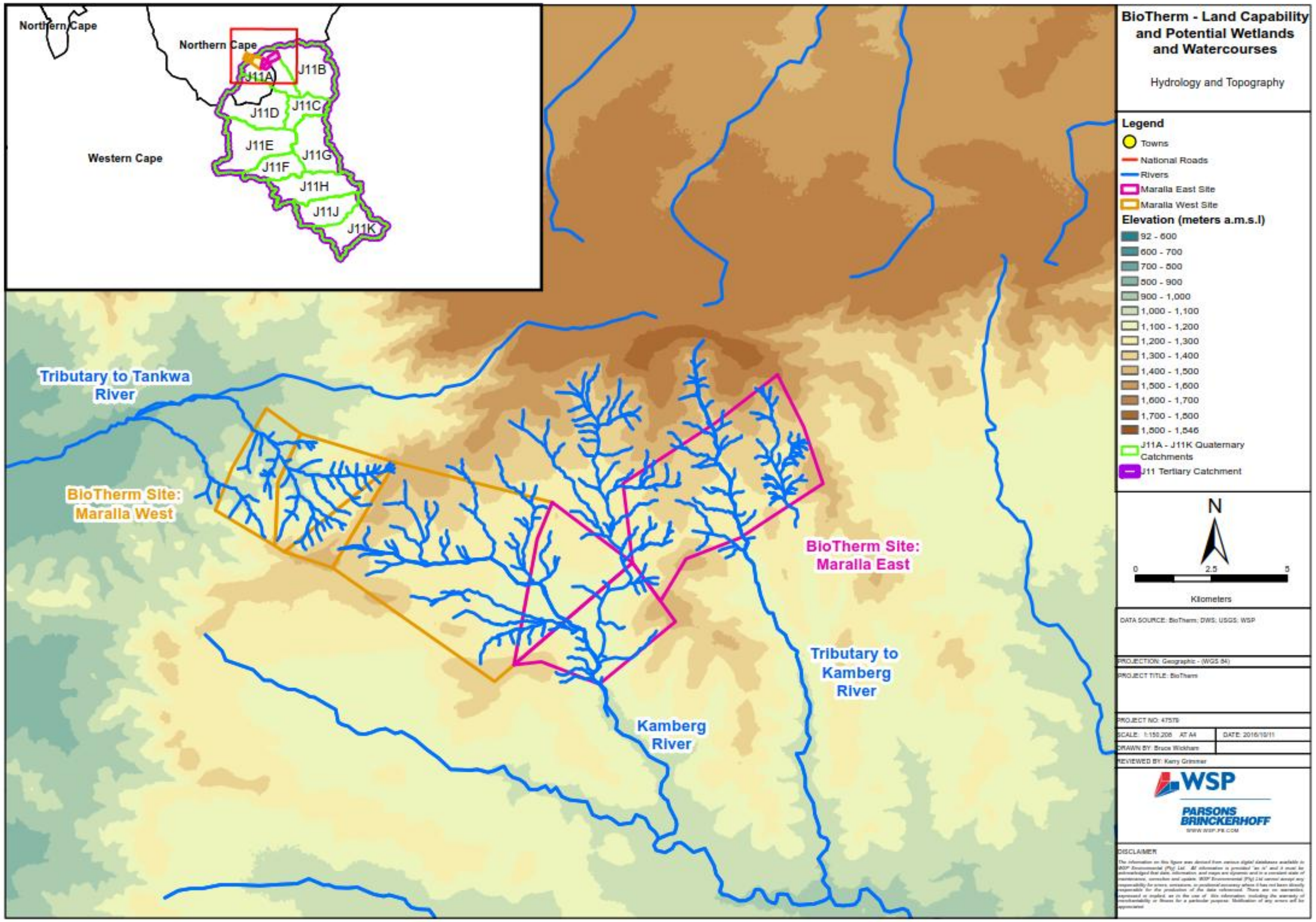

Figure 4: Local Hydrology and Topography

3.2 VEGETATION AND LAND USE

Based on the Mucina and Rutherford (2006) natural vegetation classification map, the area of proposed BioTherm wind power project is mostly Central Mountain Shale Renosterveld, with a minor contribution of Koedoesberge-Moordenaars Karoo and Tanqua Escarpment Shrubland (**Figure 5**). The Department of Agriculture, Forestry and Fisheries (DAFF) define the land use within the site, as predominantly Shrubland and Low Fynbos (DAFF, 2012) (**Figure 6**).

Upon the site visit, the vegetation was identified as mostly shrub-like vegetation and Fynbos (**Plate 1**), which is primarily used for sheep grazing. Indigenous antelope (Springbok) were also present within site boundary. There are additional surface features present in the Maralla East Site including telecommunication mast towers, windmill-driven boreholes and small farm reservoirs.

Beyond the Maralla East Site, additional land use activities identified during the site walkover included, sheep and small scale crop farming, and the Eskom Komsberg Sub-station, located approximately several km south of the site boundary.

3.3 SOILS AND GEOLOGY

Based on the information included in the land type maps of South Africa (AGIS, 2007) the soils in the region of the Maralla East Site are mostly as “Glenrosa and/or Mispha forms with lime generally present in the landscape” and “miscellaneous land classes, rocky areas with miscellaneous soils” (**Figure 7**).

The general geological description of the area is based on the 1:1 000 000 geological map for Northern Cape Province, published by the Trigonometrical Survey Office in 1970 (Schifano *et.al*., 1970). The Maralla East Site is nested in the Roggeveld Mountains range, in the Larger Cape Fold belt system. The site is located on the Beaufort Series which forms part of the Karoo system (**Figure 8**). The rock type for the series comprises of shale, mudstone, sandstone and limestone (Schifano *et al*., 1970). Upon the site visit, it was observed that shale and mudstone were the dominant rock type for the area.

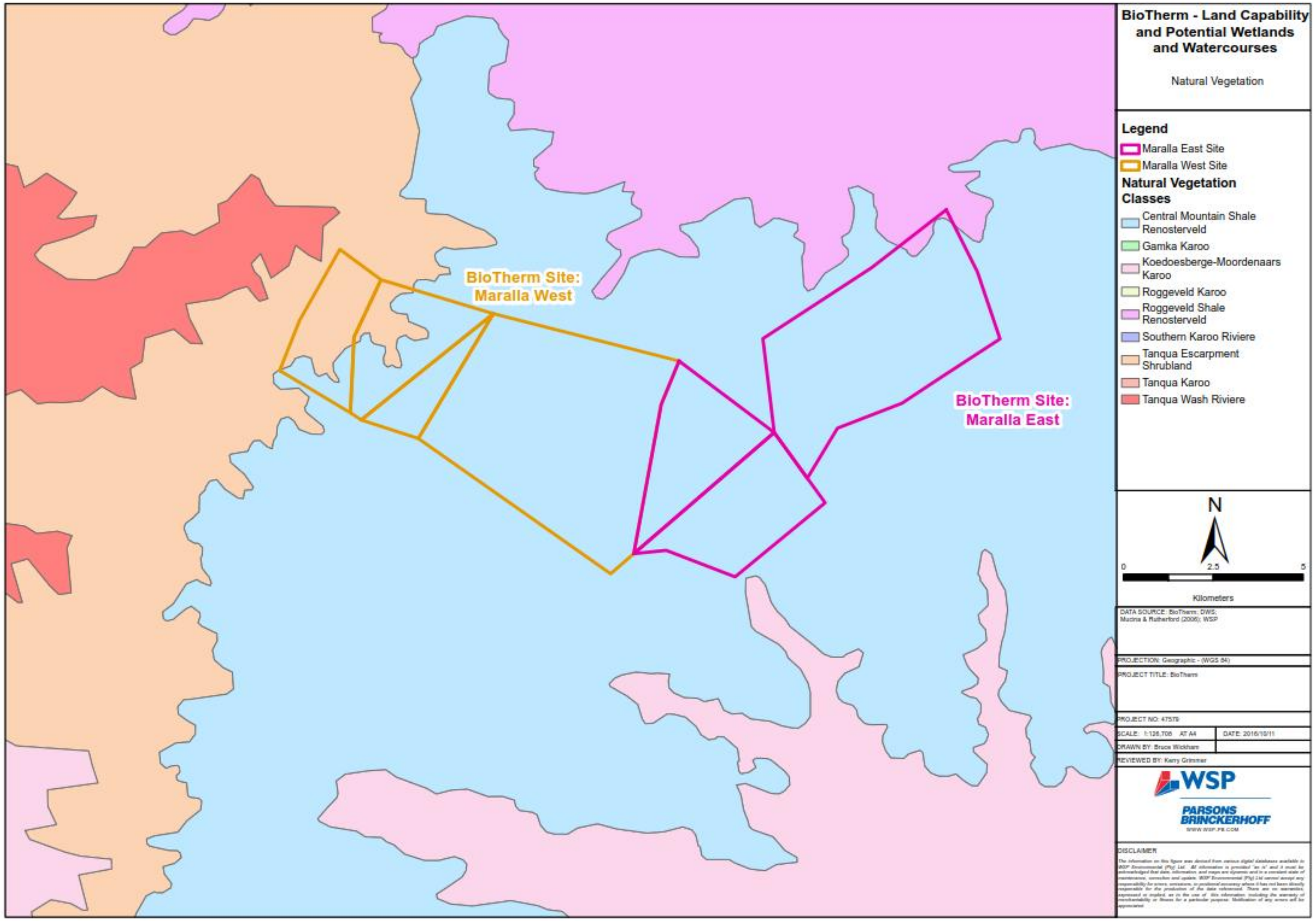

Figure 5: Local Natural Vegetation

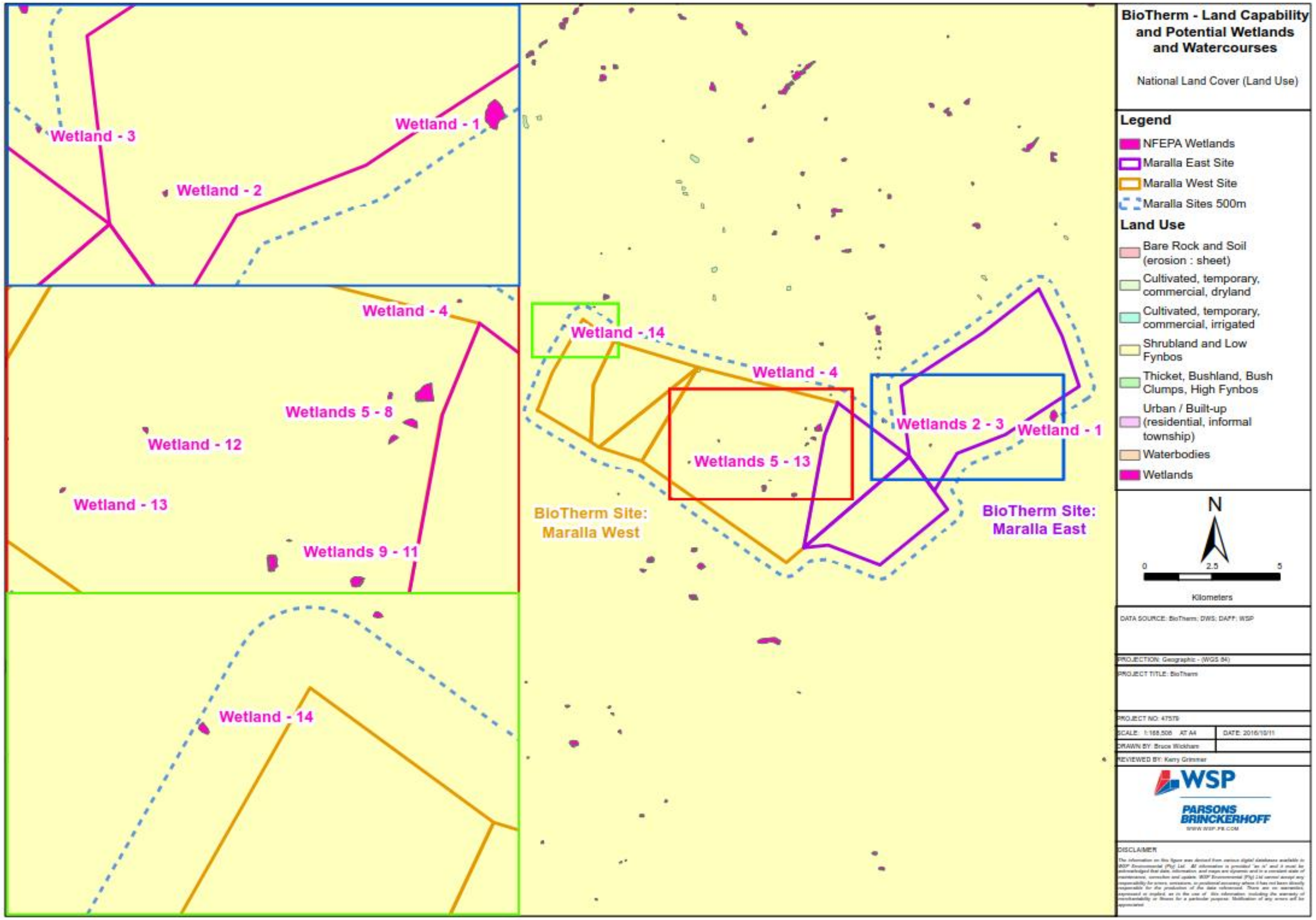

Figure 6: Local Land Cover (Land Use)

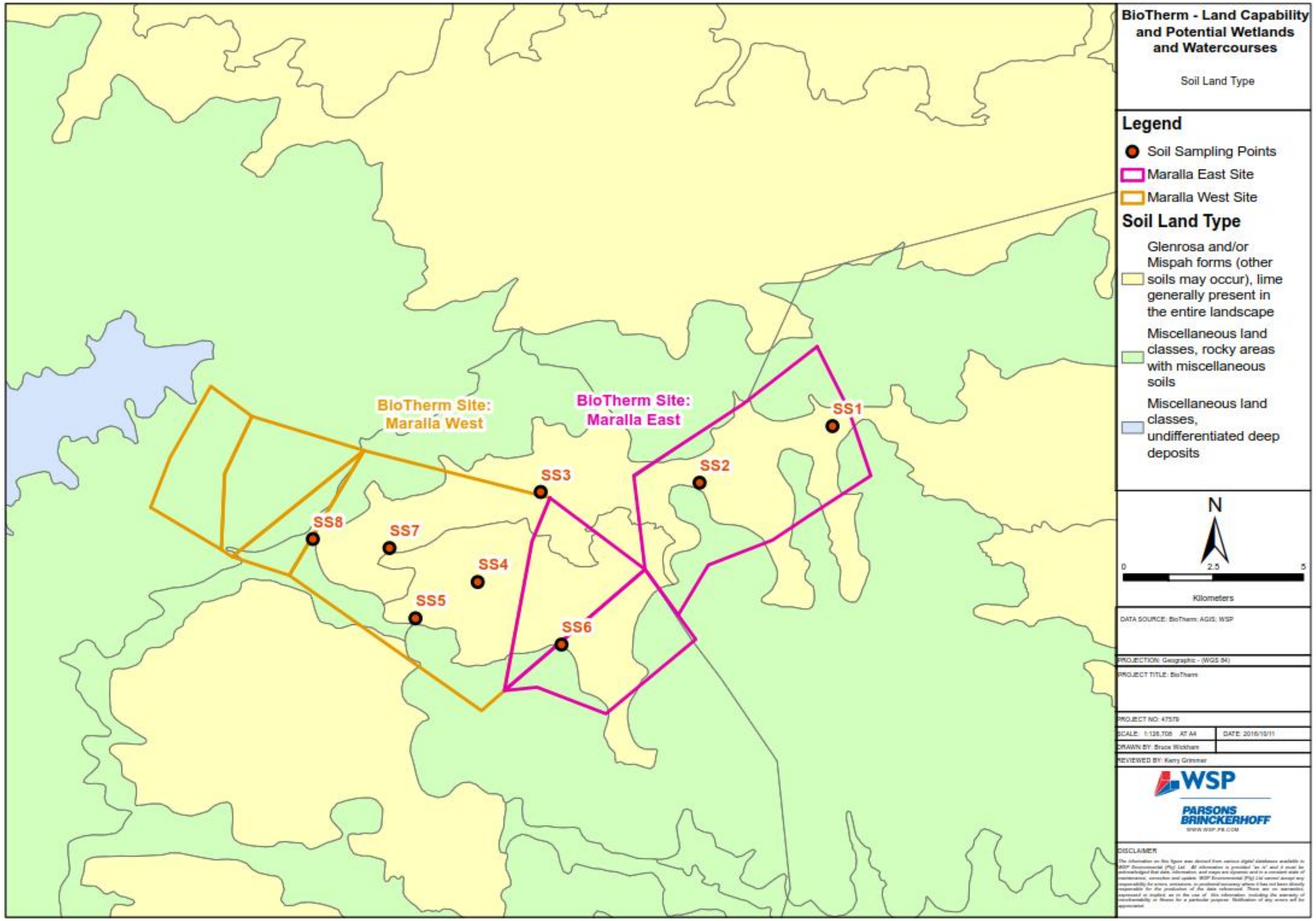

Figure 7: Local Soil land Type and Soil Sampling Locations

Figure 8: Local General Geology

4 FINDINGS – MARALLA EAST SITE

To ascertain the characteristics of the soils across the site, soil samples were obtained from eight locations (i.e. SS1 – SS8) (**Figure 8**). The location of the soil sampling points was determined from interpreting the soil land type map for the area as well as on-site observation for changes in the topography and land feature which might induce a change in the soil type.

At each location, the soil depth and diagnostics horizons were identified, and a sample was collected for chemical and physical analyses in a suitable soil laboratory (**Appendix A**). For practical reasons, soil samples that were collected (within 0.3m depth) in a similar setting and had the same soil family, were composited to provide representative samples for the area (**Table 8**). The characteristics of the soil samples and profiles are described in **Table 9**. Based on the *Taxonomic Soil Classification System for South Africa* (Macvicar, 1991) majority of the soil samples were classified as Mispha soil form (**Plate 3**). The soil samples collected in a dry river bed were classified as fine-grained alluvial soils (**Plate 4**), while those from the Depressional Pans were identified as Prieska form (**Plate 5**).

Table 8: Representative Soil Samples

REPRESENTATIVE SOIL SAMPLE	MIX SOIL SAMPLES
1	SS6
2	SS3 + SS5 + SS7 + SS8
3	SS1 + SS2 + SS4

According to DAFF Agricultural Geo-Referenced Information System (AGIS, 2007), the land capability within the Maralla East Site is evenly distributed between non-arable with a low potential for grazing (on the low relief, flatter areas) and Wilderness (on the high relief/steep slopes) (**Figure 9**). These two groups correlate to classes VII and VIII from the 8-class land capability system described in Klingebiel and Montgomery (1961), including:

- VII: Severe limitations that make the land unsuited to cultivation and restrict its use largely to grazing, woodland or wildlife. Restrictions are more severe than those for Class VI due to one or more limitations which cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soil, salts or sodicity (amount of sodium held in a soil) and unfavourable climate.
- VIII: Limitation that preclude its use for commercial plant production and restrict its use to recreation, wildlife, water supply, or aesthetic purposes; limitations that cannot be corrected may result from the effects of one or more of erosion or erosion hazard, sever climate, wet soil, stones, low water-holding capacity, salinity or sodicity.

Table 9: Soil Sample Characteristics

CHARACTERISTIC	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8
Soil Form	Prieska	Prieska	Mispah	Prieska	Mispah	Fine alluvial soil	Mispah	Mispah
Profile Depth (m)	Hardpan Horizon at 0.2	Hardpan Horizon at 0.2	0.31	Hardpan Horizon at 0.2	0.15	0.41	0.15	0.16
Dry Colour*, mottling and gleying	Pale yellow Hue 2.5Y Value 7 Chroma 3	Pale yellow Hue 2.5Y Value 7 Chroma 3	Pale yellow Hue 5Y Value 8 Chroma 3	Pale yellow Hue 2.5Y Value 7 Chroma 3	Pale yellow Hue 5Y Value 8 Chroma 3	Pale yellow Hue 2.5Y Value 8 Chroma 4	Pale yellow Hue 5Y Value 8 Chroma 3	Pale yellow Hue 5Y Value 8 Chroma 3
Subjective moisture	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Effective rooting depth- Grasses (m)	0.05	0.05	0.05	0.05	0.05	-	0.05	0.05
Effective rooting depth - Shrubs (m)	0.2	0.2	0.2	0.2	0.2	-	0.2	0.2
Soil structure	Hardpan	Hardpan	Subangular blocky structure	Hardpan	Subangular blocky structure	Single grain/ structureless	Subangular blocky structure	Subangular blocky structure
Presence of rocks, pedocretes, calcareousness	-	-	Rocks	-	Rocks	-	Rocks	Rocks
pH	5.3	5.3	5.5	5.3	5.5	5.8	5.5	5.5
Electrical conductivity (mS/m)	42.3	42.3	11.3	42.3	11.3	18.6	11.3	11.3
Exchangeable sodium (%)	4.6	4.6	1.3	4.6	1.3	6.3	1.3	1.3
Sand (S) Silt (Si) & Clay (C) (%)	48(S); 30(Si); 22(C)	48(S); 30(Si); 22(C)	82(S); 12(Si); 6(C)	48(S); 30(Si); 22(C)	82(S); 12(Si); 6(C)	94(S); 4(Si); 2(C)	82(S); 12(Si); 6(C)	82(S); 12(Si); 6(C)
Texture**	Loam	Loam	Loamy-Sand	Loam	Loamy-Sand	Sand	Loamy-Sand	Loamy-Sand
Estimate permeability (m/d)***	0.01 – 0.1	0.01 – 0.1	1.0 – 3.0	0.01 – 0.1	1.0 – 3.0	1.6 – 6.0	1.0 – 3.0	1.0 – 3.0
Erodibility K factor #	42	42	60	42	60	30	60	60

Sources:

** Colour based on the revised Standard Soil Colour Chart (Fujihara Industry Co.,2001)*

*** Texture based upon the United States Department of Agriculture (USDA) Soil texture triangle and grain size*

**** Estimate Permeability based upon soil structure and texture (van der Molen et. al., 2007)*

 # Erodibility K factor Estimated from the soil erodibility nomograph of Wischmeier, Johnson and Cross (1971)

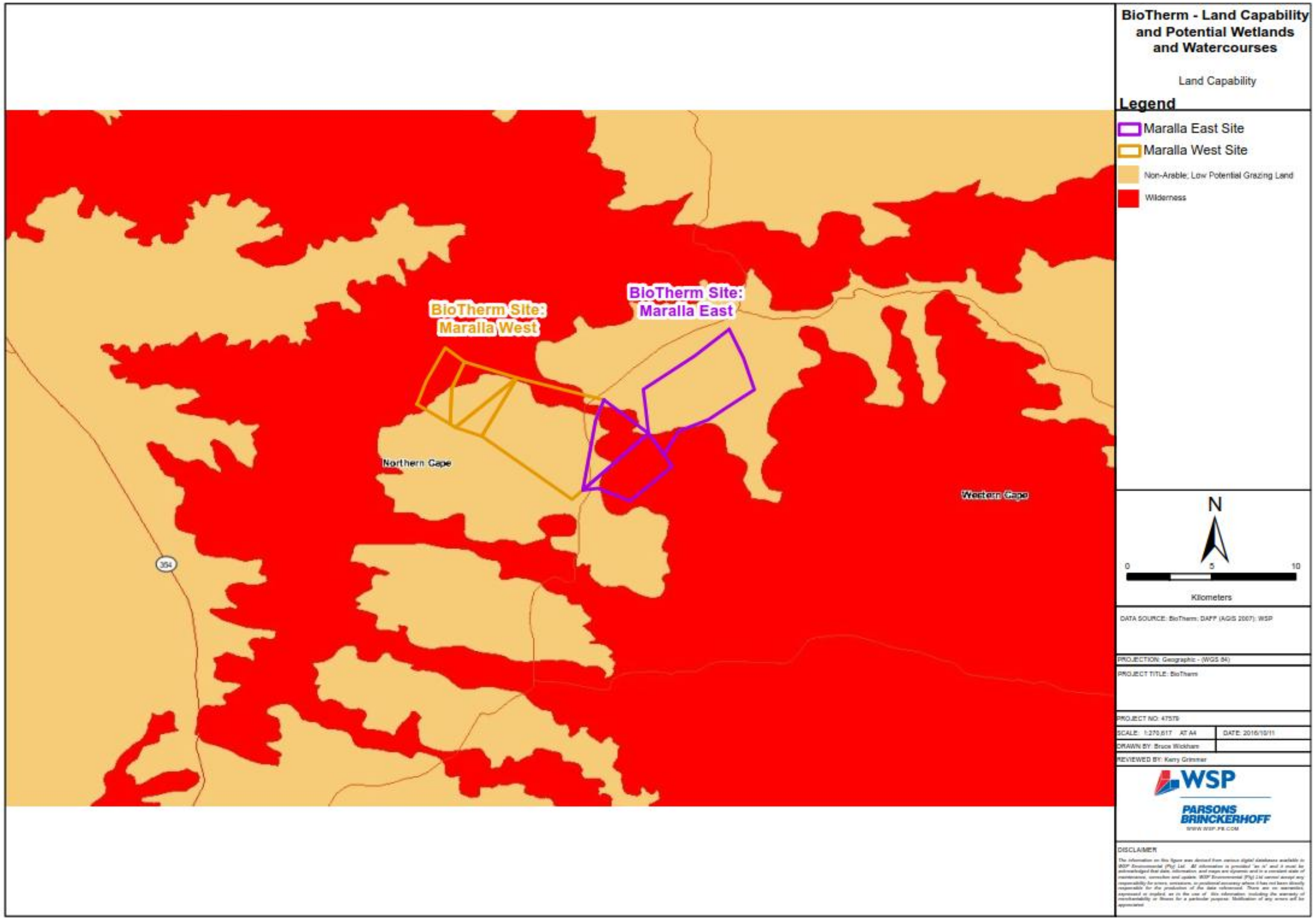

Figure 9: Local Land Capability

Based on the Land Capability Classification described in the Chamber of Mines Guidelines the land capability within the Maralla East Site is classified as *Class 3: Grazing Land*, for the following reasons:

- While there are wetlands identified within the Maralla East Site during the site walkover, collectively these surface features occupy a small portion of the total areas of the site. Thus the site in its entirety is not classified as a wetland as per the land capability classification;
- The soils are predominately shallow (average 0.2m, excluding the fluvial soil profiles). Thus by definition of the Chamber of Mines classification, it is not an arable land;
- The product of the slope (in percent) and erodibility factor (K) in the site is not less than 2 (the lowest value is 30). Thus by definition of the Chamber of Mines Guidelines, it is not arable land;
- While there are a limited minor portions of land that is cultivated, and only a few are irrigated (**Plate 2**), the collective area of these cultivated areas occupy a small portion of the total areas of the site. Thus the site in its entirety is not arable land; and
- It meets all the requirements for Class 3: Grazing Land

5 ASSESSMENT OF IMPACTS

The impacts identified for the Maralla East Site are assessed in the section that follows. The methodology for defining the significance of the respective impacts is described in section 1.2 of this report. The impacts will be assessed for the construction, operational and de-commissioning phases of the project.

A cumulative impact assessment was also conducted for the neighbouring BioTherm sites and adjacent renewable energy projects. This section will provide a summary of the findings from the significance rating tables used for each impact. The process for determining the relevant significances of each impact for the various phases of the project is provided in **Appendix B**.

5.1 CONSTRUCTION PHASE

The anticipated impacts for the Maralla East Site during the construction phase of the project are summarised in **Table 10**. The impacts summarised below are relevant to the land capability status of the affected area.

Table 10: Construction Phase Impacts

ACTIVITY	POTENTIAL IMPACT
Site preparation and construction of wind turbine facility and associated infrastructure.	Loss of grazing land current utilised for grazing mostly sheep farming, cattle farming and indigenous antelope.
	Loss of aesthetical value of the natural landscape.
	Increased potential of soil erosion due to vegetation clearance, soil disturbance and a high traffic movement on site.
	Potential land contamination from hazardous substances. This includes spillage of concrete onto soil surface, as well as oils, fuel, grease (from construction vehicles) and sewage from temporary on-site ablution facilities.

There are no fatal flaws identified for the construction phase associated with the proposed Maralla East project. The loss of grazing land is a negative impact and was assigned a low environmental significance rating score, after mitigation measures. This impact is unavoidable given the fact that during the construction phase the project will physically occupy portions of the land located within the project footprint. The low rating is under the assumption that farming practices may continue in and around the turbines during the operational phase. Potential impacts of soil erosion and spillage of hazardous substances were both classified with a low environmental significance, before and after mitigation measures, due to the lower probability of significant erosion or spills occurring. The other identified impacts (i.e. soil erosion and spillage of hazardous substances) were classified as negative impacts, but had a low environmental significance rating before and after mitigation measures.

5.2 OPERATIONAL PHASE

The anticipated impacts for the Maralla East Site during the operational phase of the project are summarised in **Table 11**. The impacts summarised below are relevant to the land capability status of the affected area.

Table 11: Operational Phase Impacts

ACTIVITY	POTENTIAL IMPACT
Day-to-day operational activities during the normal functioning of the wind turbine facility, including maintenance.	Loss of grazing land current utilised for mostly sheep farming, cattle farming and indigenous antelope.
	Loss of aesthetical value of the natural landscape.
	Increased potential of soil erosion due to vegetation clearance, and more run-off from harden surfaces (i.e. roads).
	Potential land contamination from hazardous substances. This includes spillage of oils, fuel, grease (from site operational and maintenance vehicles) and permanent onsite sewage systems.

Similar to the construction phase, there were no fatal flaws identified during this phase of the project. The loss of grazing land was assigned a medium environmental significance rating, however this negative impact is unavoidable given the fact that the powerline and substation infrastructure will permanently occupy a portion of the land within the proposed project footprint. With mitigation measures in place, this impact was brought down to a low environmental significance. The low rating is under the assumption that farming practices may continue in and around the turbines during the operational phase. The other negative impacts of potential soil erosion and spillage of hazardous substances were assigned a low environmental significance before and after mitigation measures, due to the majority of the risk/impact being isolated to the construction phase (therefore short term) and the lower probability of significant erosion or spills occurring.

5.3 DECOMMISSIONING PHASE

The anticipated impacts for the Maralla East Site during the operational phase of the project are summarised in **Table 12**. The impacts summarised below are relevant to the land capability status of the affected area.

Table 12: De-commissioning Phase Impacts

ACTIVITY	POTENTIAL IMPACT
De-commissioning of the wind turbine facility.	Increased potential of soil erosion due to removal of wind turbine infrastructure, soil disturbance and a high traffic movement on site.
	Potential land contamination from hazardous substances. This includes spillage of oils, fuel, grease (from construction vehicles) and sewage from on-site systems.

The decommissioning phase exhibited the lowest environmental significance rating scores for the associated impacts of the proposed Maralla East project. There were no fatal flaws identified during this phase of the project. The potential for soil erosion and spillage of hazardous substances were classified as a low environmental significance rating before and after mitigation measures.

5.4 CUMULATIVE IMPACTS

There are a number of Environmental Authorisations (EA) (either issued or in process) in the area surrounding the Proposed Project site. It must be stressed that the fact that there are several approved EA surrounding the site does not equate to actual 'development'. The surrounding projects, except for the Preferred Bidders, are still subject to the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bidding process like the Maralla project.

In addition to the Maralla East Site, the proposed BioTherm project includes two additional wind sites (viz. Esizayo and Maralla West) and four separate proposed renewable energy projects located within a 100 km radius from the centroid of the BioTherm sites (**Figure 2**). While an in-field site walkover in all these neighbouring projects is beyond the scope of this report, a high level desktop assessment was performed. The desktop review of the proposed neighbouring projects (Including BioTherm sites) is summarised in **Table 13**.

The renewable energy projects that have received Environmental Authorisation were investigated to determine any identified potential impacts on land capability. These individual impacts were tabulated and assigned a significance rating (Low to High) which allowed for the cumulative assessment of these impacts on the landscape. Overall the cumulative impact of the proposed Maralla East Site is deemed to be of 'Low' significance (**Appendix C**).

There was no fatal flaw identified for the cumulative impacts for the proposed Maralla East Site. The assessment of these potentially affected ecological features within the four neighbouring renewable energy developments is beyond the scope of this study, and will require an individual assessment for the respective projects in their own scoping and EIA studies. It is assumed that the impacts during the construction, operational and de-commissioning phases are expected to be the same as those summarised above for the Maralla East Site.

The loss of grazing land is unavoidable and was initially assigned a medium environmental significance, which can be reduced to low with the implementation of mitigation measures (i.e. keep the affected area to a minimal during the construction, operational and decommissioning phases). This is under the assumption that farming practices may continue in and around the turbines during the operational phase. Potential impacts of soil erosion and spillage of hazardous substances were both classified with a low environmental significance, before and after mitigation measures, due to the majority of the risk/impact being isolated to the construction phase (therefore short term) and the lower probability of significant erosion or spills occurring.

6 MITIGATION AND MANAGEMENT MEASURES

The potential impacts identified in Section 5 of this report, have been assessed with and without mitigation and management measures. These mitigation and management measures are summarised in **Table 14**, for the construction, operation and decommissioning phases of the project.

The same mitigation and management measures are proposed for the cumulative impacts identified in the previous section, however the responsible person may differ according to the renewable energy project developer.

Table 13: Neighbouring Renewable Energy Projects Comparison

Energy Entity	Renewable Energy Technology	Footprint (km^2)	Parent Farm Properties	Towns Intersected
Esizayo	Wind	61.0	à Aurora 285 à Aanstoot 1/72 à Joseph's Kraal 84	None
BioTherm Maralla West	Wind	51.62	à RE/180 Drie Roode Heuvels à RE/181 Annex Drie Roode Heuvels à 1/182 Wolven Hoek à 2/182 Wolven Hoek	None
Networx Renewables (Pty) Ltd	Unknown	118.00	à Brand Hoek 176 à De Kruis 153	None
Mainstream Renewable Power SA (Pty) Ltd	Unknown	199.12	à 1/178 Van Wyks Kraal à 2/178 Van Wyks Kraal à 6/152 Tonteldoosfontein à 1/152 Tonteldoosfontein à 1/179 Schietfontenin	None
African Clean Energy Developments (Pty) Ltd	Unknown	332.28	à Zwanepoelshoek 184 à Leeuwe Hoek 183 à Orange Fontein 185 à Orangie Fontein 203 à 2/203 Orangie Fontein à 3/203 Orangie Fontein à 4/203 Orangie Fontein à Kentucky 206 à 1/207 Volvenkop à De Hoop 202 à Rheebokke Fontein 209 à 1/209 Rheebokke Fontein à Standvastigheid 210	None

ENERGY ENTITY	RENEWABLE ENERGY TECHNOLOGY	FOOTPRINT (KM^2)	PARENT FARM PROPERTIES	TOWNS INTERSECTED
G7 Renewable Energies (Pty) Ltd	Unknown	449.83	à RE/188 Wilgebosch Rivier à RE/200 Karree Bosch à Appels Fontein 201 à Ek Kraal 199 à Klipbanks Fontein 198 à Riet Fontein 197 à Bon Espirange 73 à Fortuin 74 à RE/284 à Hartjies Kraal 77 à Barendskraal 76 à Brandvalley 75 à Kabeltouw 160	None

Table 14: Mitigation and Management Measures for Potential Impacts

ACTIVITY	MITIGATION AND MANAGEMENT MEASURE	RESPONSIBLE PERSON	APPLICABLE DEVELOPMENT PHASE	INCLUDE AS CONDITION OF AUTHORISATION	MONITORING REQUIREMENTS
Loss of land previously used for sheep, cattle and antelope grazing will be occupied by the powerline and substation infrastructure.	Areas of construction should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum.	Site construction managers (BioTherm contractors)	Construction and Operational	Yes – activity has been assigned a medium environmental significance during the operational phase	A site compliance audit should be conducted (1) prior to construction, (2) during construction on a monthly basis and (3) after rehabilitation measures have been implemented.
Increased potential for soil erosion (especially wind driven) due to vegetation clearance, soil disturbance and high traffic movement on site.	Areas of construction should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of construction vehicles should be kept to a minimum to reduce soil compaction, and limited to existing or proposed roadways where practical. Soils excavated during construction of the facility should be appropriately stored in stockpiles which are protected from erosion (wind and water) (i.e. through use of vegetation cover in the case of long-term stockpiles- this should form part of the rehabilitation process after the construction phase). Wind erosion is dominant for the region. Water erosion action is considered limited, however backfilling with soil and use of gabions or Reno Mattresses should be used where evidence of erosion is present.	Site construction managers (BioTherm contractors)	Construction, Operational and Decommissioning	No – activity has been assigned a low environmental significance during the construction phase	A site compliance audit should be conducted (1) prior to construction, (2) during construction on a monthly basis and (3) after rehabilitation measures have been implemented.
Potential spillage of hazardous substances such as oils, fuel, grease from construction and operational vehicles, and sewage from on-site sanitation systems	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and proper upkeep of machinery and vehicles. A complete spill kit must be onsite at all times.	Site construction managers (BioTherm contractors)	Construction, Operational and Decommissioning	No – activity has been assigned a low environmental significance during the construction, operational and decommissioning phases	A site compliance audit should be conducted (1) prior to construction, (2) during construction on a monthly basis and (3) after rehabilitation measures have been implemented.

7 STAKEHOLDER CONSULTATION

7.1 STAKEHOLDER CONSULTATION PROCESS

Public participation is a requirement of the S&EIR process; it consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIR decision-making process. Effective public participation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the Proposed Project.

A comprehensive stakeholder consultation process was undertaken during the scoping phase. Stakeholders were identified through existing databases, site notices, newspaper adverts and meetings. All stakeholders identified to date have been registered on the project database. All concerns, comments, viewpoints and questions (collectively referred to as 'issues') received to date have been documented and responded to in a Comment and Response Report.

There will be ongoing communication between WSP | Parsons Brinckerhoff and stakeholders throughout the S&EIR process.

7.2 STAKEHOLDER COMMENTS AND RESPONSE

No comments relating directly to land capability have been received to date. Any stakeholder query or comment relating to land capability may be responded to when received.

8 CONCLUSION

The land capability of the proposed Maralla East Site is defined as non-arable with a low potential for grazing. Grazing activities (mainly sheep) are the dominant land use for the region and has the largest potential to be impacted by the activities of the proposed Maralla East project. Indirect impacts of increased soil erosion are expected at the site given the dry, fragile environment of the region. Furthermore, spillage of hazardous substances onto the land as a result of the activities of the Maralla East project, is a possibility. However, all these potential impacts on the current land capability for the area were classified with a low environmental significance risk, should the appropriate mitigation measure be followed during the construction, operational and decommissioning phases of the project.

There are no fatal flaws anticipated for the proposed Maralla East project, from a land capability perspective. It is recommended that the mitigation and management measures outlined in this report be followed throughout all phases of the project.

9 PLATES

Plate 1: Natural vegetation with grazing sheep

Plate 2 : Irrigated cultivated grazing land

Plate 3: Rocky/shale" Mispha soil form

Plate 4: Singular fine-grained fluvial soil

Plate 5: Prieska soil form

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Appendix A

SGS LABORATORY SOIL ANALYSIS REPORT

LABORATORY REPORT FOR SOIL ANALYSIS

REG No. 1949/032643/07 VAT REG No. 4560117428

COMPANY: WSP ENVIRO
ADDRESS:
ADDRESS:
TEL/FAX:
REF: 229418

NAME: BRUCE WICKHAM
FARM: SUTHERLAND
DISTRICT:
DATE: 22/032016
REP:

Building H1
AECI-site
De Beers Avenue
Somerset West
Tel: (021) 852 7899

Lab Nr.	Ref.	Camp	Depth	pH	P	K	Ca	Mg	Na	K	Ca	Mg	Na	K	Ca	Mg	Na	KCl (H^+)	Ca:Mg	(Ca+Mg)/K
				KCl	Bray 1 mg/kg	Amm Acetate mg/kg				%				meq = cmol(+)/kg					Norms	
																			1.5 - 4.5	10 - 20
C16-072-37	1	SSAM1		5.8	5	105	608	166	72	5.4	61.0	27.3	6.3	0.27	3.04	1.37	0.31	0.00	2.2	16.4
C16-072-38	2	SSAM2		5.5	8	163	1090	205	23	5.5	71.3	22.0	1.3	0.42	5.45	1.69	0.10	0.00	3.2	17.1
C16-072-39	3	SSAM3		5.3	7	187	1534	465	134	3.8	61.2	30.4	4.6	0.48	7.67	3.83	0.58	0.00	2.0	24.0
C16-072-40	4	SSAE1		6.3	5	210	990	233	21	7.2	66.1	25.5	1.2	0.54	4.95	1.92	0.09	0.00	2.6	12.8
C16-072-41	5	SSAE2		6.6	8	272	1139	196	37	8.5	69.8	19.7	2.0	0.70	5.70	1.61	0.16	0.00	3.5	10.5
C16-072-42	6	SSAE3		5.5	29	162	1782	518	132	2.9	63.0	30.0	4.1	0.42	8.91	4.26	0.57	0.00	2.1	31.8

LABORATORY REPORT FOR SOIL ANALYSIS

REG No. 1949/032643/07 VAT REG No. 4560117428

SGS ser

COMPANY: WSP ENVIRO
ADDRESS:
ADDRESS:
TEL/FAX:
REF: 229418

Lab Nr.	Ref.	Camp	Mg:K 3 - 4	Acid Sat %	S-Value cmol(+)/kg	T-Value cmol(+)/kg	Base Sat %	EC mS/m	Clay Hydrometer %	Silt Hydrometer %	Sand Hydrometer %	Density g/cm^3
C16-072-37	1	SSAM1	5.1	0.00	5.0	5.0	100.00	18.6	2	4	94	1.500
C16-072-38	2	SSAM2	4.0	0.00	7.6	7.6	100.00	11.3	6	12	82	1.480
C16-072-39	3	SSAM3	8.0	0.00	12.5	12.5	100.00	42.3	22	30	48	1.344
C16-072-40	4	SSAE1	3.6	0.00	7.5	7.5	100.00	13.9	6	20	74	1.454
C16-072-41	5	SSAE2	2.3	0.00	8.2	8.2	100.00	22.2	6	12	82	1.471
C16-072-42	6	SSAE3	10.2	0.00	14.1	14.1	100.00	39.4	20	22	58	1.369

Appendix B

ENVIRONMENTAL SIGNIFICANCE FOR EACH IMPACT

BioTherm Energy - Maralla East (Land Capability)

{insert specialist filed here}

Significance Rating Table

Construction Phase									
Maralla East									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Loss of land previously used for sheep and antelope grazing will be occupied by the wind facility and associated infrastructure	Nature of impact:	Direct							
	Without Mitigation	2	2	6	5	50	Medium	-	Medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of construction should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum.							
	With Mitigation	1	2	4	4	28	Low	-	Medium
Construction activities will entail vegetation clearance, soil disturbance and high traffic movement on site, resulting in a higher potential for soil erosion	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	2	4	3	24	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of construction should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of construction vehicles should be kept to a minimum to							
	With Mitigation	1	2	2	2	10	Low	-	Medium
	Nature of impact:	Indirect							
	Without Mitigation	2	2	2	2	12	Low	-	Medium

Potential spillage of hazardous substances such as oils, fuel, grease from construction vehicles, and sewage from on-site sanitation systems	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and proper							
	With Mitigation	1	2	0	1	3	Low	-	Medium
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							

Maralla East - No-Go

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)	Status (+ve or -ve)	Confidence
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							

	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Maralla East (Land Capability)

{insert specialist filed here}

Significance Rating Table

Operational Phase										
Maralla East										
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Loss of land previously used for sheep and antelope grazing will be occupied by the wind facility and associated infrastructure	Nature of impact:	Direct							
	Without Mitigation	2	4	6	5	60	Medium	-	Medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Infrastructure of the wind facility should be limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum.							
	With Mitigation	1	4	2	4	28	Low	-	Medium
Vegetation clearance for wind turbines and roads, soil disturbance and stockpiles, and increased traffic movement on site, resulting in a higher potential for soil erosion	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	4	4	3	30	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of disturbance should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of maintenance vehicles should be kept to a minimum to							
	With Mitigation	1	4	2	2	14	Low	-	Medium

Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems	Nature of impact:	Indirect							
	Without Mitigation	2	4	2	2	16	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and							
	With Mitigation	1	4	2	1	7	Low	-	Medium
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							

Maralla East - No-Go

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)	Status (+ve or -ve)	Confidence
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							

	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Maralla East (Land Capability)

{insert specialist filed here}

Significance Rating Table

Decommissioning Phase									
Maralla East									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Increased potential of soil erosion due to removal of wind infrastructure (i.e. turbines), soil disturbance and a high traffic movement on site.	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	2	4	3	24	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of disturbance should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of de-construction vehicles should be kept to a minimum							
	With Mitigation	1	2	2	2	10	Low	-	Medium
Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems	Nature of impact:	Indirect							
	Without Mitigation	2	2	2	2	12	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and							
	With Mitigation	1	2	0	1	3	Low	-	Medium

	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

Maralla East - No-Go

Potential Impact	Mitigation	Extent	Duration	Magnitude	Probability	Significance		Status	Confidence

Potential impact	Mitigation	(E)	(D)	(M)	(P)	(S=(E+D+M)*P)		(+ve or -ve)	confidence
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Maralla East (Land Capability)

{insert specialist filed here}

Significance Rating Table

Cumulative Impacts									
Maralla East									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Loss of land previously used for sheep and antelope grazing will be occupied by the wind facility and associated infrastructure	Nature of impact:	Direct							
	Without Mitigation	2	4	6	5	60	Medium	-	Low
	degree to which impact can be reversed:	Medium							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Infrastructure for the different renewable power facility should be limited to the extent of the respective project footprints, and activities outside of the sites should be kept to a minimum. Special consideration should be given							
	With Mitigation	1	4	2	4	28	Low	-	Low
Vegetation clearance for wind turbines and roads, soil disturbance and stockpiles, and increased traffic movement on site, resulting in a higher potential for soil erosion	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	4	4	3	30	Low	-	Low
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of disturbance should be (where practical) limited to the extent of the respective project footprint, and activities outside of the site should be kept to a minimum. Traffic of maintenance vehicles should be kept to a							
	With Mitigation	1	4	2	2	14	Low	-	Low

Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems	Nature of impact:	Indirect							
	Without Mitigation	2	4	2	2	16	Low	-	Low
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and							
	With Mitigation	1	4	2	1	7	Low	-	Low
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							

Maralla East - No-Go

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)	Status (+ve or -ve)	Confidence
	Nature of impact:							

	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

Appendix C

CUMULATIVE IMPACT ASSESSMENT

BIOTHERM – CUMULATIVE ASSESSMENT

APPROACH

The Department of Environmental Affairs (DEA) has requested that a detailed cumulative assessment is undertaken for each of the proposed BioTherm projects. The cumulative assessment must take the specialist studies from the surrounding Environmental Authorisations into account.

In order to ensure that a consolidated cumulative assessment can be developed for each project, a template has been produced to ensure that the specialist studies across the disciplines utilise the same approach.

Each specialist discipline will be required to compile the table below and provide a qualitative discussion on the overall cumulative impact of the projects in the study area.

MASTER ASSUMPTIONS

The following assumptions and limitations have been identified in relation to the above approach:

- Due to the number of different significance rating methodologies utilised across the various projects, significance ratings have been simplified to include only Low, Medium and High ratings.
- In the event that specialist studies were unable to be obtained, this has been noted.
- Solar – All approved and ongoing environmental authorisations within a 70km radius above been considered
- Wind – All approved and ongoing environmental authorisations within an 80 radius above been considered

Table 1: Cumulative Impacts – Wind Soil & Land Capability

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation				Decommissioning				
							Agricultural potential loss	Soil erosion	Loss of agricultural land		Soil contamination	Soil erosion	Agricultural potential loss	Loss of agricultural land	Soil contamination				
Proposed 280 MW Gunstfontein Wind Energy Project	14/12/16/3/3/2/395	S&EIR	Networx Eolos Renewables (Pty) Ltd	12 000	280 MW														
Proposed development of renewable energy facility at the Sutherland site, Western and Northern Cape.	12/12/20/1782/AM1	S&EIR	Mainstream Power Sutherland	28 600	811 MW														
Proposed Hidden Valley Wind Energy Facility, Northern Cape	12/12/20/2370/2	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	9 530	150 MW		L	L			L								
Proposed Hidden Valley wind energy facility , Northern cape	12/12/20/2370/3	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	9 180	150 MW		L	L			L								
Proposed Hidden Valley wind energy facility , Northern cape	12/12/20/2370/1	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	16 620	150MW		L	L			L								
Proposed Hidden Valley wind energy facility , Northern cape	12/12/20/2370	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd		650 MW		L	L			L								
Proposed Construction Of The 140Mw Roggeveld Wind Farm Within The Karoo Hoogland Local Municipality Of The Northern Cape Province And Within The Laingsburg Local	12/12/20/1988/1/AM1	Amendment	G7 Renerable Energies (Pty) Ltd	26 529	140 MW		L	M	L			L	L	L	L				

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation				Decommissioning				
							Agricultural potential loss	Soil erosion	Loss of agricultural land		Soil contamination	Soil erosion	Agricultural potential loss	Loss of agricultural land	Soil contamination				
Municipality Of The Western Cape Province																			
Proposed Photovoltaic (PV) Solar Energy Facility On A Site South Of Sutherland, Within The Karoo Hoogland Municipality Of The Namakwa District Municipality, Northern Cape Province	12/12/20/2235	BAR	Inca Komsberg Wind (Pty) Ltd	2	10 MW														
Proposed establishment of the Suurplaat wind energy facility and associated infrastructure on a site near Sutherland, Western Cape and Northern Cape.	12/12/20/1583	S&EIR	Moyeng Energy (Pty) Ltd	28 600	120 MW														
Proposed establishment of the Witberg Bay wind energy facility, Laingsburg Local Municipality, Central Karoo District, Western cape	12/12/20/1966/A2	Amendment	Witberg Wind Power (Pty) Ltd		Unknown														
Proposed renewable energy facility at Konstabel	12/12/20/1787	S&EIR	South Africa Mainstream Renewable Power Development		170 MW														
Proposed development of a renewable Energy facility at Perdekraal, Western Cape - Split 1	12/12/20/1783/2/AM1	Amendment	South Africa Mainstream Renewable Power Development		Unknown														
Proposed Touwsrivier Solar energy facility	12/12/20/1956	S&EIR	Unknown	215	36 MW		L		L				L						
				Total Ha	**Total MW**														
				128 276	2667 MW														

PROPOSED DEVELOPMENT NAME	DEA REFERENCE	CURRENT EA STATUS	PROPONENT	EXTENT	PROPOSED CAPACITY	FARMS	IMPACTS												PROPOSED MITIGATION MEASURES
							Construction				Operation				Decommissioning				
							Agricultural potential loss	Soil erosion	Loss of agricultural land		Soil contamination	Soil erosion	Agricultural potential loss	Loss of agricultural land	Soil contamination				
Significance Totals per impact	Significance Rating						**Total Hectares per impact**												
	High Significance																		
	Medium Significance							26 529											
	Low Significance						62 074	35 330	26 744		35 330	26 529	26 744	26 529	26 529				
	Positive Impacts																		

The following EAs surrounding the solar developments have been either withdrawn or have lapsed and are therefore not been considered as part of the cumulative impact assessment:

PROPOSED DEVELOPMENT NAME	DEA REFERENCE	CURRENT EA STATUS	PROPONENT	EXTENT	PROPOSED CAPACITY	FARMS
Proposed wind energy facility near Komsberg, Western Cape	12/12/20/2228	S&EIR	Inca Komsberg Wind (Pty) Ltd		300 MW	
Proposed wind and solar project near Laingsburg, Western Cape	12/12/20/2328	S&EIR	Unknown		50 MW	