ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED CASTLE WIND ENERGY FACILITY NEAR DE AAR, NORTHERN CAPE PROVINCE

DEA REFERENCE NUMBER:

14/12/16/3/3/2/278

FINAL EIA REPORT

FOR SUBMISSION TO DEA

FEBRUARY 2015

Prepared for:

Castle Wind Farm (Pty) Ltd
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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/278
Title	:	Environmental Impact Assessment Process Draft Environmental Assessment Report: Proposed Castle Wind Energy Facility Near De Aar, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Karen Jodas Tebogo Mapinga John von Mayer
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Project Developer	:	Castle Wind Farm (Pty) Ltd (A juwi Renewable Energies (Pty) Ltd initiative)
Report Status	:	<u>Final Environmental Impact Assessment Report to DEA for review</u>
Submission Date	:	<u>February 2015</u>

When used as a reference this report should be cited as: Savannah Environmental (2015) Final Environmental Impact Assessment Report: Proposed Castle Wind Energy Facility near De Aar, Northern Cape Province

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Castle Wind Farm (Pty) Limited commissioned an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind farm on a site near De Aar in the Northern Cape Province. The project will be referred to as the "Castle Wind Energy Facility". The purpose of the proposed wind energy facility is to sell the electricity generated to Eskom under the Renewable Energy Independent Power Producers (IPP) Procurement Programme. The IPP Procurement Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities (derived from) by IPPs in South Africa. Castle Wind Farm has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

<u>The release of the Final EIA Report prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project, provided stakeholders with an additional opportunity (21 days) to verify that the issues they had raised to date have been captured and adequately considered within the study. This Final EIA Report has incorporated all issues and responses received throughout the EIA process. Any changes made from the Draft EIA Report to this Final EIA Report **have been underlined throughout** this Final EIA Report for ease of reference.</u>

EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

As outlined in the Acceptance of the scoping report dated 30 January 2014, Savannah Environmental has compiled a table (refer to Table 1 below) which outlines the requirements as well as where in the final EIR the requirements have been addressed for ease of reference.

TABLE 1: INFORMATION REQUESTED BY DEA

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
a)	i. All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the Draft Scoping Report and submitted as part of the FSR must be taken into consideration when preparing an environmental impact assessment report in respect of the proposed development. ii. Please ensure that all mitigation measures and recommendations in the specialist studies are addressed and included in the final EIAr and Environmental Management Programme (EMPr).	i. Refer to Chapter 6 ii. Refer Chapter 8,9,10 and Appendix Q (EMPr)
b)	i. Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final EIAr. This includes but not limited to the Northern Cape Department of Environmental Affairs and Nature Conservation, the Department of Agriculture, Forestry & Fisheries (DAFF), the South African Civil Aviation Authority (SACAA), the Department of Transport, the Local Municipality, the District Municipality, the Department of Water and Sanitation (DWS), the Department of Communications, SENTECH, Eskom Holdings SOC Limited, the South African National Roads Agency Limited (SANRAL), the South African Heritage Agency (SAHRA) and the Square Kilometre Array (SKA). ii. You are also required to address all issues raised by organs of state and Interested and Affected Parties (I&APs) prior to the submission of the EIAr to the Department. iii. Proof of correspondence with the various stakeholders must be included in the FEIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. iv. The EAP must, in order to give effect to Regulation 56(2), give registered interested and affected parties access to, and an opportunity to comment on the report in writing within 21 days before submitting the final environmental impact assessment report to the Department.	i. Refer to Appendix C & E (Organs of State Correspondence) and Appendix E Comments Received) ii. Refer to Chapter 8 (assessment of impacts) and Appendix E - Comments & Response Report iii. Refer to Appendix E (stakeholder correspondence) and E (organs of state correspondence) iv. N/A
c)	Please ensure that the Final EIAr includes at least one legible A3 regional map of the area and the site layout map to illustrate the turbine positions and associated infrastructure. The maps must be of acceptable quality and as a minimum, have the following attributes:	Refer to Appendix P

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	» Maps are relatable to one another; » Cardinal points; » Co-ordinates; » Legible legends; » Indicate alternatives; » Latest land Cover; » Vegetation types of the study area; and » A3 size locality map.	
d)	Proof of newspaper clippings for public participation must be eligible and clearly show the name of the newspaper where the advert was placed and the date that the advert was placed.	Refer to Appendix E
	The EIAr must also include a comments and responses report in accordance with Regulation 28(m) of the Regulations, 2010	Refer to Appendix E
	The EIAr must include the detail inclusive of the PPP in accordance with Regulation 54 of the EIA Regulation.	Refer to Chapter 6 and Appendix E
d)	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Refer to Chapter 2.
	The EIAr must provide an assessment on the glint and glare and provide mitigation measure to reduce the impacts.	Refer to Chapter 8 and Appendix H
	An Avifaunal Assessment must be conducted to determine the impacts that the proposed activity may have on avifauna. Mitigation measures must be proposed and included in the EIAr and EMPr.	Refer to Chapter 7 and Appendix L
f)	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided.	Refer Chapter 2. Agreement with the local municipalities have not been confirmed.
	The EIAr must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites.	Refer to Chapter 2 Section 2.2.
g)	A copy of the final site layout map. All biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads	Refer to Appendix P
h)	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Appendix P
i)	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix P
j)	A shapefile of the preferred development layout footprint must be submitted to this Department.	N/A
k)	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following: i. All recommendations and mitigation measures recorded in	i. Refer to Appendix Q (EMPr) ii. Refer to Appendix Q

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	the EIAr and the specialist studies conducted. ii. The final site layout map. iii. Measures as dictated by the final site layout map and micro-siting, iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken. vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase. viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats. ix. An open space management plan to be implemented during the construction and operation of the facility x. A traffic management plan for the site access roads to ensure that no hazards would results from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment xii. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off xiii. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan	(EMPr) iii. Refer to Appendix Q (EMPr) iv. Refer to Appendix Q (EMPr) v. Refer to Appendix Q (EMPr) vi. Refer to Appendix P of the EMPr vii. Refer to Appendix E of (EMPr) viii. Refer to Appendix Q (EMPr) Section 5.3 Objective 8 ix. Refer to Appendix Q (EMPr) x. Refer to Appendix F of the EMPr xi. See point above xii. Development and implementation of an appropriate stormwater management plan is required (Section 4.2 & 5.3 of the EMPr) xiii. Refer to Appendix C of the EMPr xiv. Refer to Appendix Q (EMPr) – Section 5.3 – Objective 12 xv. Refer to Appendix Q (EMPr) – Section 5.3 – Objective 7

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	to prevent and reduce the risk of any potential erosion xiv. An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the sailor storm water systems xv. Measures to protect hydrological features such as streams, rivers, pans, wetlands, darns and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	
l)	The EIAr must include a cumulative impact assessment of the facility if there are other similar facilities in the region. The specialist studies e.g. biodiversity, visual, noise etc. must also assess the facility in terms of potential cumulative impacts.	Refer to Chapter 9 of this report for the assessment of cumulative impacts.

LEGAL REQUIREMENTS IN TERMS OF THE EIA REGULATIONS

Table 2 below details how the legal requirements of Section 31 of the EIA Regulations (EIA Report content) have been addressed within this report

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Section 1.4 and Appendix A
(b) a detailed description of the proposed activity	Chapter 2
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken	Chapter 2
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 6
(e) details of the public participation process conducted in terms of sub-regulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	i. The Plan of study for the EIA Phase was proposed to achieve the following: » Provide an overall assessment of the social and biophysical environment affected by the Castle Wind Energy Facility (Chapter 7 and specialist reports – Appendix F-O) » Assess potentially significant impacts (direct, indirect and cumulative, where required) – Chapter 8 & 9. » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts (Chapter 8, 9 & 10) » Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded (Chapter 6 and Appendix E).
(f) a description of the need and desirability of the proposed activity;	Section 2.2
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that	Section 2.4

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Section 4.2.5
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 2.4, Chapter 6
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Section 8.6
(k) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	Appendix D4
(l) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 6
(m) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapter 6 and 7
(n) a description of any assumptions, uncertainties and gaps in knowledge	Section 4.2.3 and specialist reports (Appendix E-K)
(o) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 8.5
(p) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Chapter 10 Section 10.4
(q) a draft environmental management programme containing the aspects contemplated in regulation 33	Appendix L
(r) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix F-O
(s) any specific information that may be required by the competent authority.	Refer to Table 1 of the EIR.

INVITATION TO COMMENT ON THE EIA REPORT

Members of the public, local communities and stakeholders were invited to comment on the Draft Environmental Impact Assessment Report which was made available for public review and comment for a 40-day period at the following locations from **01 December 2014 –28 January 2015:**

- De Aar Public Library – 21 Station Street, De Aar
- Phandulwazi Library – Nanzwakazi Location, Hlithani Street, De Aar
- Emthanjeni Local Municipality Offices – 45 Voortrekker Street, De Aar
- Frans Jooste Library – Bree Street, Philipstown
- Renosterberg Local Municipality – Green Street, Philipstown
- www.savannahSa.com

The release of a Final EIA Report provides stakeholders with an additional opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report has incorporated all issues and responses received during the process. As required in terms of Regulation 56(2) of the EIA Regulations, this report has been made available for public review prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project. Any changes made from the Draft EIA Report to this Final EIA Report **have been underlined throughout** this Final EIA Report for ease of reference.

Comments on this FEIR should be submitted to the DEA with a copy to Savannah Environmental. Relevant contact details are as follows:

National DEA:	**Savannah Environmental(Public Facilitator):**
Muhammad Essop Tel: (012) 399 9406 **Email:** MEssop@environment.gov.za **Post:** Private Bag X 447 ,Pretoria,0001	**Gabriele Wood** **Tel:** 011 656 3237 **Fax:** 086 684 0547 **Email:** gabriele@savannahsa.com **Post:** P O Box 148 Sunninghill 2157

EXECUTIVE SUMMARY

Background and Project Overview

Castle Wind Farm (Pty) Limited is proposing the establishment of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, which is ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the Castle Wind Energy Facility. This development is proposed to comprise a cluster of up to 31 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed within an area of approximately ~3257ha in extent.

The wind energy facility is proposed to be located on the following farm portions (refer to Figure 1):

- Portion 12 of Farm 165 (Vendussie Kuil);
- Portion 13 of Farm 165 (Vendussie Kuil); and
- The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The three farm portions collectively make up a broader study area of approximately 3257ha (i.e. 32.6 km^2) which is being considered for siting of the wind energy facility.

The facility will be comprised of up to 31 wind turbines with a generating capacity of up to 3.5MW each; with a hub height of up to 120m and a rotor diameter of up to 132m. The entire facility would have a capacity of up to 140 MW.

Infrastructure associated with the wind energy facility is proposed to include:

- **31 wind turbines**;
- Turbine foundation/footprint;
- 31 Crane hardstand areas
- **Cabling** between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation;
- Temporary laydown areas);
- Temporary batching plant
- **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m)
- **Internal access roads** (approximately 7m wide) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. Due to the dispersed distribution pattern of the wind turbines however, this will necessitate the construction of new access roads in some areas.
- Workshop area / office for control, maintenance and storage.

The primary access road to the site will be off the existing gravel road from the R389 to Philipstown and Hanover. Two reasonable and feasible alternatives are have been considered (refer to Figure 8.2):

Alternative access to site during construction and operation

» **Access Road Alternative 1 (referred to as the Northern Access Road):** The site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 19.5km from the R389 to the proposed site. Several homesteads are situated along this access roads.
» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 18.5km from the R389 to the proposed site.

Savannah Environmental was contracted by Castle Wind Farm (Pty) Limited as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. The manner in which a country sources its energy plays a big part in reducing the effects of climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing the Castle Wind Facility with a maximum contracted capacity of up to 140MW on a site located on Portion 12 of Farm 165 (Vendussie Kuil), Portion 13 of Farm 165 (Vendussie Kuil) and the Remaining Extent of Portion 0 of Farm 8 (Knapdaar) has been established by Castle Wind Farm (Pty) Limited. The positive implications of establishing a wind energy facility on the identified site within the Northern Cape include the following:

» The potential to harness and utilise wind energy resources within the Northern Cape Province
» The project will assist the South African government in reaching their set targets for renewable energy.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
» The National electricity grid in the Northern Cape Province will benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by the developer. **No environmental fatal flaws were identified** to be associated with the proposed wind energy facility. A number of impacts of medium to high significance were however identified which may require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMPr)** included within **Appendix Q**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to **protect and preserve** surrounding environment.

Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Castle Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level, provided that appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

The following conditions would be required to be included within an environmental authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within **Appendices F - O** must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained to carry out a restricted activity involving a specimen of a listed threatened or protected species.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» The final location of the wind turbines and associated infrastructure within identified sensitive areas must be informed by walk-through surveys to be undertaken by ecological, heritage and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
» Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bats.

» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
» Adequate stormwater management measures to be put in place as the soils on the site are prone to erosion.
» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
» Construction managers should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
» Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

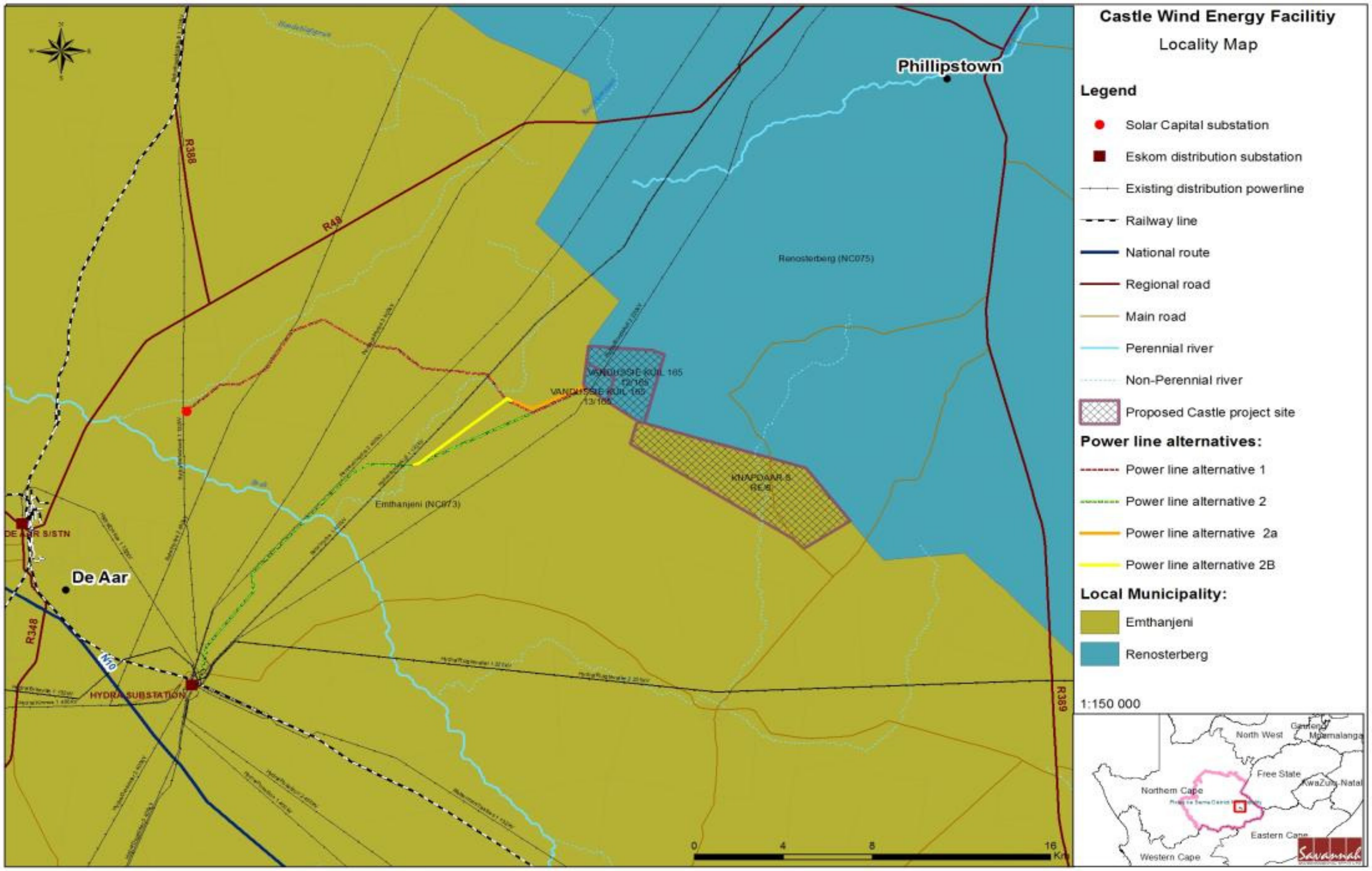

Figure 1: Locality map showing the study area for the establishment of the Castle Wind Energy (Northern Cape)

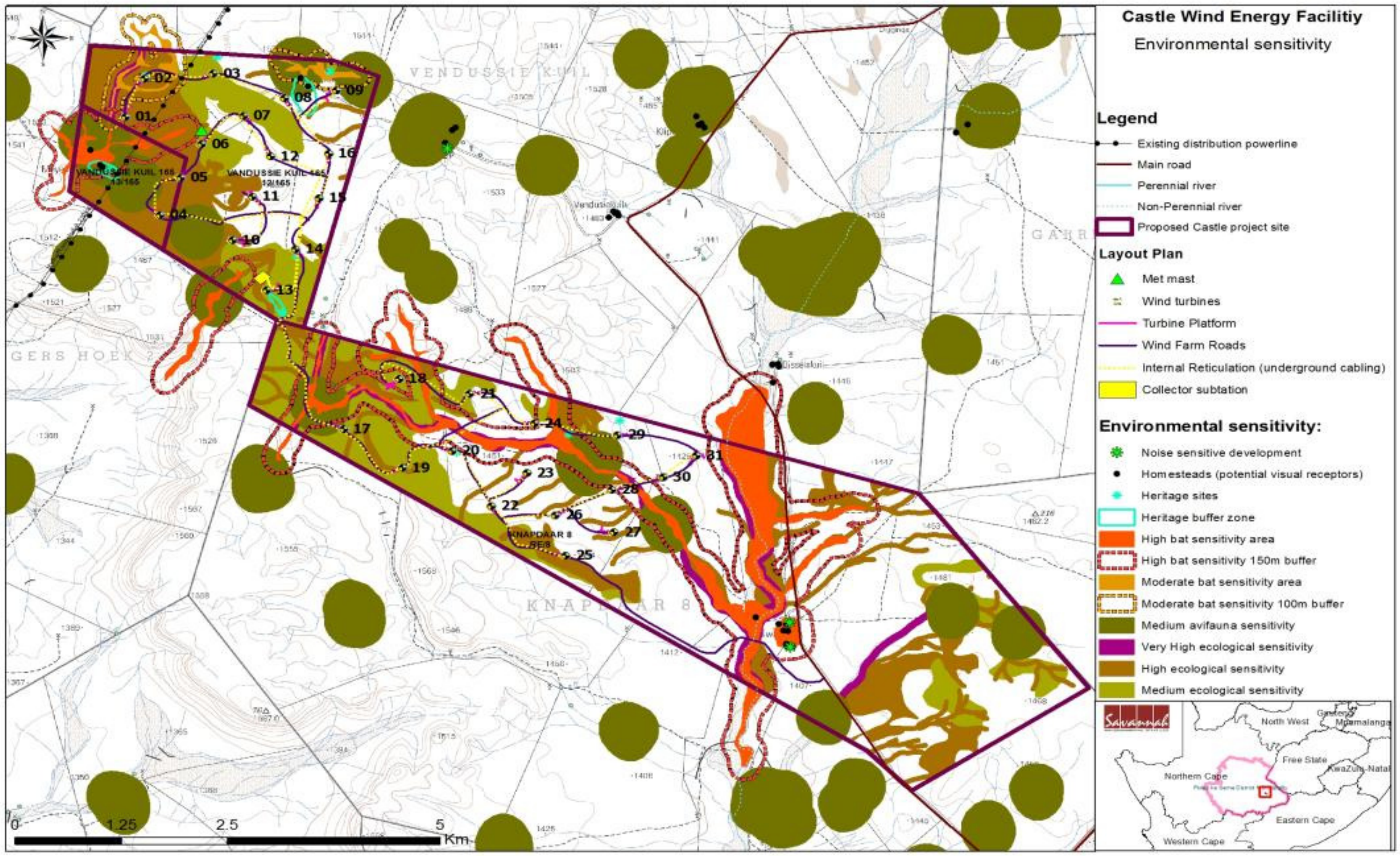

Figure 2: Environmental sensitivity map for the proposed Castle Wind Energy Facility in relation to the proposed Facility layout

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APPENDICES

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Betz Limit: The flow of air over the blades and through the rotor area allows a wind turbine to generate power. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as Betz Limit.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme/plan: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity.

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800.

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Regional Methodology: The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) have developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The methodology proposed within this guideline document is intended to be a regional level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development within the Western Cape Province (on the basis of planning, environmental, infrastructural and landscape parameters).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Tower: The tower, which supports the rotor, is constructed from tubular steel, concrete or a mixture of both. It is approximately 120 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 140 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Valley-bottom wetlands (Channelled or Unchannelled): These are flat valley-bottom wetland areas with or without a major channel/stream running through them. Water inputs are typically from an upstream channel, as the flow becomes dispersed, and from adjacent slopes (if present) or groundwater. Water generally moves through the wetland in the form of diffuse surface flow and/or interflow (with some temporary containment of water in depressional areas), but the outflow can be in the form of diffuse or concentrated surface flow. Infiltration and evaporation from unchannelled valley-bottom wetlands can be significant, particularly if there are a number of small depressions within the wetland area. Horizontal, unidirectional diffuse surface-flow tends to dominate in terms of the hydrodynamics.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

Wind speed: The rate at which air flows past a point above the earth's surface.

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DAFF	Department of Forestry and Fishery
DENC	Northern Cape Department of Environmental Affairs and Nature Conservation
DEA	National Department of Environmental Affairs
DME	Department of Minerals and Energy
DOT	Department of Transport
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited

INTRODUCTION CHAPTER 1

Castle Wind Farm (Pty) Limited is proposing the establishment of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the Castle Wind Energy Facility. This development is proposed to comprise a cluster of up to 31 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed within a larger area of approximately ~3257ha in extent.

The nature and extent of the proposed facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases of a facility of this nature is explored in more detail in this Environmental Impact Assessment Report. This Environmental Impact Assessment Report consists of eleven sections:

» **Chapter 1** provides a project overview and motivation for the proposed project and the environmental impact assessment
» **Chapter 2** provides the project description, need and desirability and identified project alternatives
» **Chapter 3** describes wind energy as a power generation option and provides insight to technologies for wind energy and the scope of the proposed Castle Wind Energy Facility
» **Chapter 4** provides a description of the processes followed in the determination of acceptable sites for the development of the proposed Castle Wind Energy Facility
» **Chapter 5** provides the strategic context for energy planning in South Africa
» **Chapter 6** outlines the process which was followed during the Scoping and EIA Phase of the project, including the stakeholder consultation programme that was undertaken
» **Chapter 7** describes the existing biophysical and socio-economic environment
» **Chapter 8** describes the assessment of environmental impacts and cumulative impacts associated with the proposed Castle Wind Energy Facility and recommended mitigation measures
» **Chapter 9** describes the assessment of cumulative impacts associated with the proposed Castle Wind Energy Facility and recommended mitigation measures
» **Chapter 10** presents the conclusions of the impact assessments, recommendations as well as an impact statement
» **Chapter 11** contains a list references for the Draft EIA report and specialist reports

1.1. Project Overview

The site for the proposed facility, was identified by Castle Wind Farm (Pty) Ltd through a Regional Site Assessment that was undertaken by Savannah Environmental, together with MetroGIS, on behalf of juwi Renewable Energies. The purpose was to determine acceptable areas considered suitable for development within the identified study area within the Northern Cape Province. The regional site identification process included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of a wind farm, including the wind resource, land availability, accessibility and existing grid infrastructure. The proposed site was confirmed by Castle Wind Farm (Pty) Limited as being potentially suitable for wind energy development. As a result, no feasible site alternatives have been identified for investigation for the proposed wind energy facility development, as the site has been screened as being potentially suitable for development of the project. This area was put forward for consideration within this EIA. The site selection process is discussed in further detail in Chapter 4 of this report.

The overarching objective for the planning process is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. As local level environmental and planning issues were not assessed in sufficient detail through the regional level site identification process, these issues must now be considered within site-specific studies and assessments through the EIA process. This process will delineate areas of sensitivity within the broader site and ultimately inform the placement of the wind turbines and associated infrastructure on a site.

The detailed project description and the scope of the proposed Castle Wind Energy Facility (for the construction, operation and decommissioning phases) is discussed in more detail in Chapter 2.

1.2. Requirement for an Environmental Impact Assessment Process

The proposed wind energy facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998). This section provides a brief overview of the EIA Regulations and their application to this project.

EIA Regulations overview: NEMA is the national legislation that provides for the authorisation of 'listed activities'. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority[1]and the Northern Cape Department of Environment and Nature Conservation (DENC) will act as the commenting authority. An application for authorisation has been accepted by DEA under application reference number 14/12/16/3/3/2/278.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. Castle Wind Farm (Pty) Ltd appointed Savannah Environmental (Pty) Ltd as the independent environmental assessment practitioner to conduct the EIA process for the proposed project.

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issues reported on in the Scoping and EIA Reports as well as dialogue with Interested and Affected Parties (I&APs). In terms of sections 24 and 24D of NEMA, as read with Government Notices R543, R544, R545 and R546, a Scoping and EIA process is required for the proposed project (GG No 33306 of 18 June 2010). A table of the listed activities for the proposed projects in terms of GN R545, R544 and R546 (as amended in December 2010) is provided below:

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[1] In terms of the Energy Response Plan, the DEA is the competent authority for all energy related applications.

Table 1.1: Listed Activities applicable to the Castle Wind Energy Facility

Relevant Notice	**Activity No.**	**Description of listed activity**	**Applicability to the project**
GN544	10	The construction of facilities or infrastructure for the transmission and distribution of electricity – Outside urban areas or industrial complexes with a capacity of more than 33kV but less than 275kV	Construction of power line/s, outside an urban area, with a capacity of more than 33kV.
GN544	11	The construction of: (iii) bridges (vi) bulk storm water outlet structures (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	Bridges, storm water structures and buildings (such as the workshop) will occur within 32m of a watercourse.
GN544	13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres	Facilities for storage of diesel / oils that are up to 500m^3 are required for the wind energy facility.
GN544, 18 June 2010	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	The construction of the wind energy facility will include excavation of soil in a watercourse (drainage line) that may exceed 5 cubic metres.

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
~~GN544~~	~~22~~	~~The construction of a road, outside urban areas,~~ ~~(i) with a reserve wider than 13.5 metres or,~~ ~~(ii) where no road reserve exists where the road is wider than 8 metres, or~~ ~~(iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 of Government Notice 387 of 2006 or activity 18 of Notice 545 of 2010.~~	~~The wind energy facility will require access roads to be constructed.~~
~~GN544~~	~~26~~	~~Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).~~	~~Sensitive / conservation worthy vegetation species, protected under the NEM:BA to be removed for infrastructure including wind turbines, access roads and associated infrastructure.~~
GN544	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – (ii) where no reserve exists, where the existing road is wider than 8 metres – excluding widening or lengthening occurring inside urban areas.	Existing farm (gravel) access roads may be widened or lengthened. These roads have no road reserve and may be wider than 8 metres in some areas.
GN545	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	The wind energy facility will consist of wind turbines for electricity generation of more than 20MW.
GN545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; Except where such physical	The development footprint for the proposed wind energy facility will cover an area greater than 20 hectares.

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
		alteration takes place for: *(i)* Linear development activities. *(ii)* Agriculture or afforestation where activity 16 in this schedule will apply	
GN 546, 18 June 2010	4 (a) (ii) (bb)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas.	New roads wider than 4 m to be constructed in a rural part of the Northern Cape within a National Protected Area Expansion Strategy Focus area.
GN 546, 18 June 2010	10(a) (ii) (bb)	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas.	Fuel required during construction will be stored on-site. The site occurs in a rural part of the Northern Cape and a portion of the site falls within a National Protected Area Expansion Strategy Focus area.
GN 546, 18 June 2010	13 (b) & (c) ii (bb)	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (b) National Protected Area Expansion Strategy Focus areas. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus	An area of 1 ha or more of indigenous vegetation cover need to be cleared in a rural part of the Northern Cape, within a National Protected Area Expansion Strategy Focus area.

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
		areas.	
GN 546, 18 June 2010	14 (a) i	The clearance of an area of 5 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) In the Northern Cape (i) All areas outside urban areas	An area of 5 ha or more of indigenous vegetation cover may need to be cleared in a rural area within the Northern Cape.
GN 546, 18 June 2010	16 (iii) & (iv) (a) ii (bb)	The construction of (iii) buildings with a footprint exceeding 10 square metres in size or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. (a) In the Northern Cape *(iii)* Outside urban areas (bb) National Protected Area Expansion Strategy Focus areas.	Buildings and infrastructure larger than 10 m^2 to be constructed within 32 m of a watercourse which fall within National Protected Area Expansion Strategy Focus areas.
GN 546, 18 June 2010	19	The widening of a road by more than 4metres, or the lengthening of a road by more than 1 kilometre. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas.	Existing farm (gravel) access roads to be widened in a rural part of the Northern Cape, within a National Protected Area Expansion Strategy Focus area.

This report documents the evaluation of the potential environmental impacts of the proposed construction and operation of the proposed Castle Wind Farm project. This Environmental Impact Assessment Report forms part of the EIA process and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.3. Objectives of the EIA Process

The Scoping Report dated November 2013 was received by the DEA on the 03 December 2013, and accepted by the DEA on the 30 January 2014. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase (i.e. the current phase) assessed identified environmental impacts (direct, indirect, and cumulative) associated with the different project development phases (i.e. design, construction, operation, and decommissioning). The EIA Phase also recommends appropriate mitigation measures for potentially significant environmental impacts. The release of a draft EIA Report provides stakeholders with an opportunity to review the information included in the Draft EIAR and to raise their concerns through the EIA Process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review phase prior to submission to DEA.

1.4. Details of Environmental Assessment Practitioner and specialist team

Savannah Environmental was appointed by Castle Wind Farm (Pty) Ltd as an independent consultant to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any of the specialist sub-consultants on this project are subsidiaries of or affiliated to Castle Wind Farm (Pty) Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

The EAPs from Savannah Environmental who are responsible for this project are:

» *Tebogo Mapinga* - is a Senior Environmental Consultant. She holds a Bsc degree with over 7 years of experience in the environmental field in both public and private sectors. Her competencies lie in environmental impact assessments, compliance monitoring and public participation for small and large scale projects. She is currently in the process of completing her honours degree in Environmental Management.
» *Karen Jodas* - the principle Environmental Assessment Practitioner (EAP) for this project, is a registered Professional Natural Scientist and holds a Master of Science degree. She has 17 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.
» *Gabriele Wood*: the public participation consultant for this project, hold an Honours Bachelor degree in Anthropology and has 7 years of experience in Public Participation and Social consulting, including professional execution of public participation processes for a variety of projects as well as managing and co-ordinating public participation processes for Environmental Impact Assessments (EIA).

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA Processes. Savannah Environmental has developed a valuable understanding of impacts associated with the construction and operation of renewable energy facilities.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

Specialist	Area of Expertise
Simon Todd of Simon Todd Consulting	Ecology
Jon Smallie of WildSkies Ecological Services	Avifauna
Werner Marias of Animalia	Bats
Lourens du Plessis of MetroGIS	Visual impacts and GIS mapping
Jaco van der Walt of Heritage Contracts	Heritage
Tony Barbour Environmental Consulting and Research	Social
Johan van Tol- of HydroPedological Solutions	Soils, erosion and agricultural potential
Morne de Jager of Enviro Acoustics Research	Noise
Toni Belcher & Dana Grobler of Blue Science	Freshwater Assessment
Barry Millsteed	Palaeontology

Curricula vitae for the Savannah Environmental project team and its specialist sub-consultants are included in Appendix A.

PROJECT DESCRIPTION, NEED AND DESIRABILITY AND ALTERNATIVES CHAPTER 2

This chapter provides details regarding the project description, scope of the proposed Castle Wind Energy Facility, including all required project components of the project and necessary steps for the project to be developed and the description of alternatives. The scope of the project includes construction, operation and decommissioning activities. This chapter also describes alternative options with regards to the proposed wind energy facility development, including the "do nothing" alternative.

2.1 Project and Site Description

Castle Wind Farm (Pty) Ltd is proposing the construction of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the Castle Wind Energy Facility.

The wind energy facility is proposed to be located on the following farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The three farm portions collectively make up a broader study area of approximately 3257ha (i.e. 32.6 km^2) which is being considered for the siting of the wind energy facility (refer to Figure 2.1).

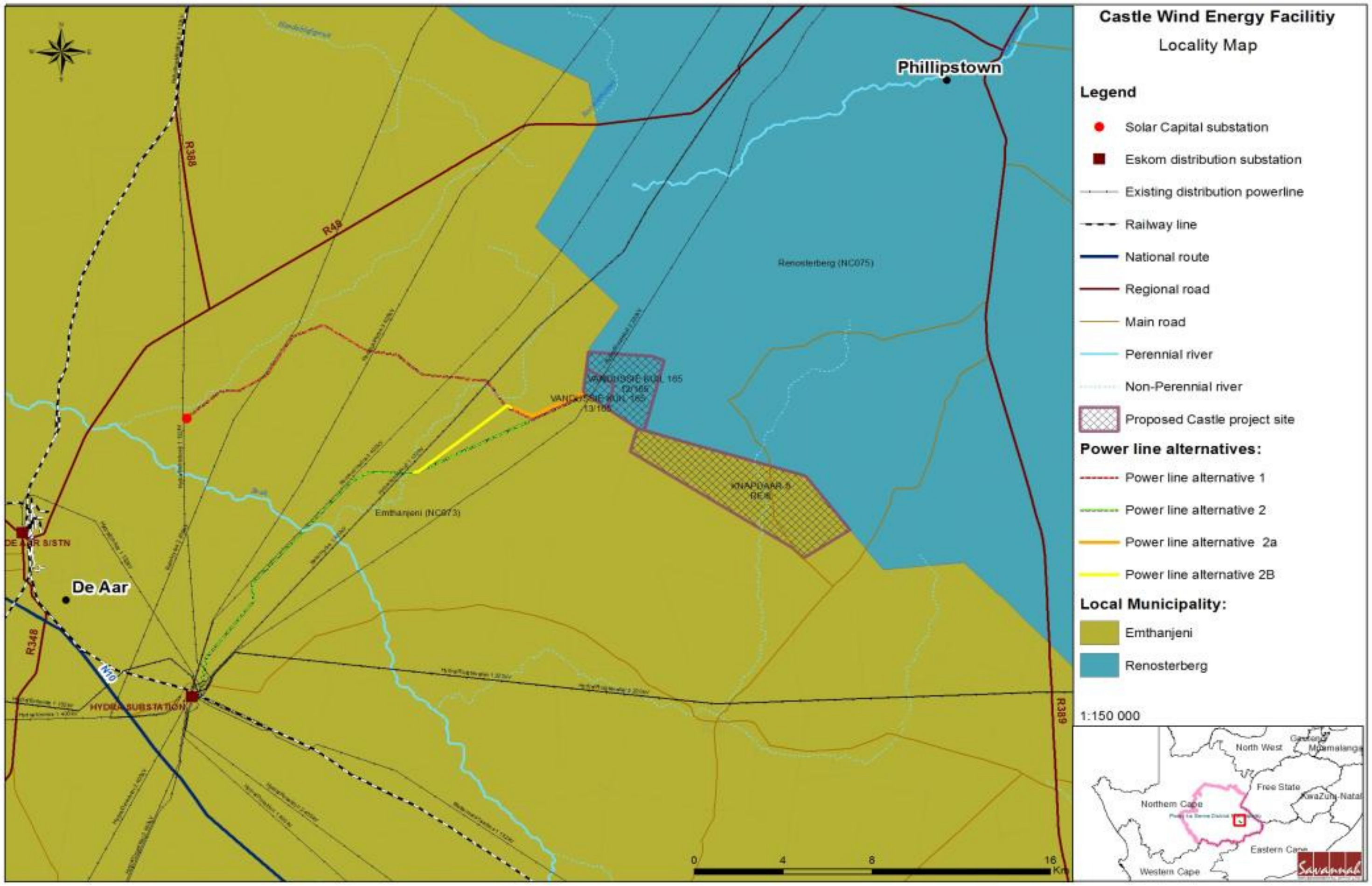

Figure 2.1: Locality map showing the study area and municipal demarcations for the establishment of the Castle Wind Energy Facility in the Northern Cape Province (refer to Appendix O for A 3 Map)

2.2 Need and Desirability

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area. It must also reflect the sustainable development vision, goals and objectives formulated, and the desired spatial form and pattern of land use reflected in the area's IDP and SDF.

2.2.1 Northern Cape Provincial Spatial Development Framework (SDF)

The Northern Cape Provincial Spatial Development Framework (2012) Section C8.2.3, Energy Objectives, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. The objectives are listed below:

- Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts.
- Enhance the efficiency of Eskom's power station at the Ilanga Lethemba Substation or the Hydra Substation.
- There is a national electricity supply shortage and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority.
- Develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government, as well as the private sector.
- Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003). This target relates to the delivery of 10 000 GWh of energy from renewable energy sources (mainly biomass, wind, solar, and small-scale hydro) by 2013.

Therefore the development of the proposed wind facility is in line with the above mentioned objectives outlined in the Northern Cape SDF.

2.2.1 District Renewable Energy Hub (Draft Concept Document)

The Local Economic Development (LED) Division of the PKSDM has proposed the development of a Renewable Energy Hub along the N10 corridor and around the town of De Aar. The proposal is set out in a District Renewable Energy Hub Draft Conceptual Document (26 February 2010).

The concept document outlines the proposed strategy which is in line with both the National and Provincial policy with respect to renewable energy generation. A number of renewable energy sources have been identified for the proposed District-wide Hub including:

» Solar;
» Wind;
» Biomass (bio diesel and associated by-products); and
» Hydro-electric.

The draft concept document indicates that the district is well positioned for renewable energy development due to the ample availability of suitable land, the existence of adequate existing infrastructure (particularly with respect to the existing railway hub) to facilitate the growth of the industrial and manufacturing sectors, the exposure to high insolation rates and steady winds, as well as access to both surface and groundwater resources.

The Renewable Energy Hub is seen as a critical component to the revitalization of the both the broader District and the town of De Aar. In this regard it is envisaged that the Hub would attract both local and foreign investors and research institutions, which, in turn, would help to alleviate the increasing demand on electricity nationally as well as South Africa’s dependence on fossil fuel. In addition the Hub would create employment and downstream business opportunities for local entrepreneurs.

As part of the broader development of De Aar and the District, the PKSDM is in the process of drafting a development plan for an inland port and transport hub centered in and around De Aar and powered by renewable energy generated by the Renewable Energy Hub.

2.2.2 Local Level Integrated Development Plans (IDPs)

The majority of the site falls within the Emthanjeni Local Municipality. A small section of the site falls within the Renosterberg Local Municipality. The Emthanjeni Local Municipality’s IDP (2012) identified a number of key performance areas (KPAs). These KPAs aim to utilise existing economic strengths and opportunities by transferring these into workable programmes and projects. These programmes and projects tend to reduce the current threats, and strengthen the weaknesses in the local economic environment. The

Renosterberg Local Municipality and the Emthanjeni Local Municipality's IDP KPAs that are relevant to the proposed energy facility include:

» Basic Service Delivery: Energy is highlighted as one of the priority issues for the Emthanjeni Local Municipality and Renosterberg Local Municipality with respect to basic services; and,
» Local Economic Development (LED): Micro and macro-economic development and land use management are highlighted as one of the priority issues for the municipality. Therefore the development of the wind energy facility is desirable by the local and district municipality and is aligned with the IDP's.

2.2.3 Financial Viability and Community Needs

In terms of the energy yield predicted for the facility calculated from more than 12 months of monitored wind data, the developer considers the Castle Wind Energy Facility to be financially viable. In the South African context, developmental needs (community needs) are often determined through the planning measures (IDP, SDF and EMF). The wind projects can contribute indirectly to the two Local Municipality's Integrated Development Plans (IDPs). In terms of the needs on the local community, the IDPs identified the need for Economic Development, Electricity Improvements, Youth Development, Infrastructure Development, Skills Development and SMME Development. The Castle Wind Energy Facility would contribute positively to these community needs. The project will create employment and business opportunities, as well as the opportunity for skills development for the local community. The project will result in benefits to the local community, in accordance with the localisation requirements of the REIPPP Programme. In addition, indirect benefits and spend in the local area will benefit the local community.

The development of the project would benefit the local/regional/national community through the development of a renewable energy project. Surrounding communities would also benefit from the development through job creation and downstream spin-offs. In addition, according to Department of Energy (DoE) bidding requirements the developer must plan for a percentage of the profit per annum from the wind energy facility to go back into the community by means of a social beneficiation scheme. Therefore, there is a potential for creation of employment and business opportunities and the opportunity for skills development for the local community.

2.2.4 The Need for the Wind Energy Facility

The purpose of the proposed wind energy facility is to sell the electricity generated to Eskom under the Renewable Energy Independent Power Producers Procurement (REIPPP)

Programme. The REIPPP Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities by IPPs in South Africa.

The need for harnessing renewable energy resources (such as wind energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns of increased greenhouse gas emmissions, the exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to a goal of ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Castle Wind Farm (Pty) Limited proposes the establishment of the Castle Wind Energy Facility to add new capacity to the national electricity grid. The proposed project was identified by the developer as a highly desirable site based on a pre-feasibility assessment that was conducted for a larger area within the Northern Cape. The proposed site displays the characteristics needed in order to develop a Wind Energy Facility and is considered as highly favourable.

2.2.5 The Desirability for the Wind Energy Facility

The use of wind power for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The site for the proposed facility was screened by Savannah Environmental, together with MetroGIS, on behalf of juwi Renewable Energies through a Regional Site Assessment that was undertaken to determine acceptable areas considered suitable for development within the identified study area in the Northern Cape Province. The proposed site was selected for the development of a wind energy facility based on its predicted wind regime (high wind speeds), environmental suitability, suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical perspective.
Castle Wind Farm (Pty) Limited considers this development site to be highly preferred for wind energy facility development. Wind monitoring has been undertaken using an 80m wind monitoring mast in order to confirm the wind resource on the site and ultimately inform the turbine layout of the facility as well as to inform the turbine selection process.

Monitored wind speeds at the site and in the larger De Aar area indicate that this area within the Northern Cape shows great potential for the generation of wind power. The proposed project is located in an area of high wind speeds, averaging > 7m/s. In addition, the recent award of the adjacent Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities near De Aar by the DoE under the REIPPP program demonstrates suitability and economic viability of the development of wind farm projects in this area (refer to Figure 2.2).

Receptiveness of the site to Wind Farm Development:

Castle Wind Farm (Pty) Limited considers this area, and specifically the demarcated site on Portion 12 and 13 of Farm 165 (Vendussie Kuil) and Remaining Extent of Portion 0 of Farm 8 (Knapdaar), to be highly preferred for the development of a wind energy facility. The reasons include:

» Extent of site: Availability of level land of sufficient area can be a restraining factor. The proposed site is approximately 3257ha in extent which is sufficient for the construction of the facility allowing for avoidance of site sensitivities.
» Power transmission considerations: The Castle Wind Energy Facility could be connected to a) the newly constructed Ilanga Lethemba Substation (Solar Capital Substation), near De Aar or b) the Hydra Substation.
» Site access: the site can be readily accessed via the existing northern or southern gravel access road from the R389 to Philipstown and Hanover.
» Loss of current land use: There is no cultivated agricultural land in the study area or directly adjacent to it which could be impacted upon by the proposed development.
» Location of the site: The proposed site will be located in the middle of the two preferred bidder round 3 projects (Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities) and therefor the proposed wind energy facility can be considered as an 'infill' development (refer to Figure 2.2).
» Climatic conditions: Climatic conditions determine the economic viability of a wind energy facility as it is directly dependent on the wind resources in the area. The De Aar area has been identified as a hub for Renewable Energy Developments for the reasons stated prior.
» Topographic conditions: The site conditions are optimum for a development of this nature with the project area being of a suitable gradient for a wind project.

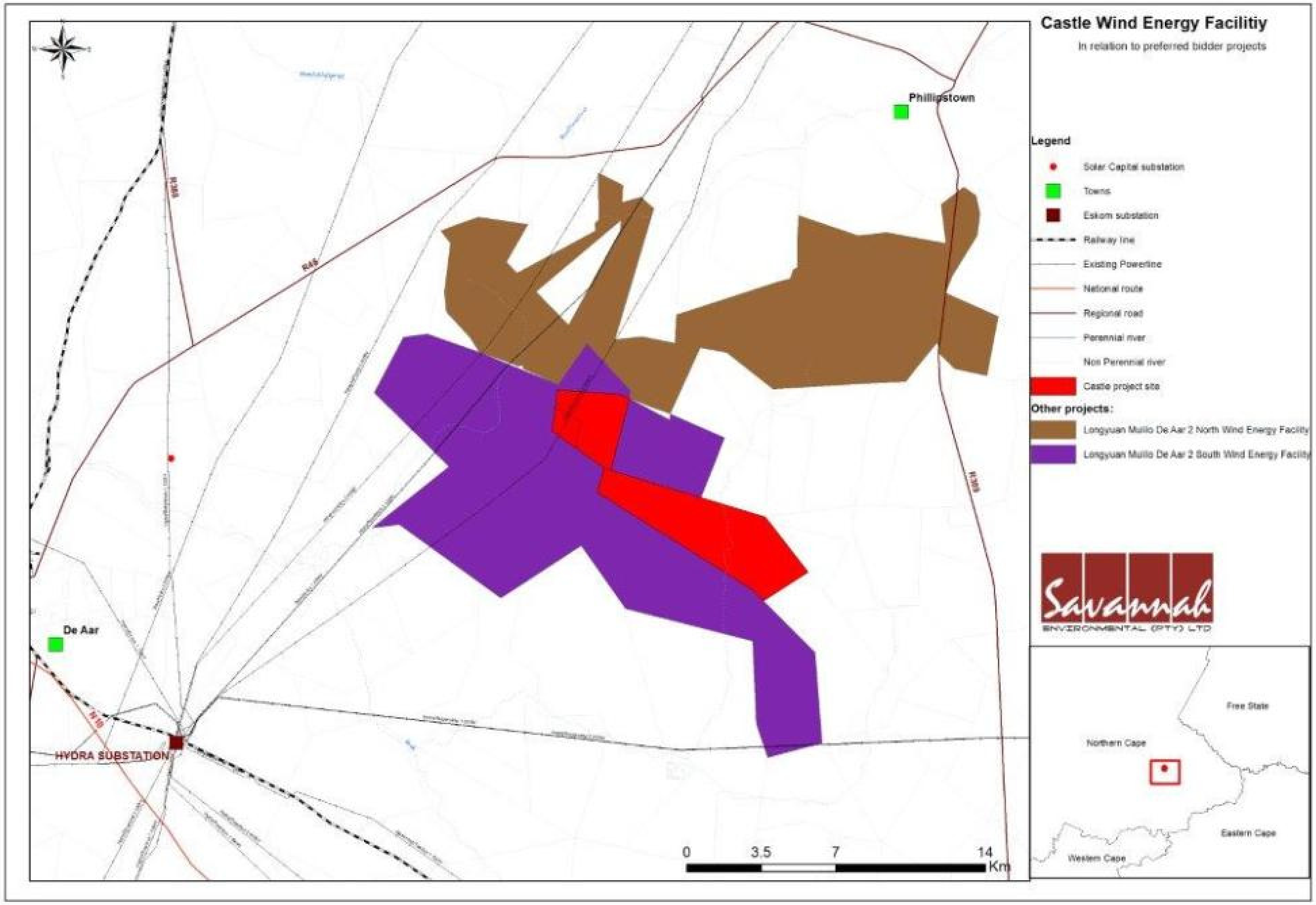

Figure 2.2: Layout indicating the location of the Castle Wind Energy Facility in relation to two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities (Preferred bidder round 3)

2.2.6 How the principles of environmental management as set out in section 2 of NEMA have been taken into account in the planning for the proposed project

The principles of NEMA have been considered in this assessment through the compliance with the requirements of the relevant legislation in the undertaking of the assessment of potential impacts, as well as through the implementation of the principle of sustainable development. Where appropriate, mitigation measures have been recommended for impacts which cannot be avoided. In addition to this, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of the minimisation of pollution and environmental degradation.

The EIA process has been undertaken in a transparent manner with all effort made to involve interested and affected parties, stakeholders and relevant Organs of State, such that an informed decision regarding the project can be made by the Regulating Authority.

The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage components. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management.

2.3 Components / Infrastructure associated with the Wind Energy Facility

The wind energy facility will comprise of up to 31 wind turbines with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 132m. The entire facility would have a generating capacity of up to 140 MW (refer to Figure 2.4). The infrastructure associated with the wind energy facility is proposed to include:

- Wind turbines;
- 31 crane hardstand areas
- Turbine foundation/footprint: $26m^{2.}$
- Cabling between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation.

Text Box 1

Please note that a separate application form has been submitted to the DEA for the proposed construction of a 132 kV overhead power line connecting the proposed Castle Wind Energy Facility to the Ilanga Lethemba (Solar Capital) Substation or the Hydra Substation. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructure associated with the project, such that a holistic picture of the project is provided.

    » Temporary Laydown areas
    » Temporary Batching plant
    » On-site substation (with an approximate compound size of 100 m x 100 m).
» A 132 kV overhead power line to connect into the newly constructed Ilanga Lethemba Substation (Solar Capital Substation), near De Aar or the Hydra Substation. The power line will have a 36m servitude and will be approximately 20-25 kilometres in length.
» Internal access roads up to 7m wide.
» Workshop area / office for control, maintenance and storage.

During the Scoping phase, the proposed development of a wind energy facility consisted of up to 38 wind turbines The entire facility would have a generation capacity of up to 140MW.

A 28 turbine layout was later developed to ensure maximum wind farm efficiency during the Final Scoping Phase, with the use of an initial road layout and the use of the sensitivities which had been identified during this phase. Subsequent to submitting the layout however, the landowner requested a larger buffer around his homestead, new sensitivities were identified and further discussion with the Project's civil engineering consultants necessitated an amendment to the layout. The final layout was amended to 31 turbines after it was concluded that the construction challenges will be significantly less than previously expected, primarily due to the improved road design, and that the previous turbine spacing had been unnecessarily large.

All specialists have been made aware of the changes to the layout and have commented on the 31 turbine layout in terms of the sensititivities identified during each study. .

Temporary infrastructure required during the construction phase includes:
» Construction camps;
» Construction yard and offices;
» Laydown area and storage areas; and
» Temporary access roads.
» Batching plant (in the event the project does not make use of 'ready mix' material)

Services required on site:
» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor to be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required.
» Sanitation – during construction, all sewage waste will be collected by a contractor to be disposed of at a licensed waste disposal site. This service will be arranged with the municipality when required during the operational phase.

» Water and electricity – water will be obtained from the municipality or a licence will be obtained from DWS for abstracting water from local boreholes. Electricity will be generated from generators for any electrical work on site.

2.4 Project Alternatives

2.4.1 Site Alternatives

The proposed site for the Castle Wind Energy Facility was identified as having potential for the installation of wind turbine generators on the basis of various technical criteria, including the wind resource, accessibility of the site, accessibility to the Eskom grid, and local site topography. The regional site assessment (described in detail in Chapter 4) involved testing the site against environmental and planning criteria, and the approach served as a site risk assessment tool from an environmental acceptability perspective – that is, a process to highlight or red-flag potential issues of concern prior to initiating a full EIA process for a proposed site. This site identification process was considered acceptable and therefore no location or site alternatives were considered any further.

2.4.2 Activity Alternatives

No activity/technology alternatives were assessed since the site has been identified by Castle Wind Farm (Pty) Limited as being highly desirable for the establishment of a wind energy generating facility due to the highly favourable wind resource associated with the proposed site. Therefore no other development or renewable technologies, such as photovoltaic solar (PV) or concentrated solar power (CSP), were considered. In addition, Castle Wind Farm (Pty) Limited as a wind farm developer, has technical expertise to develop wind farms and is not considering other renewable technologies.

A wind energy facility is therefore considered by Castle Wind Farm (Pty) Limited to be the only feasible and reasonable activity for consideration on the proposed site.

2.4.3 Site-specific or Layout Design Alternatives

During the Scoping phase, the proposed development of a wind energy facility consisted of up to 38 wind turbines. This layout was considered to be a 80% accurate layout, and would allow for some adjustment to avoid site-specific environmental constraints identified through the EIA phase, where necessary. The overall aim of the layout is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. This micro-siting information has informed the specialist impact assessments in this EIA phase. The planning process also included the positioning of other ancillary infrastructure, including, the power line and internal substation site/s.

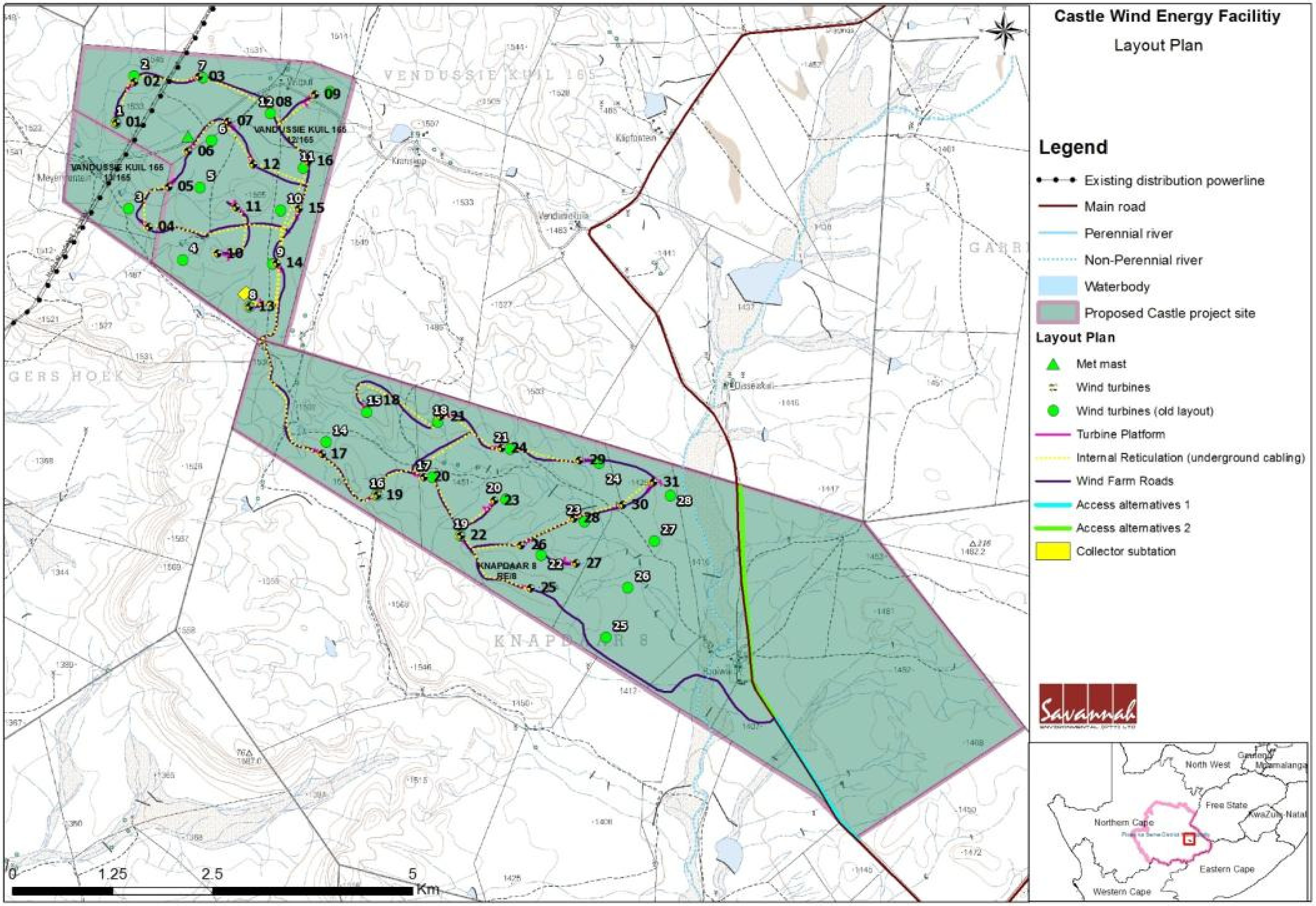

Figure 2.*3* Turbine layout consisting of both old 28 turbine layout & revised 31 turbine layout for the proposed Castle Wind Energy Facility in the Northern Cape Province

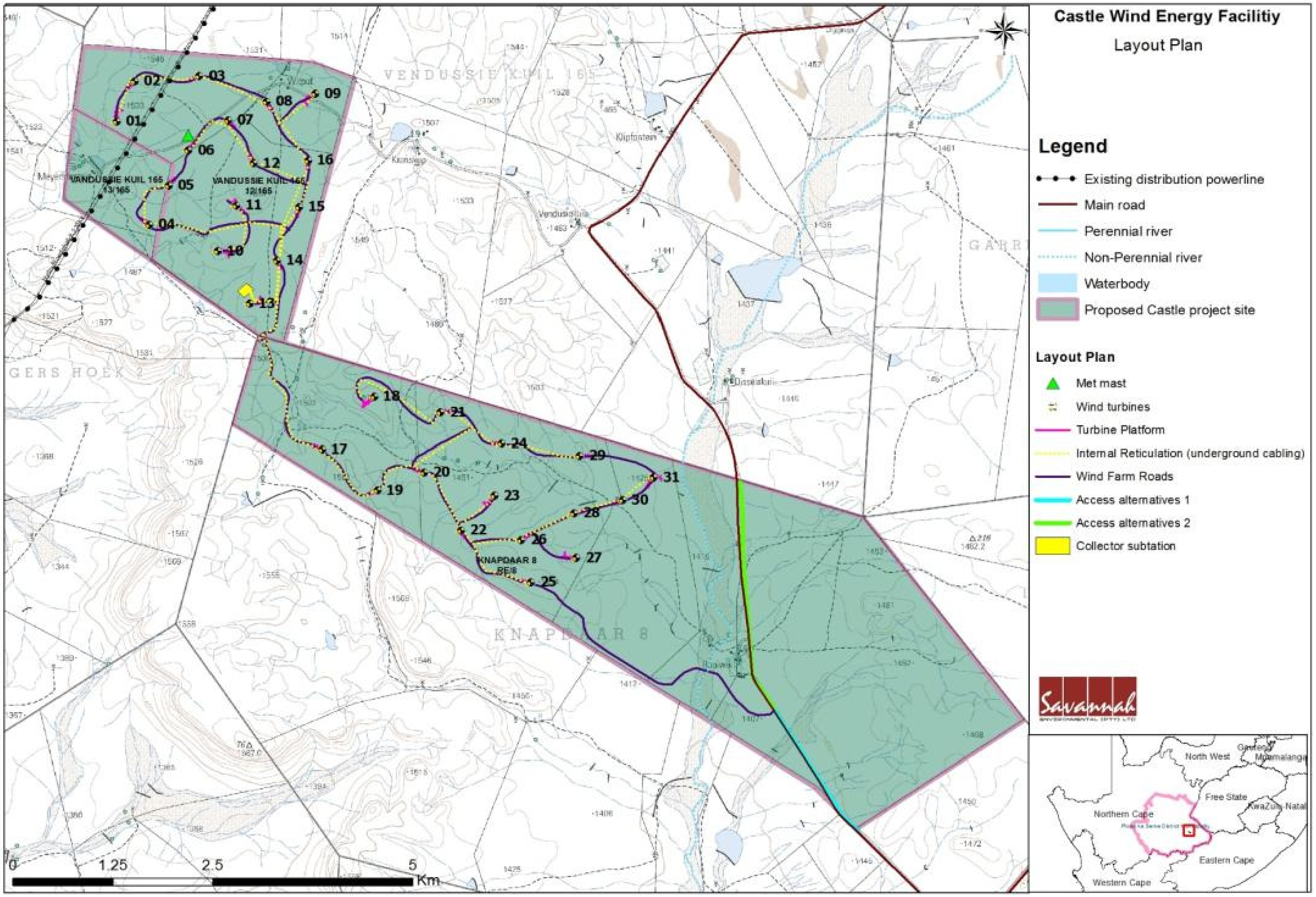

Figure 2.4 Preferred layout consisting of 31 turbines for the proposed Castle Wind Energy Facility in the Northern Cape Province

2.4.2 Access Road Alternatives

The following proposed access roads are proposed (refer to Figure 2.5):

- » **Access Road Alternative 1 (referred to as the Northern Access Road):** the site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. There are several homesteads situated along the southern access road and these homesteads will most likely be negatively impacted by traffic, generated noise and dust in the area particularly during the construction phase.
- » **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. There are no homesteads situated along the southern access road hence it has been identified as a preferred alternative.

2.4.4 Technology alternatives

This refers to alternative technologies for use in the establishment of the wind energy facility. There is a limited range of alternative technologies (turbines) for commercial-scale wind energy facilities. In addition, the technology is constantly evolving. Table 2.1 summarises the types of variables associated with existing wind turbine technologies. There are no significant differences from an environmental perspective between technologies. The technology provider has not yet been confirmed and will be decided after further wind analysis and a tender process. The developer would utilise the same make and model (and size) of turbine across the whole site.

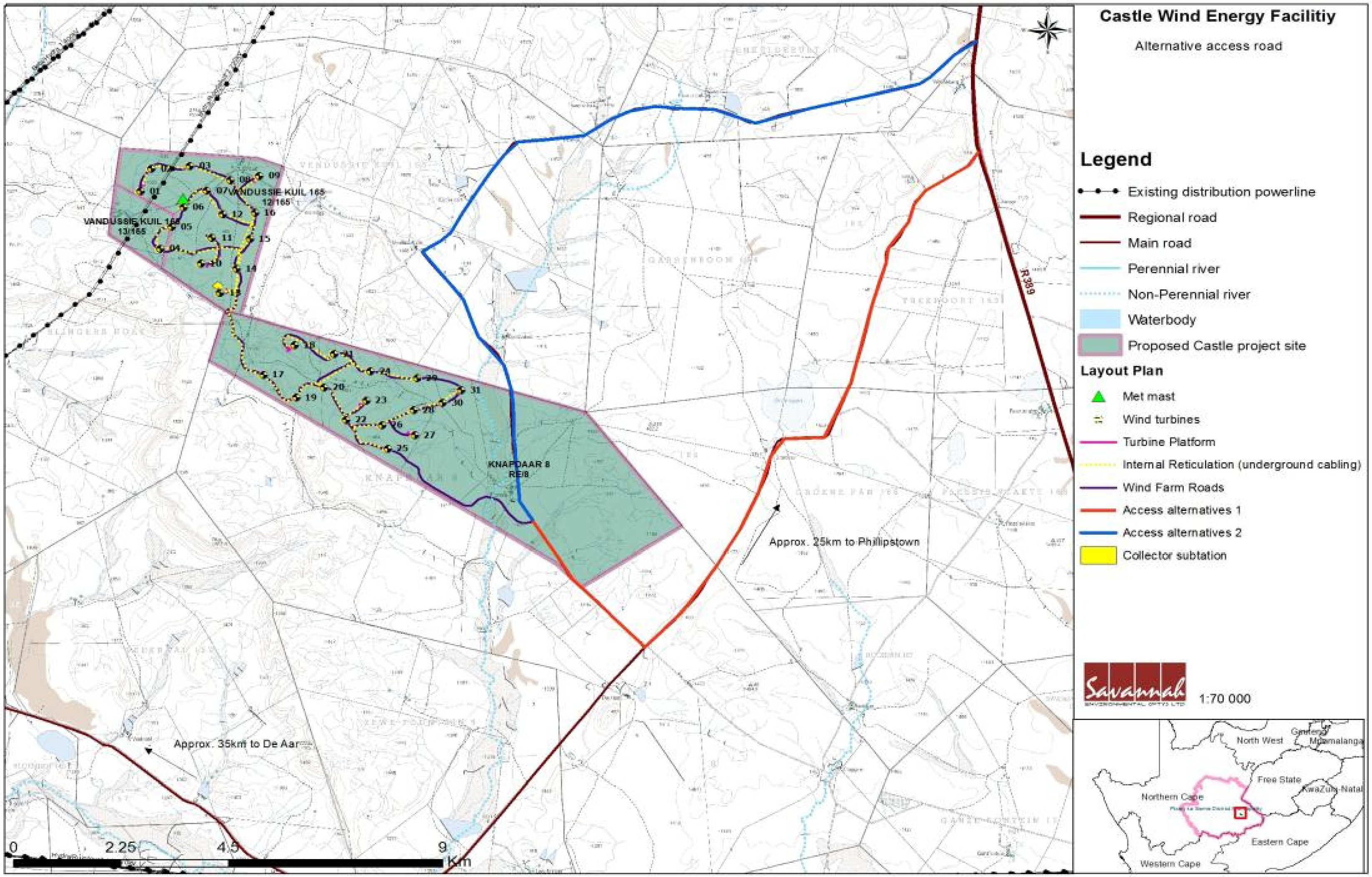

Figure 2.*4* Layout of alternative access roads to the proposed Castle Wind Energy Facility in the Northern Cape Province

Table 2.1: Variables associated with existing wind turbine technologies

Variables	Description
Type	The horizontal axis wind turbine completely dominates the commercial scale wind turbine market.
Size	Typical land-based utility scale wind turbines are currently in the 600 kW to 3.5MW range.
Foundation	The foundation is usually poured re-inforced concrete. Its size and shape is dictated by the size of the wind turbine and local geotechnical considerations.
Tower	Towers are typically constructed from steel and/or concrete. The height of towers generally varies between 80 m and 140 m.
Rotor	3- Bladed rotor is standard.
Rotor Speed Control	Fixed or variable speed rotors.
Gears	Geared and Gearless.
Generator	Standard high speed generator (geared) or custom low-speed ring generator (gearless).
Other variables	Yaw gears, brakes, control systems, lubrication systems and all other turbine components are similar on modern wind turbines.

2.4.5 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the wind energy facility on the proposed site. Two main reasons why the do-nothing alternative is not preferred in relation to this wind energy facility project are discussed below, namely:

» The current land-use regime of the site; and
» The need to diversify the energy mix is South Africa.

The overall agricultural potential of the site is very low, largely restricted by aridic climate conditions and shallow soils. The Cv/Hu soil associations are the only areas of the site suitable for crop production should adequate irrigation water be available.
Land capability is limited by the mountainous, rocky terrain, the shallow soils and the aridity of the region. The site is used for sheep farming. The natural grazing capacity is low and varies between 18 - 30 hectares per large stock unit across the site. There is a very small area of cultivated, irrigated land surrounding the farm house (Rooi Kraal) which is located on the Farm Knapdaar. Therefore, the "do nothing" alternative would leave current land-use and livestock grazing, with losing out the opportunity to generate renewable energy from the wind and at the same time continue current livestock grazing on areas that are outside of the proposed wind energy facility infrastructure. Therefore, from a land-use perspective, the do nothing alternative is not preferred.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. As a consequence of this there is therefore a need for additional electricity generation options to be developed throughout the country. The decision to expand South Africa's electricity generation capacity and the mix of generation technologies is based on **national policy.** This is informed by on-going strategic planning undertaken by the national Department of Energy (DoE), the National Energy Regulator of South Africa (NERSA) and Eskom Holdings Limited (as the primary electricity supplier in South Africa). The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least-cost energy service in many cases - and more so when social and environmental costs are taken into account.

The generation of electricity from renewable energy resources in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored further by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue saving of R26.6 million. As an already water stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.
» **Exploitation of our significant renewable energy resource:** At present, valuable renewable resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» **Pollution reduction:** The releases of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.
» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated

to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.

» **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
» **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities has significant potential for job creation in South Africa.
» **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
» **Support to a new industry sector:** The development of renewable energy offers an opportunity to establish a new industry within the South African economy.
» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contributions to final energy consumption. Furthermore the IRP 2010 states that 42% share of all new power generation should be derived from renewable energy forms, as targeted by the Department of Energy (DoE) (Integrated Resource Plan 2010 – 2030). The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. DME's macroeconomic study on renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) project, has established that the achievement of this target would provide a number of economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20 500 new jobs. In addition, the development of renewable energy beyond the 10 000 GWh target holds further employment benefits and would maximise the number of jobs created per TWh (NERSA, March 2009).

Through research, the viability of a wind energy facility near De Aar has been established. The Castle Wind Farm (Pty) Ltd proposes that up to 31 turbines for the entire facility, depending on the turbine capacity, be established as part of the facility. The purpose of the wind energy facility is to add new capacity for the generation of renewable energy to the national electricity supply which is short of generation capacity. This would meet current and expected demand and would aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). The 'do nothing' alternative will not assist the South African government in meeting increasing power supply demand or in reaching the set targets for renewable energy. In addition, the Northern Cape's power supply will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Provinces' grids.

The 'do nothing' alternative is not a preferred alternative as the following positive impacts will not be realised should the wind energy facility (all three phases) not be developed:

» Job creation from the construction and operational phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Utilisation of clean, renewable energy in an area where it is optimally available.

SUITABILITY OF THE SITE FOR THE DEVELOPMENT OF A WIND ENERGY FACILITY IN THE NORTHERN CAPE CHAPTER 4

Savannah Environmental, together with MetroGIS, undertook a regional site assessment on behalf of the developer to determine acceptable areas considered suitable for wind energy development within a broader area in the Northern Cape Province (Savannah Environmental, 2011). The study area consisted of an area of approximately 36 0000 km^2 (225km x 160km). Within this study area, an area near De Aar in the Northern Cape where the Castle Wind Energy Facility site is located, was considered as a possible site for development of a wind energy facility. A summary of the methodology and process applied in the evaluation of the developer's identified sites and the findings of the study are given in the sections below.

4.1. Identification of the Northern Cape Area for further Investigation

The potential to establish new wind energy facility developments on five sites near De Aar and Copperton in the Northern Cape Province was identified by juwi Renewable Energies (Pty) Ltd. The sites were identified as having potential for wind energy facility development and included Portion 12 & 13 of the Farm 165, (Vendussie Kuil) and the remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The sites were identified as having potential for the installation of wind turbine generators on the basis of various technical criteria, including the wind resource, accessibility of the site, accessibility to the Eskom grid, and local site topography. As part of a pre-feasibility assessment which included site selection, a high level Regional Site Assessment was undertaken for a larger study area in the Northern Cape covering an area of approximately 36 0000 km^2 (225km x 160km) in order to inform the developer of the environmental suitability of the identified sites for the development of a wind energy facility. The five identified site development footprints were then tested against the results.

This study was undertaken in accordance with the guidelines outlined in the *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006), as well as the Strategic Assessment mapping for the entire Western Cape Province (DEA&DP). The purpose of this Regional Site Assessment was to determine areas considered suitable for development *from an environmental perspective* within the broader study area, and then to test the suitability of the five identified sites against these results. The Regional Site Assessment approach therefore served as a site risk assessment tool from an environmental acceptability perspective – that is, a process to highlight or red-flag potential issues of concern prior to initiating a full EIA process for a proposed site.

This chapter provides the outcomes of the regional assessment and technical considerations specific to the Castle Wind Energy Facility study area, and provides results which indicate the suitability of specific area for wind energy siting and development.

4.2. Criteria for testing the environmental suitability of the site

The methodology utilised is a regional level planning tool to guide project development planners (and ultimately decision-makers) with regards to the appropriate areas for development and/or the environmental suitability of identified development sites. Local level issues are not assessed in sufficient detail at this regional level, and the intention is that identified suitable or preferred areas/sites be further considered within site-specific studies and assessments (that is, through an Environmental Impact Assessment).

The objectives for the Regional Site Assessment study were therefore to:

» Provide support to a robust, technically sound and defendable site selection process.
» Confirm the areas of suitability within the larger study area for wind energy development from an environmental perspective.
» Confirm the appropriateness of the sites identified for the establishment of a wind energy facility/ies (ensuring that technical and environmental constraints are minimised as far as possible).
» Define and understand any constraints associated with the identified sites for development (in terms of the outcome of the Regional Assessment study).
» Provide support to an application for authorisation to DEA for the preferred site/s, using the findings as a motivation for the site/s for which application is made.

The regional site assessment involved testing the proposed development site against the environmental and planning criteria as listed in the wind regional environmental assessment of the Western Cape Province, to determine the potential environmental suitability of the site, as well as highlight any red flags.

The aim of the Regional Assessment study was to undertake both a Criteria Based analysis[2] and a Landscape Based analysis[3] and to merge the results of the two studies in order to

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[2] The Criteria Based assessment forms the foundation of the Regional Methodology (Elements of Method 1 from DEA&DP guideline document).
[3] Landscape Assessment as a vital component, incorporating character analysis, sensitivity, value and capacity considerations (Elements of Method 2 from DEA&DP guideline document).

identify Preferred, Negotiable and Restricted Zones for wind energy development. Detailed planning, including the use of criteria and thresholds, was used to designate areas of suitability for the development of wind energy facilities specifically. The input categories for the Criteria Based Method included, but were not limited to:

» Environmental criteria that could be negatively affected by the construction and operation of a wind energy facility (e.g. national parks, nature reserves, rivers, wetlands, etc.)
» Topographical information
» Urban and industrial planning criteria
» Infrastructure criteria that could negatively affect the placement of a wind energy facility (e.g. airports, military installations, etc.)
» Vertically disturbed landscape corridors (major transmission lines, railway lines, etc.)

The input categories for the Landscape Based Method included aspects such as:

» Major scenic drives, routes of tourism importance
» Local scenic drives or "cultural" routes
» Defined historical or heritage sites
» Scenic areas, areas of natural beauty
» Viewshed analysis/visual exposure
» Landform/land cover analysis

The combined results of the two methods were merged to highlight the site's environmental suitability for a wind energy development.

4.3. Data Sources for the Regional Assessment

Data was compiled in accordance with the data layers utilised in the Western Cape Provincial Government document: *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape*.

4.4. Results of the Regional Site Assessment

The input components resulted in various layers of information that were merged using GIS to form a combined dataset (various combinations of positive and negative criteria) which have defined **preferred areas/zones for development** based on environmental and planning criteria. The table below indicates the possible combinations (based on the DEA&DP study) that resulted in the preferred areas for development index that is displayed in the map legend.

No.	Description	Preference
1	Areas with more than 1 negative criteria	Highly restricted/constrained
2	Areas with one negative criteria	Restricted/constrained
3	Neutral areas (no positive or negative criteria)	Negotiable
4	Areas with one positive criteria (and no negative criteria)	Preferred
5	Areas with more than one positive criteria (and no negative criteria)	Highly preferred

The rating system utilised within the updated DEA&DP SEA takes a more 'risk adverse approach' than that put forward by the initial DEA&DP guideline. The rating system assumes that a criteria rated as negative would always override a criteria rated as positive. Definitions of the terms used to define the level of preference are as follows:

» ***Highly Preferred / Preferred:*** Low landscape value with a high to low capacity for change. Wind energy facility development may be possible, subject to site level assessment.
» ***Negotiable:*** Low to high landscape values, but with a high capacity to absorb change. Wind energy development in these areas may be possible, subject to site level assessment.
» ***Restricted / High Restricted:*** High value landscapes combined with low capacity of landscape to adapt to change. These areas should ideally be restricted from wind energy facility development.

From the results of the desk-top mapping the majority of the full extent of the study area was indicated as being preferred for development from a planning and environmental perspective. The study areas falls virtually entirely within areas that are not restricted (as per the methodology followed). Limited areas, within the larger study area, are indicated as being highly restricted/constrained and where these areas exist, it would be possible to avoid them. This result for the larger study area is predominantly as a result of the topography (open plains), the existing impact from vertically disturbed landscapes (including power lines and substations) and the general lack of nature reserves, biospheres and conservancies in the broader area. The larger study area can be largely considered to have high suitability for development from an environmental perspective. Small areas were indicated as being restricted/constrained and highly restricted/constrained. These restrictions/constraints are largely due to:

» Localised areas of elevated relief and high-lying topography. This relates to impacts on steep slopes, as well as increased potential for visual exposure.
» The presence of rivers, drainage lines and pans
» The proximity to the De Aar Military installation

The presence of an Important Bird Area in a large portion of the study area was flagged as an important factor to consider, however this was not mapped as a constraining factor as the influence would be site specific and based on the results of long-term bird monitoring.

The broader De Aar study area was therefore largely considered to have high suitability for development from an environmental perspective.

A Composite Map was generated to show the most favourable areas for development of a wind energy facility within the study area (indicated in dark green and pale green) from an environmental perspective (refer to Figure 4.1).

4.5 Identification of a Site for Investigation in the EIA Process

The results from the testing of the proposed development site indicated that Castle Wind Energy Facility is a site of potential development based on the following conclusions from the regional assessment:

» The portions of the site associated with elevated relief are considered to be constrained to development.
» This site falls within a vegetation type known as Northern Upper Karoo and Besemkaree Koppies Shrubland Both vegetation types.These vegetation types are classified as Least Threatened and have been impacted little by transformation, with more than 95% remaining intact (Driver et al. 2005; Mucina et al., 2006). The condition of the vegetation will be confirmed through a botanical survey/assessment.
» Positive (inclusionary) criteria (including disturbed vertical landscapes) which overlap with this development site include the Hydra-Roodekuil 220kV power line which traverses the site.
» The entire site falls within the 35km buffer area of the De Aar military installation/aerodrome area, which is considered as a negotiable area with the South African Airforce (SAAF). The topography between the site and the military installation is considered highly important, as elevated topography could pose a barrier to shield the effects of wind turbines on radar at the SAAF facility.
» Part of the site (Portion 12 & 13 of Farm 165 (Vendussie Kuil)) occurs within an area identified as part of the National Protected Area Expansion Strategy.
» The site falls within the Important Bird Area (IBA) SA037 - Platberg-Karoo Conservancy. This is considered a negotiable area, but the species and frequency of occurrence of birds on the site will be confirmed through on-site monitoring.

Following the regional site assessment, it was juwi Renewable Energies' intention to proceed with an EIA process for the proposed Castle Wind Energy Facility under the project development company Castle Wind Farm (Pty) Ltd. As this Regional Site Assessment has guided juwi to site their proposed facility within an area/zone of preference (as per the regional methodology followed), no alternative locations or sites are to be considered through the EIA process. The demarcated area was an indicative area considered to be favourable/ viable for the development of a large-scale wind energy facility.

The Castle Wind Energy Facility site was considered to be the preferred location for a wind energy facility development above the three other sites which were identified and investigated through the regional assessment process, due to the proximity to the Mulilo Wind Farms near De Aar and photovoltaic (solar) energy plant on Du Plessis Dam Farm near De Aar, projects, which were awarded preferred bidder status in the REIPPP programme (Round 3). The Castle project is located directly adjacent to these facilities, and effectively acts as an infill development. Proximity to and accessibility to the grid were other factors also considered by the developer when planning the location of the Castle project.

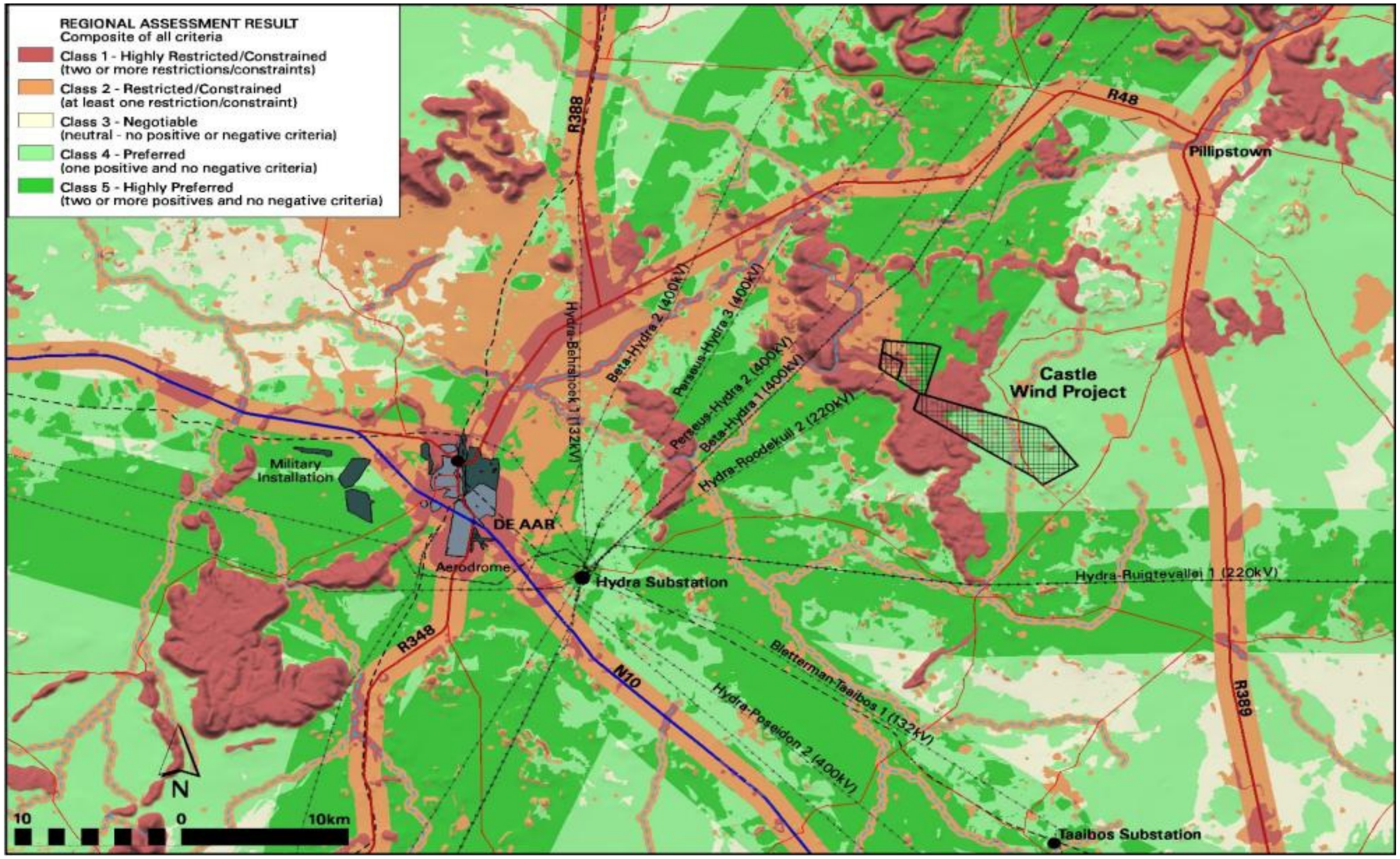


Figure 4.1: Composite map of all criteria of the Regional Assessment indicating the location of the proposed development site indicated as the Castle Wind Project

STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 5

5.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as wind energy facilities is illustrated in Figure 5.1. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed wind energy facility.

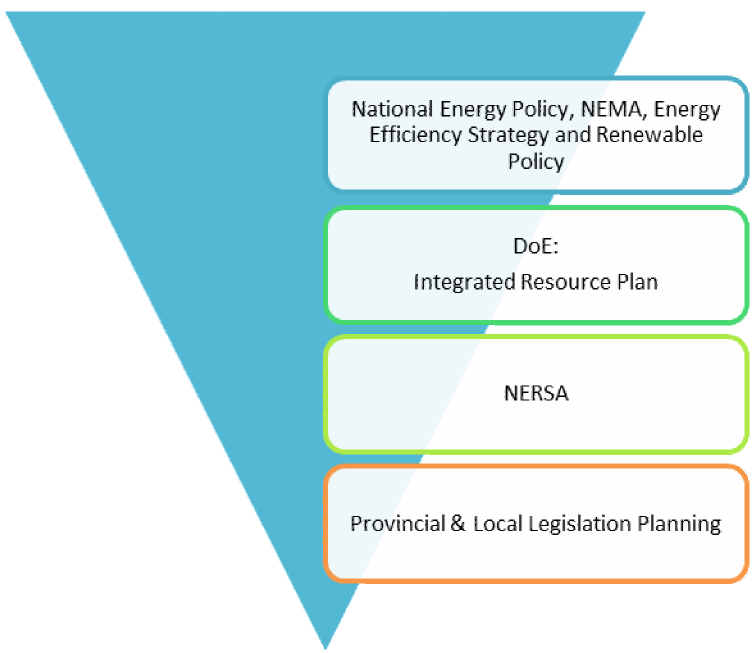


Figure 5.1: Hierarchy of electricity policy and planning documents

5.1.1 The Kyoto Protocol, 1997

South Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO_2 (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce its greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed wind energy facility) is therefore in line with South Africa's international obligations in terms of the Kyoto Protocol.

5.1.2 White Paper on the Energy Policy of the Republic of South Africa, 1998

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by DME in 1998. This White Paper identifies five key objectives for energy supply within South Africa, i.e.:

» increasing access to affordable energy services;
» improving energy sector governance;
» stimulating economic development;
» managing energy-related environmental impacts; and
» securing supply through diversity.

Furthermore, the National Energy Policy identifies the need to undertake an Integrated Energy Planning (IEP) process and the adoption of a National Integrated Resource Planning (NIRP) approach. Through these processes, the most likely future electricity demand based on long-term southern African economic scenarios can be forecasted, and provide the framework for South Africa to investigate a whole range of supply and demand side options.

5.1.3 White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)

Internationally there is increasing development of the use of renewable technologies for the generation of electricity, primarily due to concerns related to climate change, reduction in greenhouse gas emmisions and exploitation of fossil fuel resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with addressing the following challenges:

- » Ensuring that economically feasible technologies and applications are implemented;
- » Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
- » Addressing constraints on the development of the renewable industry.

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

5.1.4 Final Integrated Resource Plan 2010 - 2030

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions

The document outlines the proposed generation new-build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new-build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW.

The DoE has released a draft Integrated Energy Planning Report (June 2013) for public comment. The Draft Integrated Energy Planning Report gives insight on the possible implications of pursuing alternative energy policy options in South Africa. Once the implications of all the alternative options have been explored and evaluated against each of the eight (8) key objectives, final recommendations will be made in the form of the Final IEP Report.

5.15 Department of Energy Process for Independent Power Producers (IPP)

In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Castle Wind Farm (Pty) Ltd proposes the establishment of the Castle Wind Energy Facility to add new capacity to the national electricity grid. Castle Wind Farm (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (i.e. typically for a period of 20 - 25 years) in order to build and operate the proposed wind energy facility. As part of the agreement, Castle Wind Farm would be remunerated per kWh by Eskom or subsequent authority/market operator. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned, or the power purchase agreement renegotiated and extended.

The IPP will undergo a bidding process in which the Department of Energy will determine preferred bidders. A Preferred Bidder will be held to comply with the price and economic development proposals in its bid, with regular reporting to demonstrate compliance during the life span of the project.

The DoE REIPPP Programme is currently underway, with the preferred bidders having been awarded a total of 3 916MW across 7 of the 9 Provinces. Construction on many of these has already commenced. The government signed contracts for 47 IPP projects (in 2012 and 2013 from the Round 1 and Round 2 projects), and have awarded a further 17 projects in Round 3. Castle Wind Farm (Pty) Ltd intend bidding the project to the DoE for the bid submission in 2015.

5.2 Provincial and Local Level Developmental Policy

5.2.1 Northern Cape Growth and Development Strategy (2004-2014)

The Provincial Growth and Development Strategy (PGDS) notes that the most significant challenge that the government and its partners in growth and development are confronted with is the reduction of poverty. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The PGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

» Agriculture and agro-processing;
» Fishing and mariculture;
» Mining and mineral processing;
» Transport;
» Manufacturing; and
» Tourism.

However, the PGDS also notes that economic development in these sectors also requires:

» Creating opportunities for lifelong learning;
» Improving the skills of the labour force to increase productivity;
» Increasing accessibility to knowledge and information.

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

» Developing requisite levels of human and social capital;
» Improving the efficiency and effectiveness of governance and other development institutions;
» Enhancing infrastructure for economic growth and social development.

Of specific relevance to this project, the PGDS make reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape, the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the Province's natural resource endowments must be encouraged. In this regard the PGDS notes "the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc, could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The PGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The PGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the Province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed wind energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape.

The PGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the Province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. It is noted that attention should be paid to ensuring that the development of large renewable energy projects, such as the proposed wind energy facility, do not negatively affect the region's natural environment or the tourism potential of the Province.

5.2.2 Local & District Level Integrated Development Plans

The majority of the site falls within the Emthanjeni Local Municipality. A small section of the site falls within the Renosterberg Local Municipality. For relevance, the Emthanjeni Local Municipality's IDP and the greater Pixley ka Seme District Municipality's IDP are discussed here. The Emthanjeni Local Municipality's IDP (2012) identified a number of key performance areas (KPAs). These KPAs address the outcome of an analysis of the status quo across numerous sectors within the ELM and include the following:

» Basic Service Delivery;
» Local Economic Development;
» Environmental Management;

» Social Development;
» Good Governance and Public Participation;
» Safety and Security;
» Cross-Cutting Issues;
» Municipal Financial Viability and Management; and
» Municipal Institutional Transformation.

These KPAs aim to utilise existing economic strengths and opportunities by transferring these into workable programmes and projects. These programmes and projects tend to reduce the current threats, and strengthen the weaknesses in the local economic environment. The IDP KPAs that are relevant to the proposed energy facility include:

» Basic Service Delivery: Energy is highlighted as one of the priority issues for the ELM with respect to basic services; and,
» Local Economic Development (LED): Micro and macro-economic development and land use management are highlighted as one of the priority issues for the municipality.

The Municipality identified a number of industrial and manufacturing projects that form part of their strategy for the economic development within the area. These include amongst others:

» The development of N10 Corridor;
» Revitalisation of the rail infrastructure;
» Development of industrial sites (Hanover / Britstown);
» Urban Renewal Programme (Renewal of Townships);
» A Logistics hub (De Aar); and
» A Renewable Energy hub (De Aar).

The proposed wind energy facility therefore is in line with the development of a Renewable Energy hub in the region around De Aar, as highlighted in the Emthanjeni Local Municipality's IDP (2012-2013) and the Pixley ka Seme District's IDP (2009-2012).

5.3 Project Planning and the site-specific Environmental Impact Assessment

In terms of the EIA Regulations under NEMA, a Scoping and EIA report (including an environmental management programme (EMPr)) are required to be compiled for this proposed project. The EIA is considered as an effective planning and decision-making tool in the planning process of a new power generation facility. It allows potential environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed through project design and implementation. The level of detail at a site-specific level is refined through the process, and allows for resolution of potential issue(s) through dialogue with affected parties.

The relationship between project development and the environmental assessment and management process is depicted in the figure below.

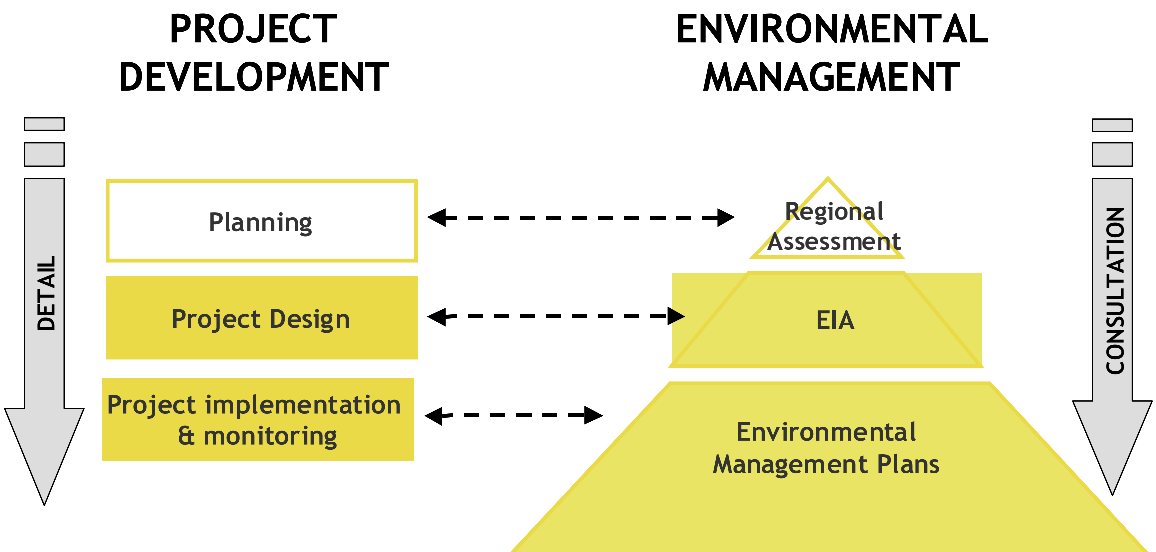


Figure 5.2: Diagram depicting the relationship between project development and environmental management

The project planning phase for the Castle Wind Energy Facility included a detailed site selection process, as well as the environmental suitability of the site being confirmed through an environmental screening process undertaken by Savannah Environmental. This site screening process is detailed further in Chapter 4 of this Draft Environmental Impact Assessment Report.

The environmental screening process considered a high-level region for possible development. Within this region, the developer proposed a site. This entire extent of the site has been considered in this Draft Environmental Impact Assessment Report to determine any environmental sensitivity and/or fatal flaws and to inform the layout of the wind energy facility.

APROACH TO UNDERTAKING THE EIA PROCESS CHAPTER 6

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: i.e. **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an Environmental Management Programme (EMPr)) to the competent authority for decision-making. The EIA process is illustrated below:

Figure 6.1: Phases within the EIA Process

The EIA Phase for the proposed Castle Wind Energy Facility and associated infrastructure has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of 18 June 2010, as amended in December 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations. This chapter serves to outline the EIA process that was followed.

6.1. Phase 1: Scoping Study

The Scoping Study, which was concluded in January 2014 with the acceptance of the Scoping Report by DEA, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed Castle Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

The draft Scoping Report compiled was made available at the following public venues for I&AP review and comment from 26 October 2013 to 04 November 2013:

» De Aar Public Library – 21 Station Street, De Aar
» Phandulwazi Library – Nanzwakazi Location, Hlithani Street, De Aar
» Emthanjeni Local Municipality Offices – 45 Voortrekker Street, De Aar
» Frans Jooste Library – Bree Street, Philipstown
» Renosterberg Local Municipality – Green Street, Philipstown
» The report was also available for download from www.savannahSA.com

All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report and Plan of Study for EIA. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) on 03 December 2013. The Final Scoping Report was accepted by the DEA in 30 January 2014 (refer to Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project in line with the Plan of Study for EIA as stated in the Scoping Report. In addition, it is required that comments from the relevant organs of state are submitted with the Final Environmental Impact Assessment Report (EIAR), and that the EIAR is to contain a construction and operational phase Environmental Management Programme (EMPr).

6.2. Phase 2: Environmental Impact Assessment Phase

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess identified feasible alternatives put forward as part of the project.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits associated with all phases of the project including design, construction, operation, and decommissioning, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

6.3. Overview of the EIA Phase

The EIA Phase was undertaken in accordance with the EIA Regulations published in GN 33306 of 18 June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed in detail below.

6.3.1. Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and EIA report. Consultation with the regulating authorities (i.e. DEA and NC DENC) has continued throughout the EIA process. On-going consultation included the following:

» Submission of a Final Scoping Report (December 2013) following a public review period (and consideration of stakeholder comments received).
» Correspondence with DEA and NC DENC in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

The following was undertaken as part of this EIA process:

» Submission of a Draft Environmental Impact Assessment (EIA) Report for a 40 day public review period.

» Provision of an opportunity for DEA and NC DENC representatives to visit and inspect the proposed site once the Final EIA Report has been submitted to the DEA for review.
» Consultation with Organs of State that may have jurisdiction over the project:
  * National Department of Environmental Affairs
  * National Energy Regulator of South Africa (NERSA)
  * Department of Energy
  * Department of Water and sanitation
  * Department of Agriculture, Forestry and Fisheries
  * Department of Mineral Resources
  * Department of Science and Technology
  * Northern Cape Department of Environment and Nature Conservation (NC DENC)
  * Department of Transport and Public Works and various District Roads Departments
  * Department of Land Affairs
  * Department of Communications
  * Northern Cape Department of Agriculture, Land Reform and Rural Development
  * Civil Aviation Authority (SACAA)
  * Emthanjeni Local Municipality
  * Renosterberg Local Municipality
  * Pixley Ka Seme District Municipality
  * The South African Airforce (SAAF)
  * South African Heritage Resources Agency (SAHRA)
  * Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
  * South African National Roads Agency Limited (SANRAL)
  * SANParks
  * Eskom
  * Telkom SA Ltd
  * Sentech
  * Square Kilometer Array (SKA)

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within this Final EIAR. A record of the authority consultation in the EIA process is included within **Appendix E**.

6.3.2. Public Involvement and Consultation: EIA Phase

The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.

» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to **Appendix C** for a listing of recorded parties). Adjacent landowners were identified and informed of the project (refer to landowner map in **Appendix P**). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA process and the project database has been updated on an on-going basis.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by Savannah Environmental through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders and parastatals (refer to Table 6.1).

Table 6.1: Key stakeholder groups identified during the EIA Phase

Organs of State
National Government Departments
Department of Agriculture, Forestry and Fisheries
Department of Communications
Department of Energy
Department of Mineral Resources
Department of Public Works
Department of Rural Development and Land Reform
Department of Science and Technology
Department of Water and Sanitation
South African Airforce (SAAF)
South African National Parks (SANParks)
Government Bodies and Institutions
Eskom SOC Ltd
National Energy Regulator of South Africa (NERSA)

Sentech
South African Civil Aviation Authority (SACAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
Square Kilometre Array: Southern Africa
Telkom SA Ltd
Provincial Government Departments
Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
Northern Cape Department of Agriculture, Land Reform and Rural Development
Northern Cape Department of Environment and Nature Conservation (DENC)
Northern Cape Department of Roads and Public Works
Local Government Departments
Emthanjeni Local Municipality
Renosterberg Local Municipality
Pixley Ka Seme District Municipality
Conservation Authorities
BirdLife South Africa
Wildlife and Environment Society of South Africa (WESSA)
Landowners
Affected landowners and tenants
Neighbouring landowners and tenants

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA Phase were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA Process and the project database has been updated on an on-going basis.

» **Newspaper Advertisements**

As part of the EIA phase a newspaper advert was placed in the De Aar Echo and Die Volksbald to:

- notify and inform the public of the proposed project and invite members of the public to register as I&APs
- inform the public of the review period for the Draft EIA Report

The adverts were placed as follows:

- Afrikaans advert in **Die Volksbad** on the **02 December 2014.**
- English advert in the **De Aar Echo** on the **05 December 2014**

» **Stakeholder Engagement**
In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA phase, including:

- **Focus group meetings** (stakeholders invited to attend- 14-15 January 2014)
- **Public feedback meeting** (public invited to attend- 14 January 2014)
- One-on-one **consultation meetings** where required (for example with directly affected or surrounding landowners)
- **Telephonic consultation** sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants)
- Written, faxed or e-mail **correspondence.**

Record of all consultation undertaken during the EIA phase is included within Appendix E.

6.3.3 Notification of the EIA Process

In order to notify and inform the public of the proposed project and invite members of the public to register as interested and affected parties (I&APs), the project and EIA process was advertised in the De Aar Echo and Die Volksblad on 23 August 2013.

In addition, site notices were placed on site and in public places on 21 August 2013 (farm entrance gates, the public library in De Aar and municipal office in De Aar) in accordance with the requirements of the EIA Regulations

In addition to the above advertisements and notices, key stakeholders and identified I&APs were notified in writing of the commencement of the EIA process. These parties included, inter alia:

» Relevant parties from municipalities potentially affected by the proposed project.
» The affected landowners and neighbouring landowners
» Organs of State having jurisdiction in respect of any aspect of the activity, including:
  - National Department of Environmental Affairs
  - National Energy Regulator of South Africa (NERSA)
  - Department of Energy
  - Department of Water and sanitation
  - Department of Agriculture, Forestry and Fisheries

* Department of Mineral Resources
* Department of Science and Technology
* Northern Cape Department of Environment and Nature Conservation (NC DENC)
* Department of Transport and Public Works and various District Roads Departments
* Department of Land Affairs
* Department of Communications
* Northern Cape Department of Agriculture, Land Reform and Rural Development
* Civil Aviation Authority (SACAA)
* Emthanjeni Local Municipality
* Renosterberg Local Municipality
* Pixley Ka Seme District Municipality
* The South African Airforce (SAAF)
* South African Heritage Resources Agency (SAHRA)
* Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
* South African National Roads Agency Limited (SANRAL)
* SANParks
* Eskom
* Telkom SA Ltd
* Sentech
* Square Kilometer Array (SKA)

Copies of all the advertisements placed and notices distributed are contained in Appendix E of this report. Copies of these letters distributed to the above mentioned organs of state/ key stakeholders are included in Appendix E of this report.

6.3.4. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Report (refer to Appendix E for the Comments and Response Reports compiled through the EIA Process to date).

The Comments and Response Report includes responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

6.3.5. Public Review of Draft Environmental Impact Assessment Report

The Draft EIA Report was made available for a 40 day public review period from **01 December 2014 –28 January 2015** at the following locations:

- De Aar Public Library – 21 Station Street, De Aar
- Phandulwazi Library – Nanzwakazi Location, Hlithani Street, De Aar
- Emthanjeni Local Municipality Offices – 45 Voortrekker Street, De Aar
- Frans Jooste Library – Bree Street, Philipstown
- Renosterberg Local Municipality – Green Street, Philipstown
- The report is also available for download from www.savannahSA.com

In order to facilitate comments on the Draft Environmental Impact Assessment Report, all registered I&APs were notified of the availability of the report by letter. An advert was placed in the De Aar Echo and Die Volksbad, to inform the public and I&APs of the availability of the Draft EIAR for review. The public meeting was held on the 14 January 2014 at the De Aar East Community Hall at 18h00. A Land owner focus group meeting was held on the 15 January 2014 at Mr Andries van der Merwe's Farm (Vandussie Kuil) at 12h30.

6.3.6. Final Environmental Impact Assessment (EIA) Report

The final stage in the EIA Phase entailed capturing of responses from I&APs on the Draft EIA Report in order to refine this report. This Final EIA report is submitted to the decision-making Authorities, and it is this Final report upon which a decision is made regarding the proposed project.

Table 6.2: Summary of Public Involvement Process undertaken to date

	Activity	**Date**
Scoping Phase	Placement of newspaper advert in local newspapers notifying the public and interested parties of the project.	23 August 2013
	Placement of site notices on-site & in public places	21 August 2013
	Distribution of a stakeholder letter, background information document to authorities, ward councillors, landowners within the study area, neighbouring landowners and stakeholder groups	August 2013 – September 2013
	Placement of newspaper advert in local newspapers informing interested and affected parties of the availability of the Draft Scoping Report and Public Meeting date.	27 – 28 September 2013

	Activity	Date
	40-day public review period for the Draft Scoping Report for public comment.	26 September 2013 to 04 November 2013
	Public Meeting	26 September 2013
	Focus group meetings	26-27 September 2013
	Notification to registered I&APs of submission of Final Scoping Report to DEA	November 2013
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting	02 & 05 December 2015
	40-day public review period for the Draft Environmental Impact Assessment Report for public comment	01 December 2014 to 28 January 2015

6.4. Assessment of Issues Identified through the EIA Process

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in the table below.

Table 6.3: Specialists involved in the assessment of impacts

Specialist	Area of Expertise	Refer Appendix
Simon Todd of Simon Todd Consulting	Ecology	Appendix F
Toni Belcher and Dana Grobler	Freshwater Assessment	Appendix G
Jon Smallie of WildSkies Ecological Services	Avifauna (including long-term monitoring)	Appendix H
Werner Marais of Animalia	Bats (including long-term monitoring)	Appendix I
Johan van Tol of HydroPedological Solutions	Soil, erosion and agricultural potential	Appendix J
Morne de Jager of Enviro Acoustic Research	Noise	Appendix K
Lourens du Plessis of MetroGIS	Visual	Appendix L
Tony Barbour (Environmental Consultant and Researcher)	Social	Appendix M

Jaco van der Walt of Heritage Contracts and Archaeological Consulting cc	Archaeology and Heritage	Appendix N
Barry Millsteed	Palaeontology	Appendix P

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the wind energy facility. Issues were 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.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);
  * Assigned a score of 4 is highly probable (most likely); and
  * Assigned a score of 5 is 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.
» 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)P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area);
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated); and
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As the project developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An Environmental Management Programme has been included as **Appendix Q**.

6.5. Regulatory and Legal Context

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and local levels. As a renewable energy development is a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for the renewable energy facility project and the related statutory environmental assessment process.

6.5.1. Regulatory Hierarchy

At **National Level**, the main regulatory agencies are:

» *Department of Energy*: This department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provide legislative protection for listed or proclaimed heritage sites.
» *Department of Transport – South African Civil Aviation Authority (SACAA):* This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *South African National Roads Agency Limited (SANRAL):* This department is responsible for all National road routes.
» *Department of Water and Sanitation (DWS):* The DWA is mandated to manage South Africa's water resources by ensuring the security and quality thereof. This Department is responsible for evaluating and issuing licenses pertaining to water use.
» *The Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. This Department has published a guideline for the development of wind farms on agricultural land. Deals with sub-division or registration of a long term lease on agricultural land. Consent from this Department is required for the development and reckoning of the land to be utilised by the wind energy facility.
» *Department of Mineral Resources*: A Section 53 Application is required in terms to this Department. DMR consent required.

At **Provincial Level**, the main regulatory agencies are:

» *Provincial Government of the Northern Cape – Department of Environment and Nature Conservation (Northern Cape DENC).* This department is the commenting authority for this project.

» *Department of Transport and Public Works - Northern Cape.* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Northern Cape Department of Agriculture and Rural Development* – This is the provincial authority responsible for matters affecting agricultural land.
» *Northern Cape Heritage*: provides legislative protection for listed or proclaimed heritage sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, the local and district municipalities (Emthanjeni Local Municipality, Renosterberg Local Municipality and Pixley Ka Seme District Municipality) play a role. In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

There are also numerous non-statutory bodies such as wind energy associations and environmental lobby groups that play a role in various aspects of planning and the environment that will influence wind energy development.

6.5.2 Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Scoping Report:

» National Environmental Management Act (Act No. 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA)
» Municipal Integrated Development Plans;
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in the scoping report, and to be addressed in the EIA. A listing of relevant legislation identified at this stage of the process is provided in Table 6.4.

Table 6.4: Initial review of relevant policies, legislation, guidelines and standards applicable to the proposed Castle Wind Energy Facility EIA

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No. 107 of 1998)	» NEMA requires, inter alia, that: ∗ Development must be socially, environmentally, and economically sustainable. ∗ Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. ∗ A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions. » EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. » In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority charged by NEMA	» National Department of Environmental Affairs (DEA) » Northern Cape Department of Environment and Nature Conservation (NC DENC)	» The Final EIA Report is to be submitted to the DEA for review and decision making. » The NC DENC is the commenting authority.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	with granting of the relevant environmental authorisation. » In terms of GNR 543 of 18 June 2010, a Scoping EIA Process is required to be undertaken for the proposed project.		
National Environmental Management Act (Act No. 107 of 1998)	» A project proponent is required to consider a project holistically and to consider the cumulative effect of potential impacts. » In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with a project is avoided, stopped or minimised.	» DEA	» While no permitting or licensing requirements arise directly, the holistic consideration of the potential impacts of the proposed project has found application in the EIA process. » The implementation of mitigation measures are included as part of the Draft EMPr and will continue to apply throughout the life cycle of the project.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	» In terms of the Biodiversity Act, the developer has a responsibility for: * The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). * The application of appropriate environmental management tools	» DEA	An Ecological Impact Assessment has been undertaken as part of the EIA process. » A permit may be required should any listed plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	to ensure integrated environmental management of activities. * Limit further loss of biodiversity and conserve endangered ecosystems. » In terms of S57, a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 4. In this regard the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. » In terms of S75, (1) The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs. (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	damage to the environment. (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating, or re-establishing itself in any manner. » In terms of GNR 152 of 23 February 2007: regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements. » In terms of GNR 1002 on 9th December 2011: National List of Threatened Ecosystems published under S52(1)(a) of the Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	(2004). » GNR1187 Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List published under S56(1)of the Act.		
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	» The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. » In terms of the regulations published in terms of this Act (GN 921, 29 November 2013), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that (a) The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste; (b) Adequate measures are taken to prevent accidental spillage or leaking; (c) The waste cannot be blown away; (d) Nuisances such as odour, visual impacts and breeding of vectors do not arise; and (e) Pollution of the environment and	» DEA » NC DENC	» As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. » Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act. This is detailed in the EMPr for the project. » The volumes of waste to be generated and stored on the site during construction and operation of the power line will not require a waste license (provided these remain below the prescribed thresholds).

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	harm to health are prevented.		
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	» S18, S19 and S20 of the Act allow certain areas to be declared and managed as "priority areas" » Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. » Dust control regulations promulgated in November 2013 may require the implementation of a dust management plan.	» DEA » NC DENC	» While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction phase of the project. » The Air Emissions Authority (AEL) may require the compilation of a dust management plan.
National Water Act (Act No. 36 of 1998)	» Under S21 of the act, water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation. » In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» National Department of Water Affairs » Northern Cape Department of Water Affairs	» A water use license is required to be applied for or obtained if infrastructure (such as access roads or cabling) impacts on a wetland or watercourse (Section 21c and i). » If ground or surface water is planned to be abstracted for use at the facility

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			(either during construction or operation), this may also require a water use licence (Section 21a).
Environment Conservation Act (Act No. 73 of 1989)	» National Noise Control Regulations (GN R154 dated 10 January 1992)	» DEA » Local Authorities	» There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328. This must be completed as part of the EIA process for the project.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (i.e. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. » S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of	» Department of Minerals and Energy	» If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained. » Approval in terms of S53 will be required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.		
National Heritage Resources Act (Act No. 25 of 1999)	» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent » The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Standalone HIAs are not required	» South African Heritage Resources Agency	» A Phase 1 heritage impact assessment has been undertaken as part of the EIA process. » A permit may be required should identified cultural or heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Forests Act (Act No. 84 of 1998)	» In terms of S5(1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated". » GN 1042 provides a list of protected tree species.	» Department of Agriculture, Forestry and Fisheries	» A permit would need to be obtained for any protected trees that are affected by the proposed project.
National Veld and Forest Fire Act (Act 101 of 1998)	» Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 places a duty on landowners to prepare and maintain firebreaks, and Chapter 5 places a duty on all landowners to acquire equipment and have available personnel to fight fires. » In terms of S12 the applicant would be obliged to burn firebreaks to	» Department of Agriculture, Forestry and Fisheries	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project in terms of fire prevention and management.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	ensure that should a veldfire occur on the property, that it does not spread to adjoining land. » In terms of S12 the firebreak would need to be wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. » In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.		
Hazardous Substances Act (Act No. 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising, or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by	» Department of Health	» It is necessary to identify and list all the It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. » The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.	» Provincial Department of Transport (provincial roads) » South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		power station components may not meet specified dimensional limitations (height and width).
Conservation of Agricultural Resources Act (CARA) (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5). » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	Department of Agriculture, Forestry and Fisheries	This Act will find application during the EIA and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.
Development Facilitation	Provides for the overall framework and	Emthanjeni Local Minicipality	The applicant must submit a

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Act (Act No 67 of 1995)	administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for land development and conflict resolution.	and Renosterberg Local Municipality	land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
Provincial Legislation			
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	Provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require. **Manipulation of boundary fences** 19. No Person may – (a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape	Northern Cape Department of Environment and Nature Conservation	A permit is required for any activities which involve species listed under schedule 1 or 2. The DENC permit office provides an integrated permit which can be used for all provincial and Threatened or Protected Species (TOPS)-related permit requirements.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	therefrom; The Act also lists protected fauna and flora under 3 schedules ranging from Specially protected (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1.		
Aviation Act (No. 74 of 1962)	In terms of Section 22(1) of the Aviation Act (Act No 74 of 1962) (13^{th} amendment of the Civil Aviation Regulations (CARs) 1997) the Minister promulgated amendments pertaining to obstacle limitation and markings outside aerodromes or heliports. In terms of this act no buildings or objects higher than 45 metres above the mean level of the landing area, or, in the case of a water aerodrome or heliport, the normal level of the water, shall without the approval of the Commissioner be erected within a distance of 8 kilometres measured from the nearest point of the boundary of an aerodrome or heliport. No building, structure or other object which will project above the approach, transitional or horizontal surfaces of an aerodrome or heliport shall, without the prior approval of the Commissioner, be erected or allowed to come into existence. Structures lower than	South African Civil Aviation Authority	In terms of the proposed wind energy facility, Castle Wind Facility may need to obtain the necessary approvals from the Civil Aviation Authority (CAA) for erection of the proposed wind turbines.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	45 m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and, in addition, their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircrafts Section 14 relates specifically to wind energy facilities and it is stated that due to the potential of wind turbine generators to interfere with radio navigation equipment, no wind farm should be built closer than 35 km from an aerodrome. In addition, several other conditions relating specifically to wind turbines are included in Section 14.		

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 7

This section of the EIA Report provides a description of the environment that may be affected by the proposed Castle Wind Energy Facility near De Aar, in the Northern Cape Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development and associated infrastructure, such as the power line, have been described. This information has been sourced from both existing information available for the area as well as through site investigations. It also aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices F - O**.

7.1. Regional Setting and the Study Area

The proposed Castle Wind Energy Facility site is located in the sparsely populated region of the Karoo in the Northern Cape Province. The proposed site falls within the Emthanjeni Local Municipality and the Renosterberg Local Municipality, within the Pixley ka Seme District Municipality. The administrative center of the Emthanjeni Local Municipality is De Aar, which lies approximately 300 km south east of the provincial capital of Kimberley. The site lies ~28 km north-east of De Aar and ~22 km south-west of Philipstown. The wind energy facility is proposed to be located on the following farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The three farm portions collectively make up a broader study area of approximately 3257ha (i.e. 32.6 km^2) which is being considered for the wind energy facility and in this report. The N10 (De Aar-Hanover), R48 (De Aar-Philipstown) and R389 (Hanover-Philipstown) are the nearest tarred road links to the study area. Gravel roads off these tarred connections provide access to the study area farms. Access to the site is constrained by the local topography.

Portions 12 and 13 of the Farm 165 (Vendussie Kuil) are traversed by the Hydra to Roodekuil 2 -220kV power line. A host of other power lines traverse further northwest of the site, which congregate at the Hydra substation. These are: Hydra to Roodekuil 1- 220kV, Beta to Hydra 1 & 2 - 400kV and Perseus to Hydra 2 & 3 - 400kV. Another set of power lines traverses south of the proposed development site. The closest of these are the Hydra to Ruigtevallei 1 & 2 - 22kV lines, located just less than 7km at the closest. The Eskom Hydra Substation is located southeast of De Aar, approximately 23km from the proposed Castle Wind Energy Facility site, and the newly constructed Ilanga Lethemba Substation (Solar Capital Substation) which is located near De Aar.

Homesteads or farm residences surrounding / in proximity to the proposed wind energy facility site include: Meyersfontein, Witput, Die Dam, Leeufontein, Slingershoek, Matjiesfontein, Pienaarskloof, Kranskop, Klipfontein, Garrenboom, Vendussiekraal, Disselskuil, Groenpan, Plessisvlakte, Rooidam, Knapdaar, etc. The average population density of the District Municipality is estimated at approximately 10 people per km^2, primarily concentrated within the towns of De Aar and Philipstown.

7.2. Land Cover/ Land-Use

The vegetation of eastern side of the study area consists of Northern Upper Karoo and that of the western side was classified as Besemkaree Koppies Shrubland (Mucina & Rutherford, 2006) (refer to Figure 7.1). The current land-use is restricted to low intensity grazing. The natural grazing capacity of the site is approximately 25 hectares per large stock unit. The low rainfall, high potential evaporation, high maximum and low minimum temperatures, coupled with shallow soils covering most of the site, limits any additional land-use activities. A small area of 7.5 ha near the Rooiwal homestead in the south-eastern part of the study area, is cultivated and irrigated using borehole/groundwater. A number of non-perennial streams are present, but the dominant source of water for agricultural purposes is groundwater.

7.3 Climatic Conditions

The study area receives an average of less than 300mm rainfall per annum and is representative of the dry semi-desert climate associated with the Great Karoo. Rainfall for the site is low and is ~290 mm per annum according to the South African Rain Atlas (Water Research Commission, undated). In terms of the relationship between rainfall and evaporation the lower lying parts of the site fall into the classification of arid while the higher lying parts fall into the classification of semi-arid. The aridity is a significant limitation to agriculture in the region.

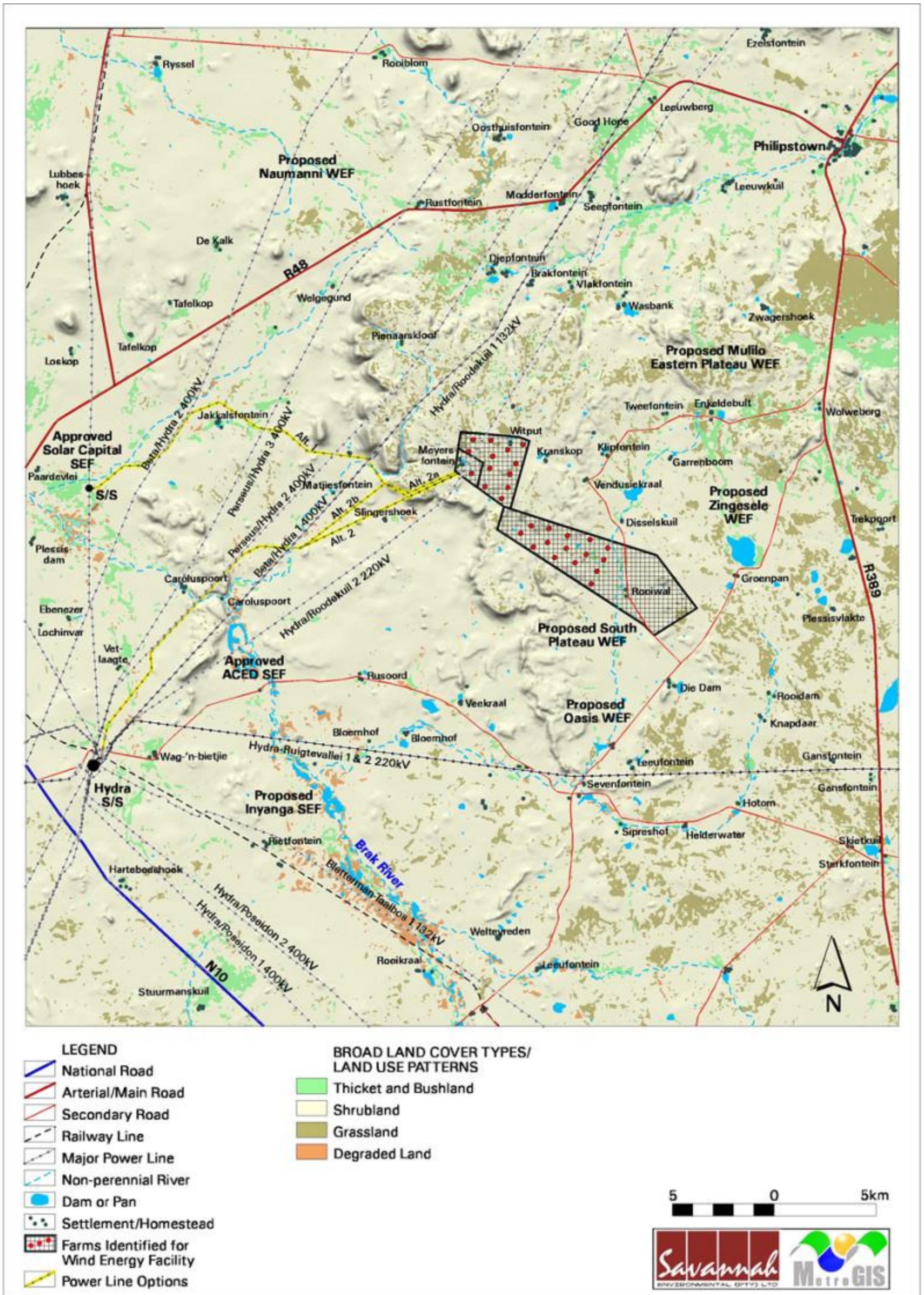


Figure 7.1: Land cover/land use map for the Castle Wind Energy Facility, as well as the broader study area

7.4. Biophysical Characteristics of the Study Site and immediate surrounds

This section of the report describes the development footprint and its immediate surroundings of the proposed Castle Wind Energy Facility.

7.4.1. Topography

The topography or terrain morphology of the region is broadly described as Lowlands with Hills of the Interior Plain. The elevation above sea level ranges from 1687m at the top of the northern section of the escarpment (near Pienaarskloof), to 1238m along the Brak River floodplain (where it leaves the study area in the west). The site itself has an undulating slope elevation with some low hills or ridges occurring in places. A shaded relief map is shown in Figure 7.2. The proposed wind energy facility site is predominantly on an elevated, mountainous plateau within the Karoo. There is a drainage valley that runs through the eastern part of the site. Elevation ranges between 1400 m in the valley to 1550 m on the highest parts of the plateau. Average slope across the site is around 3%, however the terrain is broken and also contains short slopes that are much steeper (up to 25%).

7.4.2. Hydrology

The non-perennial Brak River is the only major hydrological feature traversing the study area. The Brak River flows in a north westerly direction to the south west of the study area with a number of its tributaries crossing the site as they flow in a south-westerly direction. The main tributary of the Brak River flows southwards through the southern portion of the site. This tributary is seasonally flowing and contains an associated valley bottom wetland area consisting of low growing sedges and grasses. Most of the smaller tributaries within the study area are ephemeral and are discernible only as slightly shallow depressions with no clear associated vegetation and slightly clayey soils. Small, shallow instream dams and erosion control structures that have been constructed within many of these drainage channels. Associated with many of the streams and the small dams are small wetland areas and endorheic pans. The significant pans within the area are located outside of the site.

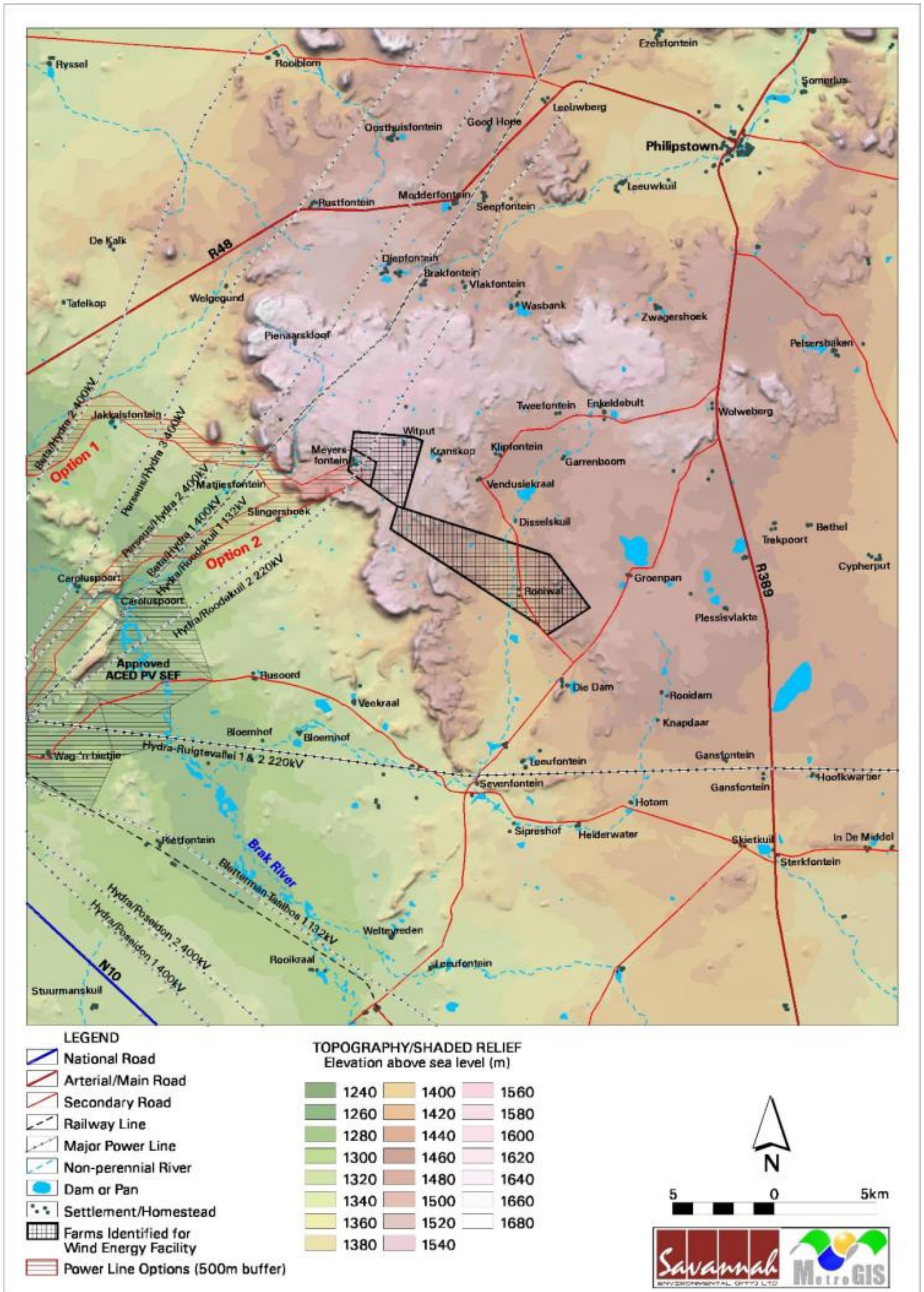


Figure 7.2: Shaded relief map indicating the location of the proposed facility and the topography and elevation above sea level

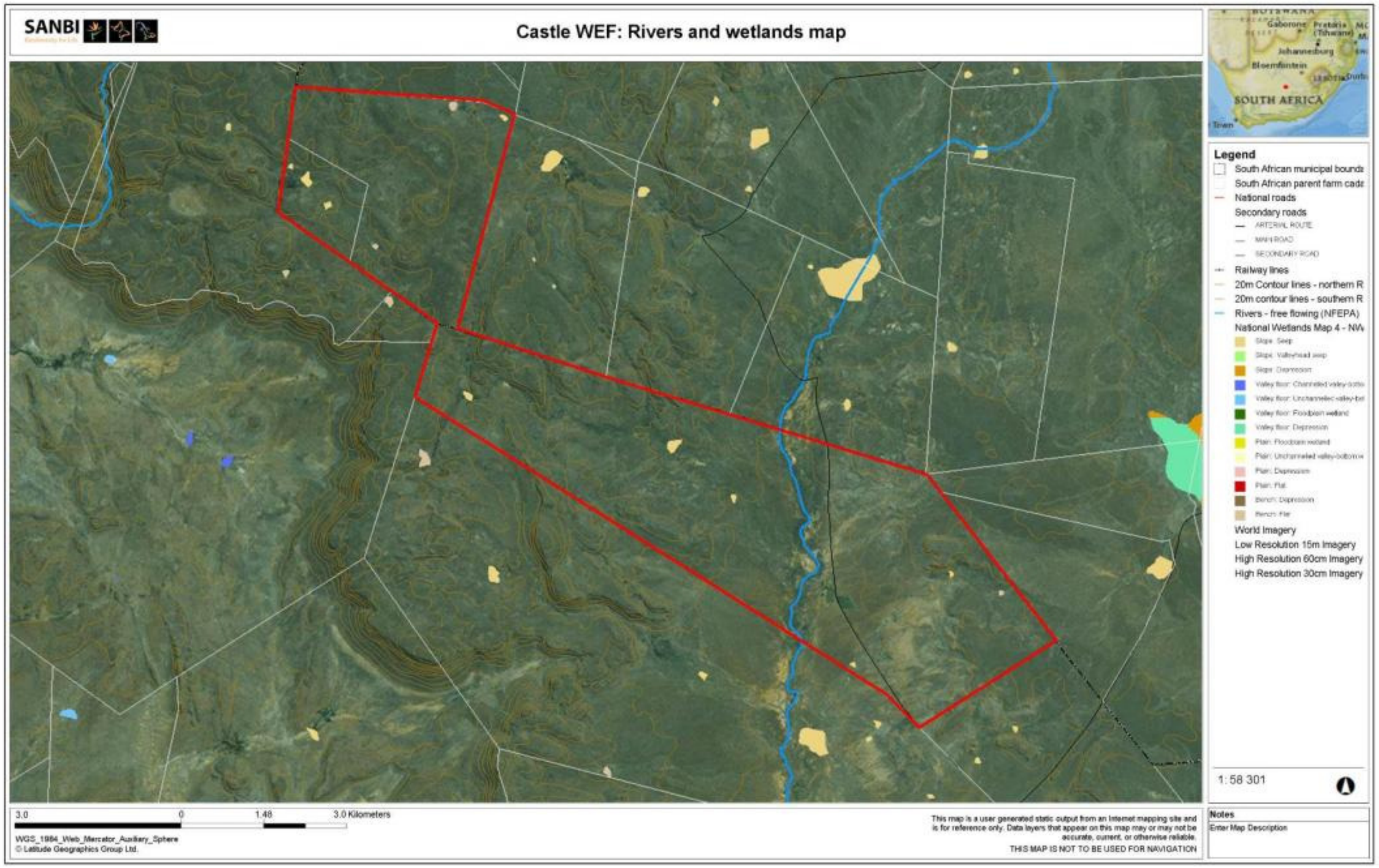


Figure 7.3: Water features within the study area

7.4.3. Geology, Soils and Agricultural Potential

The underlying geology of the site are shales, mudstones and sandstones of the Beaufort Formation, Karoo Sequence. Windblown deposits are however dominant in lower midslope and footslope positions in the south-eastern corner of the study area.

Three land types dominate the study area, namely Fb72, Fb73 and Ae142 (refer to Figure 7.3) described as follows:

» *Land type Ae142* - Ae land types (Ae142 in Figure 7.4) refers to an area where more than 40% of the soils are red, high base status soils that are deeper than 300 mm. The agricultural potential of the land covered by Ae142 is low and land-use restricted to low intensity grazing due to the climatic constraints. The potential of large parts of the land type can however be dramatically increased, should adequate irrigation water be available.
» *Land type Fb72 and Fb73* - in Fb land types (Fb72 and Fb73 in Figure 7.4), lime accumulations occur frequently in one or more of the valley bottom soils. The agricultural potential of the land covered by Fb72 and Fb73 is low due to the soil and climatic constraints.

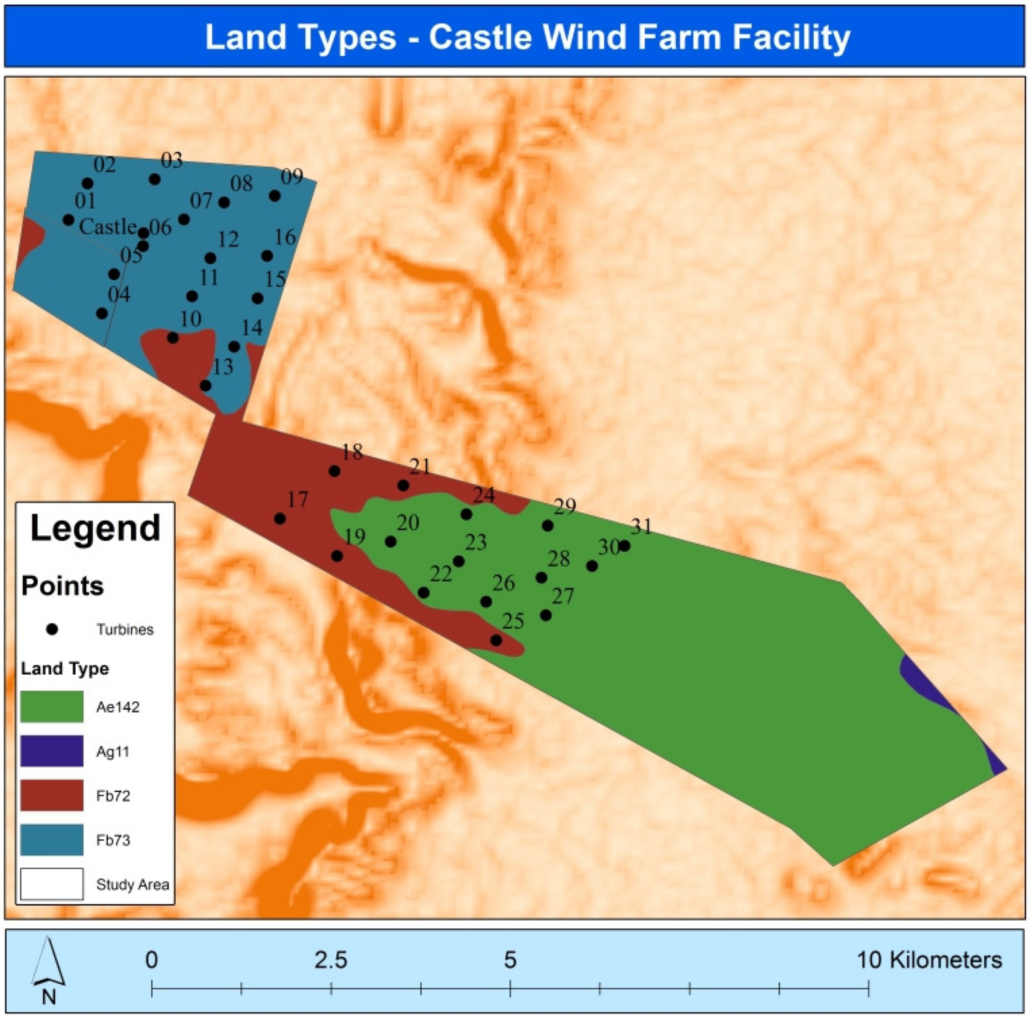


Figure 7.4: The distribution of the different land types within the Castle Wind Energy Facility site

The following six different soil associations are found on the site (refer to Figure 7.5):

» **Cv/Hu**: These are deep (>1 000 mm) well drained soils of the Hutton and Clovely soil form. These soils are derived from aeolian deposits and are restricted to the south-western corner of the study area. The clay content of these soils is low and their morphology indicates that both internal and external drainage is good. They are not sensitive to erosion.
» **Du/Sw**: These soils of the Dundee and Swartland forms occur in valley bottom positions of the site. The Du formed to alluvial depositions and alluvial stratifications are still visible. The majority of trees and large shrubs are found on these Du soils, suggesting that they can support plant growth by supplying nutrients and water even in this harsh climate. The

occurrence of Du soils are however restricted to a narrow band around the stream channels (Figure 7.4); a landscape position prone to erosion. Swartland soils show a marked increase of clay with depth and a moderate to strong structure in the B-horizon (pedocutanic). Due to the duplex nature of the Swartland soils as well as high Na^{+} contents in the B-horizon, these soils are susceptible to erosion.

» **Hu/Gs**: This soil association occur on relatively flat areas of the Fb land types. The Hutton soils in this association differ dramatically from that in the Cv/Hu association. These Hutton soils are shallow (<500 mm) with abundant doleritic rocks in the profile. Glenrosa soils are shallow orthic A horizons on weathering rock (lithocutanic B horizons). The small storage capacity of these soils makes them sensitive to erosion with limited agricultural potential.
» **Ms/Gs**: This soil association is dominated by shallow (<250 mm) soils of the Mispah and Glenrosa forms. They dominate convex positions of areas with slopes >2%. The limited storage capacity of the soils limits the agricultural potential to natural grazing and makes these soils susceptible to erosion.
» **R/Ms**: This association is dominated by rock outcrops on steep slopes 5 – 55%. Limited or no storage capacity will result in overland flow due to infiltration excess and this soil association is susceptible to erosion.
» **Sw**: Swartland soils occur on relatively flat areas (slope <2%) of especially Fb land types. As discussed above, luviation of clays resulted in the duplex character of these soils. Although this particular association were found on gentle slopes, these soils can be dispersive and susceptible to erosion. The strong structure of the pedocutanic B horizon will limit root penetration and water infiltration.

Table 7.1. Summary of the soil potential of the study site.

Soil Association	Soil Forms	Current Potential	Limitations	Inherent potential for irrigation	Erosion sensitivity
Cv/Hu	Clovely & Hutton	Very low	Arid climate	Very high	Low
Du/Sw	Dundee & Swartland	Very low	Arid climate	Low	High
Hu/Gs	Hutton & Glenrosa	Very low	Arid climate and limited soil depth	Very low	Moderate
Ms/Gs	Mispah & Glenrosa	Very low	Arid climate and limited soil depth	Very low	High
R/Ms	Rocks & Mispah	Very low	Arid climate and limited soil depth	Very low	High
Sw	Swartland	Very low	Arid climate and strong structure of pedocutanic B horizon	Low	Moderate

The overall agricultural potential of the site is very low, largely restricted by aridic climate conditions and shallow soils. The Cv/Hu (refer to Figure 7.5) soil associations are the only areas of the site suitable for crop production should adequate irrigation water be available.

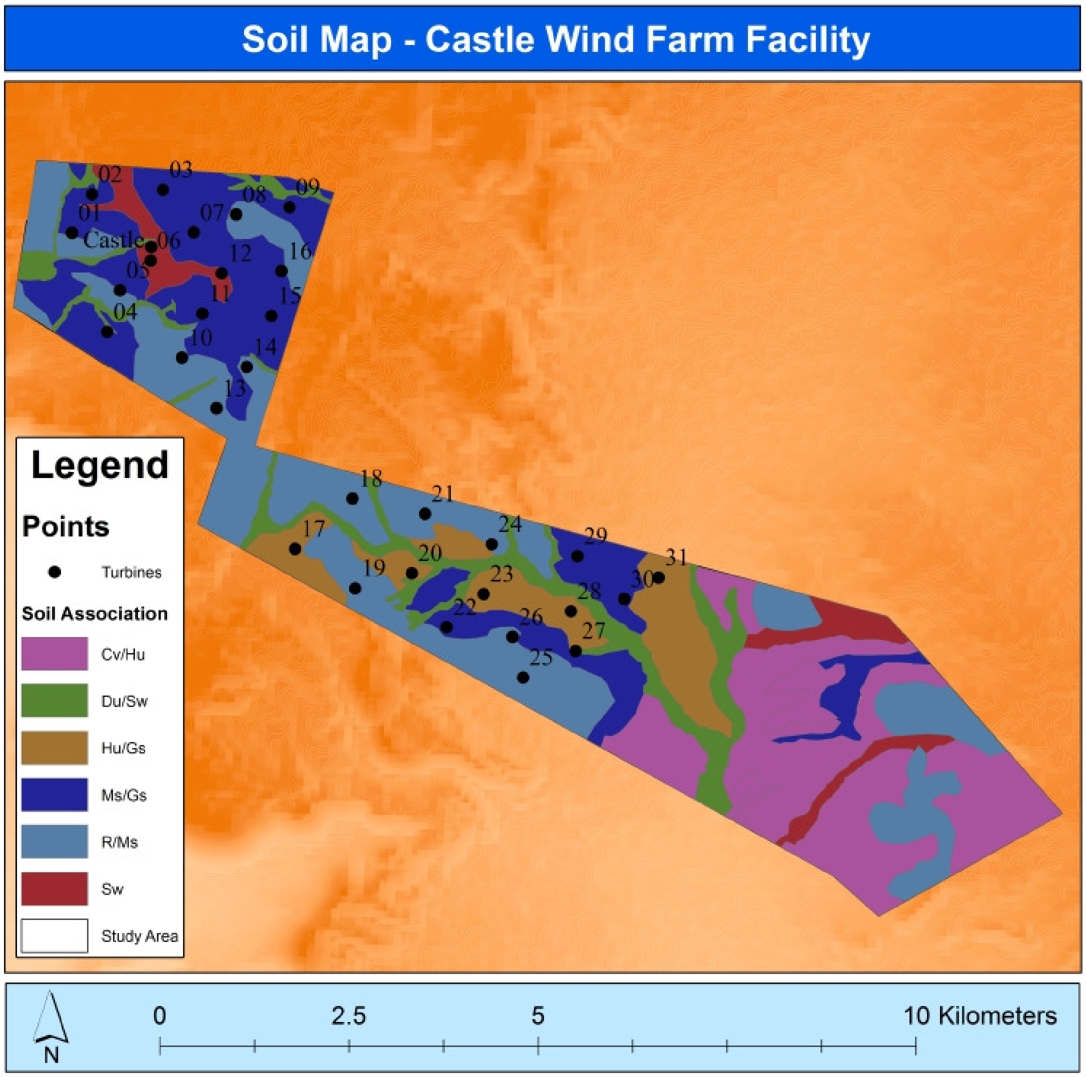


Figure 7.5. Soil association map of the study site with proposed turbine positions.

Land capability is the combination of soil suitability and climate factors. The entire site has a land capability classification, on the 8 Category scale, of Class 7 (i.e. non-arable, low potential grazing land). Land capability is limited by the mountainous, rocky terrain, the shallow soils and the aridity of the region. The site is used for sheep farming. The natural grazing capacity is low and varies between 18 - 30 hectares per large stock unit across the site. There is a very small area of cultivated, irrigated land surrounding the farm house (Rooi Kraal) which is located on the Farm Knapdaar which will not be impacted upon by the development.

7.4.4. Critical Biodiversity Areas and Conservation Planning Areas

No fine-scale conservation planning has been conducted in the area and no Critical Biodiversity Areas have been defined for the region. However, the western part of Portion 12 and 13 of the Farm 165 (Vendussie Kuil) lies within a National Protected Areas Expansion Strategy focus area (NPAES) (refer to Figure 7.6). NPAES focus areas are areas that are considered important for the expansion of the land-based protected area network as they contribute towards meeting biodiversity thresholds for terrestrial or freshwater ecosystems, maintaining ecological processes or climate change resilience. The affected NPAES focus area comprises 6400 ha and is a relatively small part of the broader 345 913ha Senqu Caledon focus area. Approximately 450ha of the NPAES focus area is actually within the site (i.e. the eastern boundary of the mapped NPAES focus area) and the loss of this area to the development would not be likely to compromise the ability to meet future conservation targets within this focus area.

The vegetation type in the area, particularly on the plains, consists of Northern Upper Karoo. This is one of the most extensive vegetation types in the country and has a low overall abundance of species of conservation concern.

7.4.5. Flora & Broad Scale Vegetation Patterns

According to the national vegetation map (Mucina & Rutherford 2006) (refer to Figure 7.6), two vegetation types (Northern Upper Karoo and Besemkaree Koppies Shrubland) occur within the site itself. The eastern part of the site consists of Northern Upper Karoo and the western part of the site consists of Besemkaree Koppies Shrubland. Both vegetation types are classified as Least Threatened and have not been significantly transformed. These vegetation types are described below and in more detail in the ecological report (Appendix F):

» *Northern Upper Karoo* is usually an open shrubland dominated by low karoo shrubs and grasses with larger elements such as *Acacia mellifera* more prominent in the north. Known endemic plant species found in this vegetation type include: *Lithops hookeriana, Stomatium pluridens, Atriplex spongiosa, Galenia exigua and Manulea deserticola*.
» *Besemkaree Koppies Shrubland* is associated with the slopes of koppies, butts, and tafelbergs within the dry grasslands of the southern and central Free State and the adjacent parts of the Northern and Eastern Cape. This vegetation type consists of an upper layer of tall shrubs, such as *Searsia erosa, S.burchellii, S.ciliata, Euclea crispa, Diospyros austro-africana* and *Olea europea subsp africana*, with an understorey of low shrubs and grasses. This vegetation type is associated with dolerite koppies and sills embedded within Karoo supergroup elements. Four vegetation-type endemics have been

recorded including *Euphorbia crassipes, Neohenrica sibettii, N.spicata* as well as an undescribed species of *Cussonia*.

Although these two vegetation are clearly differentiated on the SA Vegmap, in reality, they form a much more patchy mosaic at the site. In the west of the site, there are large tracts that have more affinity with Northern Upper Karoo than Besemkaree Koppies Shrubland. Even within this area, the flats between the rocky outcrops are consistent with Northern Upper Karoo and the north-west of the site consists of the large plain of this vegetation type.

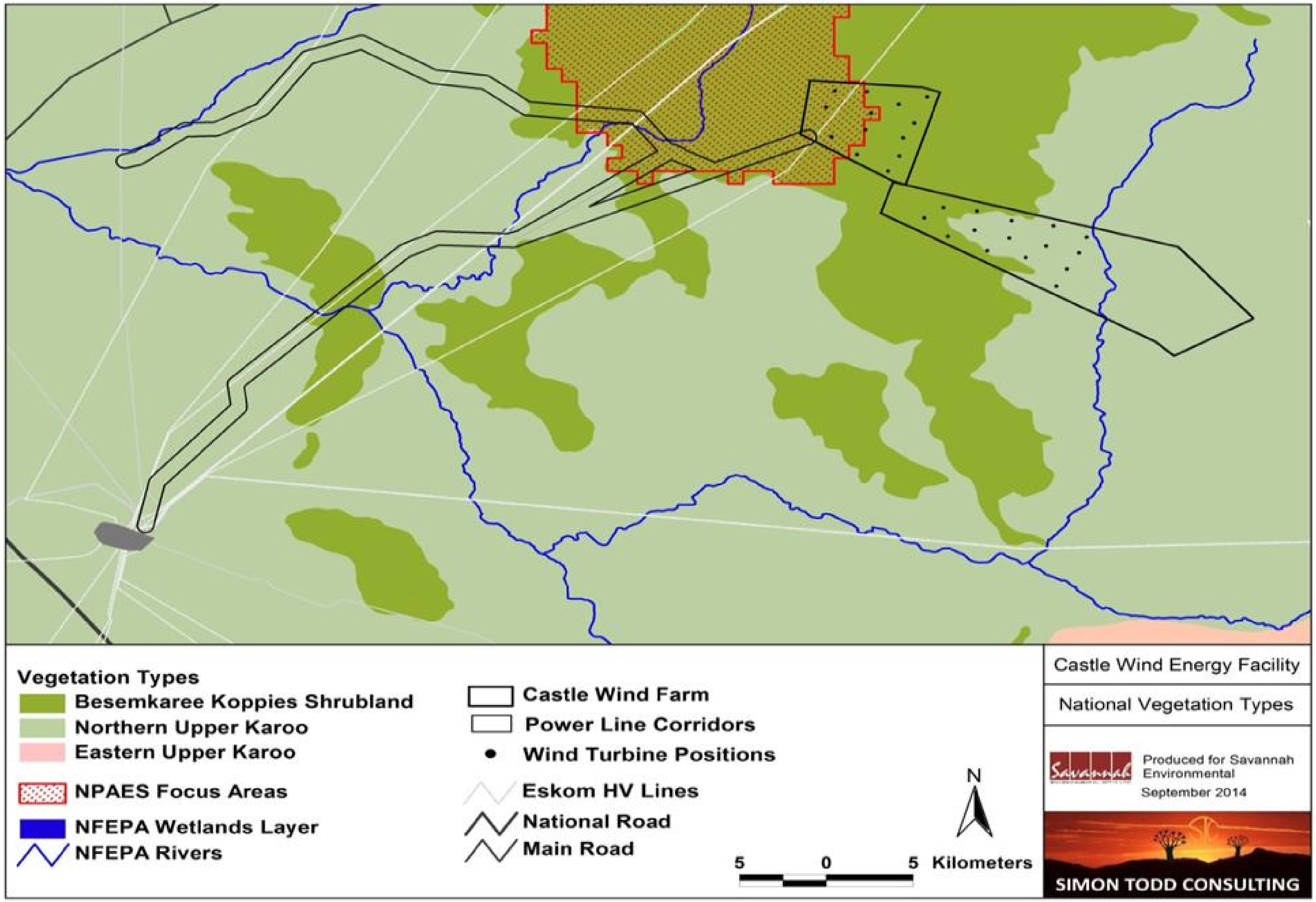


Figure 7.5: Broad-scale overview of the vegetation in and around the Castle Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011), as well as NPAES focus areas.

7.4.6 Listed and Protected Plant Species

According to the SANBI SIBIS database, 270 plant species have been recorded from the quarter degree squares 3024 CA, AD, CA, CB. This includes 3 species of low conservation concern, *Hermannia repetenda*, *Chasmatophyllum maninum* and *Hereroa concava*, all of which are classified as DDD. These species are poorly known species that have not been recently collected and their presence within the area is dubious and may result from database errors as they are not reported as occurring in the De Aar area. Other species of significance observed at the site include *Stomatium pluridens* and *Euphorbia crassipes*, which are regional endemics and provincially protected. Other protected species include *Aloe broomii* var. *broomii*, *Aloe variegata*, *Aloe claviflora*, *Pachypodium succulentum* and *Boscia albitrunca*. The density of these species was generally low, except for *Aloe broomii* which was abundant in the western section of the site.

7.4.7 Fauna

Mammals

The Castle Wind Energy Facility site lies within the range of 51 terrestrial mammals, including four listed mammal species. The four listed species are the Brown Hyaena *Hyaena brunnea* (NT), Black-footed cat *Felis nigripes* (VU) South African Hedgehog *Atelerix frontalis* (NT) and Honey Badger *Mellivora capensis* (SA RDB EN). While the Hedgehog, Black-footed Cat and Honey Badger are likely to occur at the site, the Brown Hyaena is less likely to be present. All of these species have relatively wide ranges across South Africa.

The south-facing slopes with dense vegetation, riparian areas and rocky outcrops are likely to provide habitat for mammalian species. Species observed at the site include Suricate, Yellow Mongoose, South African Ground Squirrel, Cape Porcupine, Springbok, Steenbok, Namaqua Rock Mouse, Baboon, Aardvark, Rock Hyrax, Hewitt's Red Rock Rabbit and African Mole Rat. All of these species have relatively wide ranges across South Africa and the development would not be likely to result in a significant overall decline in the available habitat for these species.

Reptiles

According to the distribution maps available in the literature, as many as 44 reptiles could occur in the study area. However, according to the records within the SARCA database, only 32 have been recorded in the region, which is a more representative estimate of the species richness likely to be encountered at the site. Species observed include Karoo Girdled Lizard *Karusasaurus polyzonus*, Spotted Sand Lizard *Pedioplanis lineoocellata lineoocellata*, Western Three-striped Skink *Trachylepis occidentalis* and Leopard Tortoise *Stigmochelys pardalis*.

The site represents a relatively rich habitat for reptiles as it contains various types of rocky outcrops, koppies, cliffs and steep slopes as well as more densely vegetated riparian areas, and flats of varying texture. Despite the likely high reptile richness at the site, no listed species are known from the area.

Amphibians

Eleven frog species are known from the broad area around the site, including the Giant Bullfrog (*Pyxicephalus adpersus)* which is listed as Near Threatened. The majority of species known from the area are toads and sand frogs which are relatively independent of water except for breeding purposes, which reflects the aridity of the area.

7.4.8 Bats

In terms of habitat, the table below described the potential of the vegetation units of the site to serve as suitable roosting and foraging spaces for bats.

Table 7.2: Potential of vegetation units suitable for roosting

Vegetation Unit	Roosting Potential	Foraging Potential	Comments
Besemkaree Koppies Shrubland	Moderate - High	Low - Moderate	The koppies and tafelbergs found within the unit can provide roosting areas for bats while the vegetation can attract insects which in turn attract insectivorous bats.
Northern Upper Karoo	Moderate	Moderate - Low	The pans, dwarf shrubs and grasses may attract insects which in turn will attract foraging bats. The low trees may prove useful for roosting purposes.

The ecology of three common South African insectivorous bat species are described below. These three species could occur on the site (refer to Table 7.3):

» ***Miniopterusnatalensis:*** *Miniopterusnatalens*is, commonly called the Natal - clinging bat, occurs widely across the country but mostly within the southern and eastern regions. It is listed as a Near Threatened conservation category. It is a cave-dependent species, such that the presence of suitable roosting sites in an area may be more important in predicting its presence than the vegetation. This species assembles in large numbers to roost within caves. It utilises separate caves for winter hibernating activities and summer maternity behaviour. Winter hibernacula generally occur in more temperate areas of the country and at higher altitudes, while summer maternity roosts are warmer and lower altitudes (Monadjemet al., 2010). No locations of any caves are known within the area of the site. If a suitable roosting cave is located near to the site, it would most likely be used as a summer maternity roost. *Miniopterusnatalensis* are known to undertake short migratory journeys between hibernacula and maternity roosts.

» ***Neoromicia capensis:*** Commonly called the Cape Serotine, *Neoromiciacapensis* has a Least Concern conservation category as it is widespread over much of sub-Saharan Africa in high numbers. It roosts individually or in small groups of two or three bats in a variety of shelters, such as under the bark of trees, at the base of aloe leaves, and under the roofs of houses. They will utilise most man-made structures as day roosts (Monadjemet al., 2010). These types of roosting sites on the farms must be considered as sensitive. They do not undertake migrations and therefore considered residents of the site. They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; inferring that they may occupy several habitat types across the site, and are adaptable towards habitat changes. They are thought to have a Medium – High likelihood of risk of fatality due to wind turbines (Sowler and Stoffberg, 2012).
» ***Tadarida aegyptiaca:*** The Egyptian Free-tailed Bat, *Tadaridaaegyptiaca*, is a Least Concern species as it has a wide distribution and high abundance throughout South Africa. This species is protected by national legislation in South Africa (ACR, 2010). They roost communally in small (dozens) to medium-sized (hundreds) groups in caves, rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. *Tadaridaaegyptiaca* has also adapted to roosting in buildings, in particular roofs of houses. Therfore man-made structures and large trees on the site would be important roosts for this species. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey. The Egyptian Free-tailed bat is considered to have a high likelihood of risk of fatality due to wind turbines (Sowler and Stoffberg, 2012).

Table 7.3: Table of species that may be roosting or foraging on the study area, the possible site specific roosts, and their probability of occurrence based on literature (Monadjem et al. 2010).

Species name	Common name	Probability of Occurrence (%)	Conservation Status	Possible roosting sites occupied on or near site	Foraging habits (indicative of possible foraging areas on or near site)
Eptesicus hottentotus	Long tailed Serotine	90-100	Least Concern	Dwells in crevices and buildings which can be found within the site, specifically the dolerite koppies and tafelbergs found in the Eastern Upper Karoo unit.	A clutter edge forager that feeds mainly on species of Coleoptera.
Miniopterus natalensis	Natal long-fingered bat	90-100	Near Threatened	Cave and hollow dependent, but have been personally observed to roost in small groups or individually in culverts.	Clutter-edge forager. Feeds on a variety of aerial prey including Diptera, Hemiptera, Coleoptera, Lepidoptera and Isoptera. May forage in open grassland during suitable weather.
Myotis tricolor	Temmink's myotis	40-50	Least Concern	It roosts socially in caves and moves between its winter hibernacula and summer maternity caves. It has a close association with mountainous areas. On the edge of distribution.	A clutter-edge forager that is restricted to aerial prey such as Coleoptera, Hemiptera, Diptera, Neuroptera and Hymenoptera
Neoromicia capensis	Cape Serotine	90-100	Least Concern	Roosts under the bark of trees, at the base of aloe leaves, under roofs and within crevices.	Clutter-edge forager feeding mainly on Coleoptera, Hemiptera, Lepidoptera and Neuroptera.May forage over open grassland in suitable weather.
Nycteris thebaica	Egyptian slit-faced bat	10-20	Least Concern	Roosts during the day in burrows, culverts and trunks of large trees. Preferring cluttered habitats more. On	A clutter forager with a diet that varies according to season between Orthoptera, Coleoptera

				edge of distribution.	and Lepidoptera as well as a number of other insects and arachnids.
Rhinolophus clivosus	Geoffroy's horseshoe bat	40-50	Least concern	Roosts socially in caves and mine adits and can also make use of cavities in rock formations. There are no known caves within the study area.	Known to establish feeding stations during the night under trees or the verandas of houses. Clutter forager with a diet comprised mainly of Lepidoptera and Coleoptera. More probable in cluttered valley areas. Unlikely to forage over open grassland.
Rhinolophus darlingi	Darling's Horseshoe bat	10-20	Least Threatened	Roosts in caves, mine adits and other suitable hollows. On edge of distribution.	A clutter edge forager that feeds mainly on species of Lepidoptera and Coleoptera.
Tadarida aegyptiaca	Egyptian free-tailed bat	90-100	Least concern	Roosts in caves, crevices, hollow trees, buildings, and any other suitable crevices. May be roosting in any crevice found on site, including buildings and trees.	Open-air forager with a diet consisting mainly of Diptera, Hemiptera, Coleoptera and to some extent Lepidoptera. Strong flier that will forage over the open grasslands.

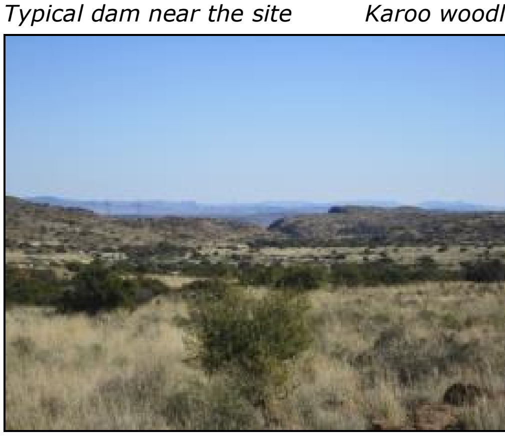
7.4.9 Avifauna

The Castle Wind Energy Facility site is situated within the Platberg Karoo Conservancy Important Bird Area (IBA – Barnes 1998) as the area supports populations of two Globally Threatened species, namely the Lesser Kestrel and the Blue Crane. The Important Bird Areas (IBA) Programme is one of BirdLife International's conservation initiatives. The site also falls within a high sensitivity area as classified in the "Avian Wind Farm Sensitivity Map for South Africa" (Retief *et al*, 2011).

Bird Micro Habitats

The habitats available to birds at a small spatial scale are known as micro-habitats, which are determined largely by vegetation structure rather than vegetation composition. These micro- habitats are formed by a combination of factors such as vegetation, land use, anthropogenic factors, topography and others. The micro -habitats identified on the site include: Karoo flats; drainage lines; dams; rocky kopjes and arable lands.


Typical dam near the site *Karoo woodland on site*




Karoo woodland on edge of escarpment *Shrubby Karoo on site*

Grassy Karoo in east of site *Small arable land on site*

Karoo flats or 'vlakte'

Figure 7.7: Examples of bird micro- habitats available on the Castle Wind Energy Facility site.

<u>Target Species</u>

A list of '26 target species' has been compiled for the Castle Wind Facility site. Target species are those species for which there is most conservation concern, and therefore the focus of this study (refer to Table 7.4). Data on bird activity collected thorough the pre-construction bird monitoring programme is available in the Avifaunal Impact Assessment Report (refer to Appendix **H**).

Table 7.4: Target bird species for the Castle Wind Energy Facility

Common name	Taxonomic name	Ecological group	SABAP 1	SABAP 2	Taylor 2014	IUCN 2013	Preferred micro habitat
Tawny Eagle	*Aquila rapax*	Raptor	X		EN	LC	Karoo – throughout study area
Martial Eagle	*Polemaetus bellicosus*	Raptor	X		EN	VU	Karoo – throughout study area
African Marsh-Harrier	*Circus ranivorus*	Raptor	X		EN	LC	Karoo – particularly flats
Ludwig's Bustard	*Neotis ludwigii*	Large terrestrial	X		EN	EN	Karoo – particularly on flats
Yellow-billed Stork	*Mycteria ibis*	Large terrestrial	X		EN	LC	Riverine
Black Harrier	*Circus maurus*	Raptor	X		EN	VU	Karoo – particularly flats
Black Stork	*Ciconia nigra*	Large terrestrial	X		VU	LC	Riverine, cliffs
Verreaux's Eagle	*Aquila verreauxii*	Raptor	X		VU	LC	Rocky mountainous areas, cliffs
Secretarybird	*Sagittarius serpentarius*	Large terrestrial	X		VU	VU	Karoo - throughout study area
Lanner Falcon	*Falco biarmicus*	Raptor	X		VU	LC	Karoo - throughout study area
Blue Crane	*Anthropoides paradiseus*	Large terrestrial	X		NT	VU	Karoo, particularly flats and dams
Kori Bustard	*Ardeotis kori*	Large terrestrial	X		NT	NT	Karoo – throughout study area
Lesser Flamingo	*Phoenicopterus minor*	Water bird	X		NT	NT	Dams, pans
Abdim's Stork	*Ciconia abdimii*	Large terrestrial	X		NT	LC	Karoo – particularly on flats
Karoo Korhaan	*Eupodotis vigorsii*	Large terrestrial	X		NT	LC	Karoo – throughout study area
Greater Flamingo	*Phoenicopterus ruber*	Water bird	X		NT	LC	Dams, pans

Lesser Kestrel	*Falco naumanni*	Raptor	X	-	LC	Karoo – throughout study area
Blue Korhaan	*Eupodotis caerulescens*	Raptor	X	-	NT	Karoo – particularly on flats
White Stork	*Ciconia ciconia*	Large terrestrial	X		BONN	Karoo – particularly on flats
Hamerkop	*Scopus umbretta*	Water bird	X	-	LC	Riverine
Jackal Buzzard	*Buteo rufofuscus*	Raptor	X	-	LC	Karoo – throughout study area
Egyptian Goose	*Alopochen aegyptiacus*	Water bird	X	-	LC	Dams, pans and arable lands
Southern Pale Chanting Goshawk	*Melierax canorus*	Raptor	X	-	-	Karoo – throughout study area
Northern Black Korhaan	*Afrotis afraoides*	Large terrestrial	X	-	-	Karoo – throughout study area
South African Shelduck	*Tadorna cana*	Water bird	X	-	LC	Dams, pans
Black-headed Heron	*Ardea melanocephala*	Large terrestrial	X	-	LC	Dams, pans

EN = Endangered; VU = Vulnerable, NT = Near-threatened, Bonn = Protected Internationally under the Bonn Convention on Migratory Species, LC = Least Concern. NOTE: Stork species are classified as large terrestrial for the purposes of analysis later in this report, as their behaviour is in most respects similar to that of large terrestrials.

7.5. Social Characteristics

The proposed site occurs within the Emthanjeni Local Municipality and the Renosterberg Local Municipality, which both fall within the greater Pixley ke Seme District Municipality. The social and economic characteristics of the region are described below.

7.5.1 Economy (Provincial level)

The Northern Cape economy has shown significant recovery since 2000/2001 when it had a negative economic growth rate of -1.5% (LED Strategy). The provincial economy reached a peak of 3.7% in 2003/2004 and remained the lowest of all provinces. The Northern Cape is the smallest contributing province to South Africa's economy (only 2% to South Africa GDP per region in 2007).

The mining sector is the largest contributor to the provincial GDP, contributing 28.9% to the GDP in 2002 and 27.6% in 2008. Agriculture and agri-processing sector is also a key economic sector. The agricultural sector contributed 5.8% to the Northern Cape GDP per region in 2007 which was approximately R1.3 billion, and it employs approximately 19.5% of the total formally employed individuals (NCSDF, 2012).

Economic development in the Northern Cape is hampered by the vastness of the area and the remoteness of its communities in rural areas. Development is also hampered by the low education and skills levels in the Province. As a result unemployment in the Northern Cape presents a major challenge.

7.5.2. Employment

The official unemployment rate in both the Pixley ka Seme District Municipality and Emthanjeni Local Municipality decreased for the ten year period between 2001 and 2011. In the Pixley ka Seme District Municipality, the rate fell from 36.4% to 28.2%, a decrease of 8.2%. In the Emthanjeni Local Municipality the unemployment rate decreased from 40.7% to 28.0%, a decrease of 12.7%. Youth unemployment in both the Pixley ka Seme District Municipality and Emthanjeni Local Municipality also dropped over the same period. Youth unemployment in the Emthanjeni Local Municipality is still high however at 37.2% in 2011.
The unemployment rate of the Renosterberg Local Municipality has decreased from 48% in 2001 to 26.8% in 2014 and the youth unemployment rate has also decrease from 55.8% in 2001 to 29.8% in 2011.

7.5.3. Population

The population of the Pixley ka Seme District Municipality increased by from 166 547 in 2001 to 186 351 in 2011, which represents an increase of ~ 12%. The population of the Emthanjeni Local Municipality increased from 35 785 in 2001 to 42 356 in 2011 (~ 18%) over the same period. The Renosterberg Local Municipality increased from 9070 in 2001 to 10 978 in 2011. The increase in the population in the Pixley ka Seme District Municipality was linked to an increase in the 15-64 and 65 and older age groups. The number of households in the Pixley ka Seme District Municipality, Emthanjeni Local Municipality and Renosterberg Local Municipality increased between 2001 and 2011. The size of the household sizes in both areas essentially remained the same, namely in the region of 3.7-3.9.

7.5.4. Education

The education levels at both the district and local municipal level have improved from 2001, with the percentage of the population over 20 years of age with no schooling in the Pixley ka Seme District Municipality decreasing from 27.1% to 14.6% in 2011. For the Emthanjeni Local Municipality the percentage has decreased from 23.7% to 11.0%. For the Renosterberg Local Municipality the percentage has decreased from 26% to 16%. The percentage of the population over the age of 20 with matric also increased in the Pixley ka Seme District Municipality, Emthanjeni Local Municipality and the Renosterberg Local Municipality. This was from 12.9% to 20.5% in the Pixley ka Seme District Municipality, from 17.1% to 24.7% in the Emthanjeni Local Municipality and from 6.1% to 6.6% in the Renosterberg Local Municipality.

7.6. Heritage and Palaeontological Profile

The town of De Aar was founded in 1881 on the farm by the same name. The farm originally belonged to Jan Vermeulen who sold it for the purpose of the development of the town. With the development of railway the town became an important station with one of the largest marshaling yards in the country.

Occupation by early humans would probably date to at least the Middle Stone Age (Earlier Stone Age sites are known in the wider region) and would consist of open sites near stream beds or hills and outcrops. Raw material sources would have been amongst the foci for Stone Age activity. Population density might have increased during the Later Stone Age and people would have occupied rock shelters where available, as well as open sites.

During this later period they also produced rock engravings, of which some are known to occur on the farm Tafelkop north of the study area, as well as rock paintings, some of which occur on the farm Veekraal east of the study area and others on Jakkalsfontein north of the study area.

The following heritage sites, features, and objects are known to occur in the larger region (Morris 2011):

- Stone Age sites located near the foot of hills and in rock shelters where these have developed;
- Sites with either rock engravings or rock paintings. Dolerite koppies in the region are known to have rock engravings (Fock & Fock 1989; Morris 1988; Parkington *et al*. 2008);
- Stock enclosures constructed of stone;
- Burial sites in the vicinity of the Brak River (power line servitudes);
- Houses and other structures older than 60 years;
- Farming infrastructure such as wind mills, etc; and
- Graves and cemeteries, both formal and informal.

A variety of heritage resources occur in this larger region and there is thus a likelihood that similar resources will be located in the study area. Sites can be expected especially in the areas where hills and outcrops occur, as well as along the banks of the Brak River.

The Castle Wind Energy Facility to the northeast of De Aar, Northern Cape, is underlain by Late Permian sedimentary rocks of the Adelaide Subgroup, Jurassic dolerites of the Karoo Dolerite Suite and unconsolidated sands constituting a Cenozoic-age regolith. The rocks of the Adelaide Subgroup are known to be fossiliferous elsewhere in the Karoo Basin and contain famous and scientifically significant vertebrate faunas and plant macrofossil floras. Several fragmentary fossils were located within this unit and the density of their occurrence suggests that numerous other fossils may be present within the unit elsewhere in the reporting area. No fossils were located within the Cenozoic regolith, but similar deposits are known to be fossiliferous elsewhere in the Karoo and fossil materials may well be present within subsurface portions of the stratigraphic unit. The dolerites formed via intrusion of magma that crystallised deep in the earth's crust, and accordingly, are unfossiliferous.

ASSESSMENT OF IMPACTS CHAPTER 8

Environmental impacts associated with the proposed Castle Wind Energy Facility are expected to be associated with the construction, operation and decommissioning of the facility. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site.

The construction for a wind energy facility include land clearing for site preparation and access/haul roads; transportation of supply materials and fuels; construction of foundations involving excavations and cement pouring; compaction of laydown areas and roadways, manoeuvring and operating cranes for unloading and installation of equipment; laying cabling; and commissioning of new equipment. Decommissioning activities may include removal of the temporary project infrastructure and site rehabilitation. Environmental issues associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to wildlife through mortality, injury and disturbance; impacts to sites of heritage value; soil erosion; and nuisance noise from the movement of vehicles transporting equipment and materials during construction.

Environmental issues specific to the operation of a wind energy facility may include visual impacts; noise produced by the spinning of rotor blades; avian/bat mortality resulting from collisions with blades and barotrauma; and light and illumination issues.

These and other environmental issues were identified through the scoping evaluation. Potentially significant impacts identified have now been assessed within the EIA phase of the study. The EIA process has involved input from specialist consultants, the project proponent, as well as input from key stakeholders (including government authorities) and interested and affected parties engaged through the public consultation process. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts vary significantly from site to site.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed wind turbines and associated infrastructure (substation, access road/s to the site, internal access roads between turbines, underground and overhead electrical cabling between turbines and turbine foundations), and to make recommendations regarding preferred alternatives for consideration by DEA, as well as for the management of the impacts for inclusion in the draft Environmental Management Programme (refer to **Appendix Q** for the EMPr).

In order to assess the impacts associated with the proposed wind energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation, and associated access roads[4]. A wind energy facility is unlike other power generation facilities in that it does not result in whole-scale disturbance to a site. The study area for the Castle Wind Energy Facility (approximately ~3257ha in extent) is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by turbines and associated infrastructure is illustrated in Figures 8.1 and 8.2 below, and includes the area covered by the following three farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The project will include the following infrastructure:
» 31 wind turbines;
» 31 crane hardstand area
» Turbine foundation/footprint
» Cabling between turbines to be laid underground (1m deep) along the road verge where practical to connect to an on-site substation.
» Temporary laydown area
» Temporary batching plant
» On-site substation (with an approximate compound size of 100 m x 100 m).
» Internal access roads up to 7m wide.
» Workshop area / office for control, maintenance and storage.

The assessment presented within this chapter of the report is on the basis of the Preliminary Layout of the Castle Wind Energy Facility, indicating the layout of 31 wind turbines (which took into consideration the outcome and specialist assessments of the site) provided by Castle Wind Farm (Pty) Ltd. The assessment of issues presented within this chapter (and within the specialist studies attached within **Appendices F – O**) considers the worst-case scenario in terms of potential impacts.

[4] The 132kV overhead line connecting the proposed Castle Wind Energy Facility to the National grid (at either Ilanga Lethemba Substation (Solar Capital Substation) or the Hydra Substation (Eskom Substation)) is being assessed under a separate Basic Assessment process (BAR).

8.1 Alternative access to site during construction and operation

The primary access road to the site would be off the existing gravel access road from the R389 to Philipstown and Hanover. Two reasonable and feasible alternatives are have been considered (refer to Figure 8.2):

» **Access Road Alternative 1 (referred to as the Northern Access Road):** The site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 19.5km from the R389 to the proposed site and several homesteads are situated along this access roads.
» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 18.5km from the R389 to the proposed site.

Potential impacts pertaining to access to the site are assessed in the sections below, and a comparative assessment of the two access alternatives have been provided.

8.2 Assessment of Potential Impacts on Ecology (Flora, Fauna and Ecosystems)

Wind energy facilities require relatively large areas of land for placement of infrastructure. The expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to Appendix F - Ecology Report for more details).

8.2.1 Specialist Findings

The site consists of two vegetation types, Northern Upper Karoo and Besemkaree Koppies Shrubland. At a broad level, the areas of Besemkaree Koppies Shrubland are considered more sensitive than the Northern Upper Karoo on account of the rocky habitat and greater abundance of species of conservation concern associated with the former. The national vegetation map is, however, drawn at a very coarse scale and the site visit revealed that the extent of Besemkaree Koppies Shrubland at the site is significantly less than that suggested by the map. Apart from the above vegetation types, there are several large drainage lines within the site which are considered to be of high sensitivity as they contain significant woody biomass and represent important faunal habitat in the area (refer to Figure 8.3). Although some protected species can be confirmed present and are likely to be impacted by the development, these are relatively widespread species of low conservation concern. The development is likely to have an impact on fauna, especially during the construction phase, but in the long-term, it is likely that most species will be able to continue to utilise the site and any impacts on fauna would be of local significance only.

No fine-scale conservation planning has been conducted in the area and thus no Critical Biodiversity Areas have been defined for the region to date. However, the western part of Vendussie Kuil lies within a National Protected Areas Expansion Strategy (NPAES) focus area (refer to Figure 8.4). NPAES focus areas are areas that are considered important for the expansion of the land-based protected area network as they contribute towards meeting biodiversity thresholds for terrestrial or freshwater ecosystems, maintaining ecological processes or climate change resilience. The affected NPAES focus area is a part of the Senqu Caledon focus area. Only approximatley 450ha of the focus area is actually within the Castle Wind Farm development area and the loss of this area to the development would not be likely to compromise the ability to meet future conservation targets within this focus area.

The major sensitive feature of the site are the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass which contrasts with the surrounding landscape. The steeper, south-facing slopes are also considered sensitive on account of their woody biomass and more mesic environment, while the less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. The remaining flats and gentle slopes are lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type. Although the majority of turbines are located within these lower sensitivity areas, there are a few turbines located within the moderately sensitive rocky areas. No turbines are however located on very steep slopes or within drainage lines.

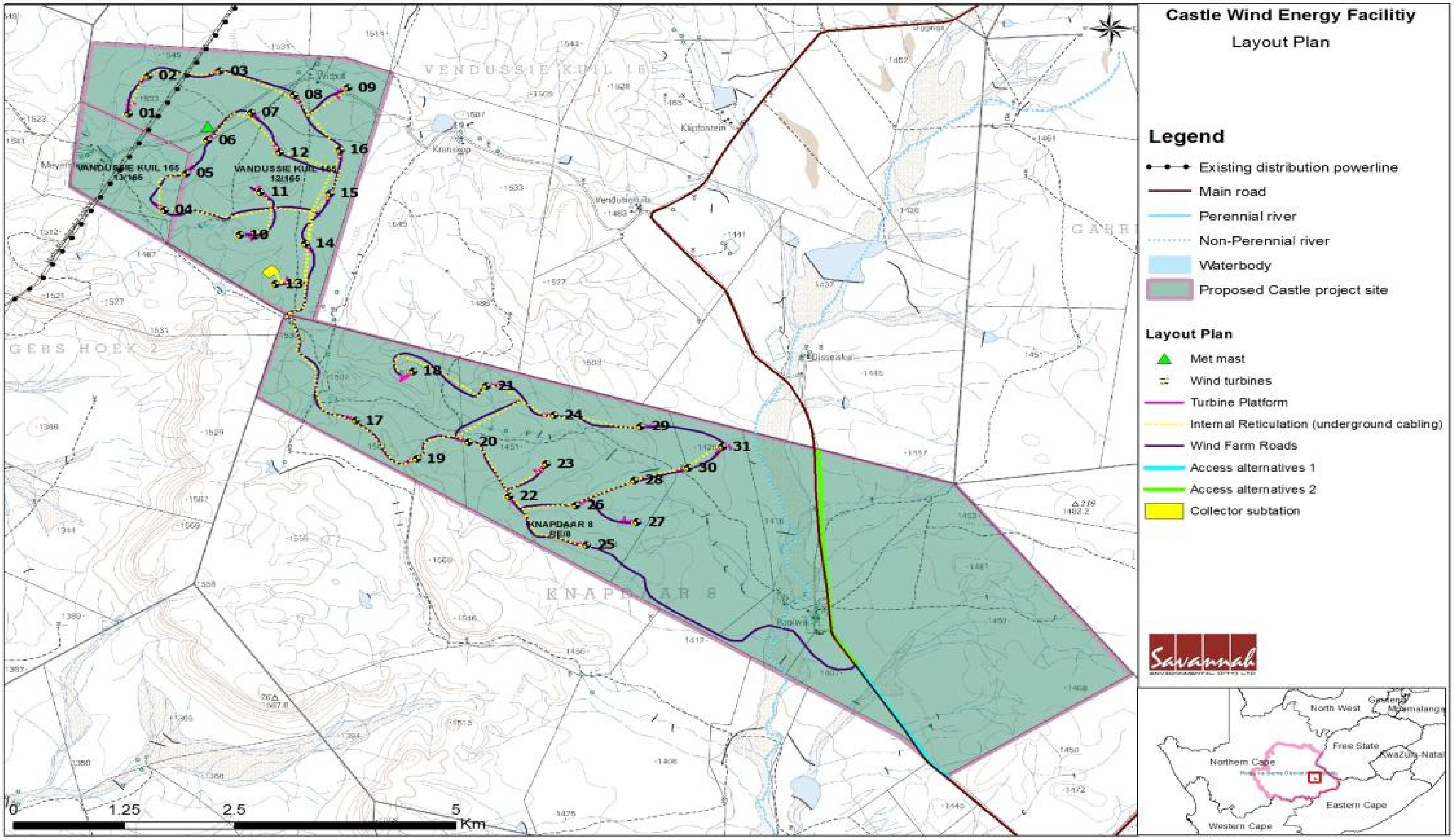


Figure 8.1 Preliminary Layout of the Castle Wind Energy Facility, indicating the cluster of 31 wind turbines (refer to Appendix P for an A3 map)

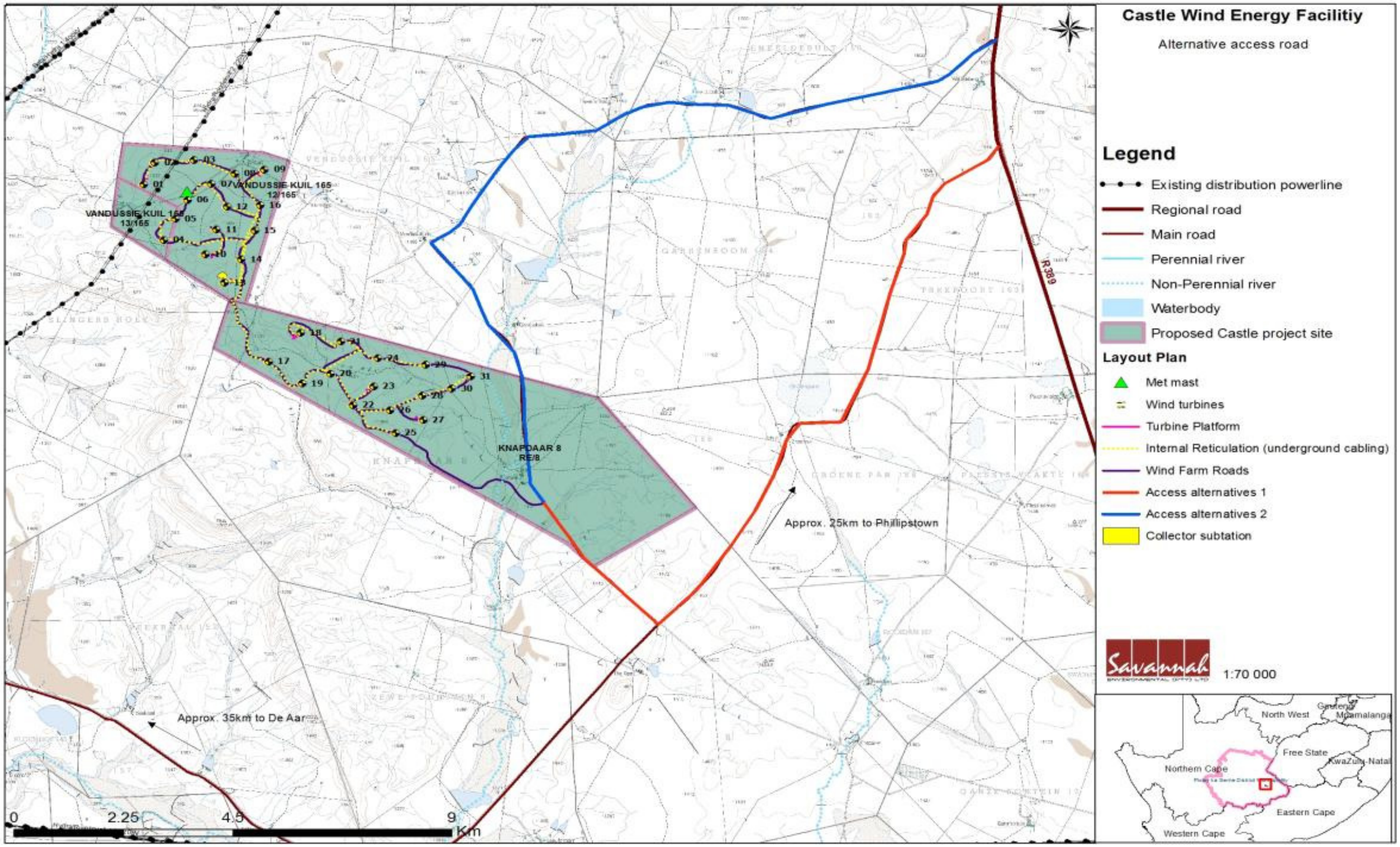


Figure 8.2 Layout map of the Castle Wind Energy Facility, indicating the 2 access road alternatives from the R389

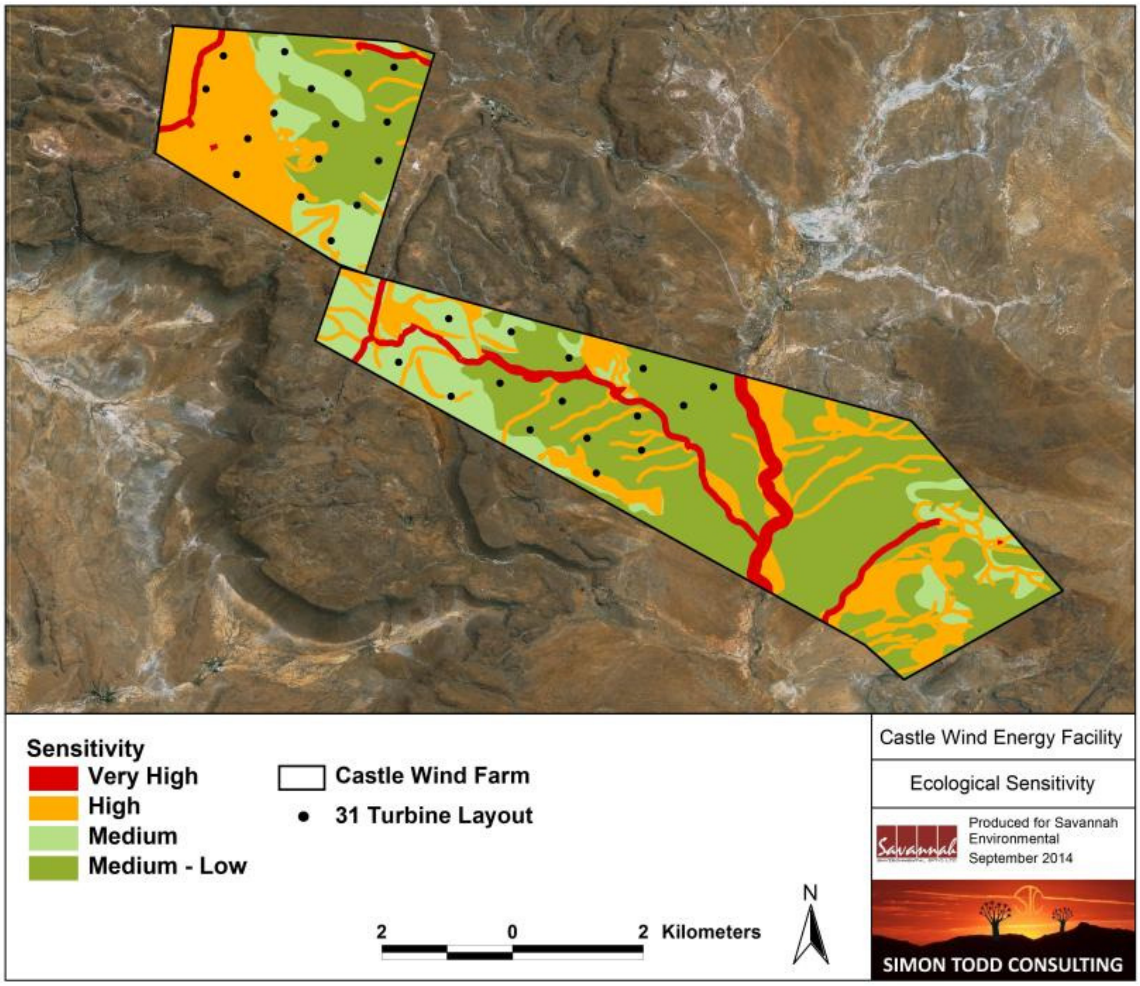


Figure 8.3: Ecological sensitivity map of the Castle Wind Energy Facility study area

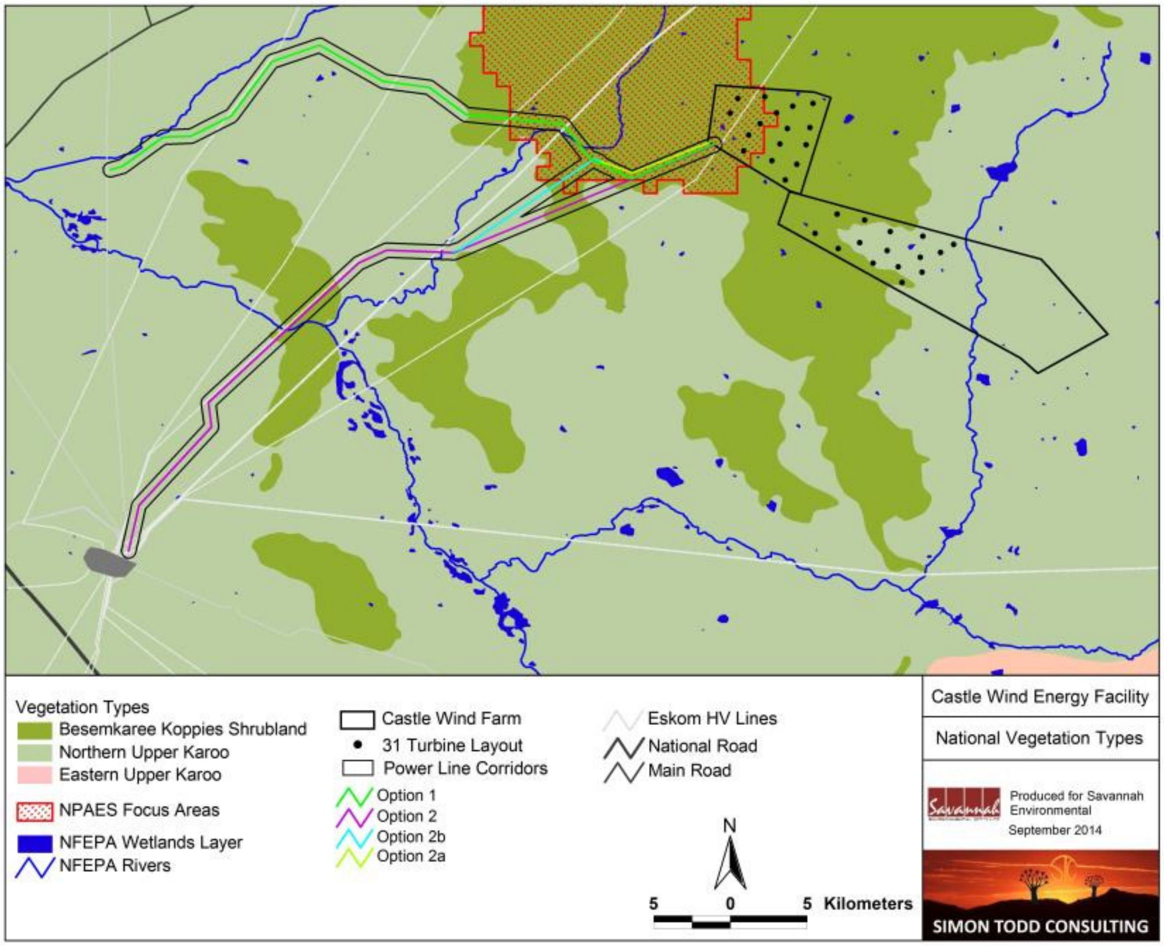


Figure 8.4: Broad-scale overview of the vegetation in and around the Castle Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011), as well as NPAES focus areas

8.2.3 Identified Impacts

The development will result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as roads, turbine foundations, operations buildings etc. The following impacts are identified as those most likely to be associated with the development of the facility.

Impacts on vegetation and protected plant species: Several endemic and protected plant species are confirmed present at the site and it is likely that some of these would be affected by the development. In addition, the construction of the facility would generate significant disturbance of intact vegetation. This impact would be restricted largely to the construction phase and would occur within the development footprint.

Soil erosion and associated ecosystem degradation: The large amount of disturbance created during construction will leave the site vulnerable to soil erosion. Erosion would result in changes in hydrology, water retention, productivity etc. resulting in a decline in ecosystem function and integrity. Although large parts of the site are quite flat with a relatively low erosion risk, there are also some steeper areas where the risk would be higher. Hardened infrastructure such as roads would also generate a large amount of runoff that would require specific management to reduce erosion risk. This impact would occur largely during the operational phase, within the facility development footprint.

Alien plant invasion: The disturbance created during construction is highly likely to encourage the invasion of the disturbed areas by alien species. Although the current levels of invasion are low, several alien species were present including *Prosopis glandulosa* and it is likely that these species will take advantage of the disturbance if given the opportunity.

Direct faunal impacts: Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would be likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals and reptiles, such as tortoises, would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. In the long term, the operational phase impacts are likely to be relatively low and would be related to noise generated by the turbines and human presence during operation and maintenance activities. This impact is likely to be restricted within the facility.

Impacts on landscape connectivity and Broad-Scale Ecological Processes: The development would disrupt the connectivity of the landscape for some species, which may avoid the area on account of the activity and turbine operation at the site. In itself this is not likely to be a highly significant impact given the relatively low extent of the development in relation to the overwhelmingly intact surrounding landscape. However, as there are a number of other planned renewable energy facilities in the area, cumulative impacts on broad-scale ecological processes may be more severe. This impact would be restricted to the facility itself as the power line would have a very low footprint and would not contribute significantly to this impact.

Nature of impact: Impacts on vegetation and protected plant species will occur due to vegetation clearing and disturbance associated with the construction of the facility.		
Listed Activities: » GN 544:10, 47(ii), » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium-High (7)	Medium (5)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (27)**
Status	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Impacts on protected plant species can to some extent be mitigated through avoidance, but some impact on vegetation and protected species is inevitable and cannot be avoided.	
Mitigation	» Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DAFF permitting requirements. » Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. » Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. » ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas. » Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. » All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed. » Temporary lay-down areas should be located within the development footprint or within areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.	
Cumulative Impacts	The potential for cumulative impacts is high as there are numerous other wind (with specific reference to the	

	preferred bidder Round 3 projects- Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities) and PV facilities planned, approved or already constructed in the area. There are however no narrow endemics in the area that would be significantly impacted or by the development.
Residual Impacts	As the abundance of some protected species is high, it is unlikely that all of these can be avoided or translocated and some impact on protected species is an inevitable and unavoidable consequence of the development.

Nature of impact: Increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated by the turbine service areas and access roads.		
Listed Activities: » GN 544:10, 47(ii), » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (44)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation	» All roads and other hardened surfaces must have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. » Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. » A cover of indigenous species should be established in disturbed areas in order to bind the soil and prevent erosion.	
Cumulative Impacts	Cumulative impacts are likely to be very low after mitigation	
Residual Impacts	If erosion at the site is controlled, then there will be no residual impact	

Nature of impact: Alien plants are likely to invade the site as a result of the large amounts of disturbance created during construction		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Probable (4)	Improbable (3)
Significance	**Medium (40)**	**Low (21)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation	» Due to the disturbance at the site as well as the increased runoff generated at the site, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. » Rehabilitation of cleared areas with indigenous species after construction to reduce alien invasion potential. » Regular monitoring for alien plants within the development footprint. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible or used under strict guidance (Prosopis sp).	
Cumulative Impacts	Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impact from alien species would not be significant.	
Residual Impacts	If alien species at the site are controlled, then there will be very little residual impact.	

Nature of impact: Alien plants are likely to invade the site as a result of disturbance during decommissioning activities		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb***)***		
	Without Mitigation	**With Mitigation**

Extent	Local (2)	Local (2)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (44)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation	» Due to the disturbance at the site during decommissioning, alien plant species are likely to invade the site and a long-term control plan will need to be implemented for several years after decommissioning » Regular monitoring for alien plants within the development footprint for 2-3 years after decommissioning. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible or used under strict guidence. » Cleared and disturbed areas should be revegetated with a cover of indigenous grass or shrubs.	
Cumulative Impacts	Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impacts from alien species would not be significant.	
Residual Impacts	If alien species at the site are controlled, then there will be very little residual impact	

▪

Nature of impact: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction.

Listed Activities:
» GN 544:10, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (3)	Short-term (3)
Magnitude	Medium-High (7)	Medium-Low (5)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (30)**
Status	Negative	Negative

Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Noise and disturbance at the site during construction is largely unavoidable.	
Mitigation	» Site access should be controlled and no unauthorized persons should be allowed onto the site. » Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site. » Fires should not be allowed on site. » No firewood collection should be allowed on site. » No dogs should be allowed on site. » If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.	
Cumulative Impacts	During the construction phase, the activity would contribute to cumulative fauna disturbance and disruption in the area, but the impact would be of local extent and not of high significance.	
Residual Impacts	There will be some residual impact as the facility will persist past the construction phase.	

Nature of impact: The operation and presence of the facility may lead to disturbance or persecution of fauna.

Listed Activities:

» GN 544:10, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium-Low (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative

Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes.	
Mitigation	» No unauthorised persons should be allowed onto the site. » Undesirable and problem fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. » No fires should only be allowed at the site. » No fuelwood collection should be allowed on-site. » No dogs should be allowed on site. » If parts of the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All vehicles on the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises.	
Cumulative Impacts	The development would contribute towards habitat loss for fauna in the area. As the landscape in the vicinity of the facility site is currently overwhelmingly intact this would be a relatively low contribution under the current circumstances in terms of the number of developments that have been built to date.	
Residual Impacts	The facility will be operational for at least 20 years and impact sources such as noise will persist for the operational lifetime of the facility and cannot be mitigated although many fauna would become habituated to these disturbance sources.	

▪

Nature of impact: Disturbance or persecution of fauna during the decommissioning phase.		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (4)	Low (2)
Probability	Probable (3)	Improbable (3)

Significance	**Low (24)**	**Low (15)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes.	
Mitigation	» Site access to be controlled and no unauthorized persons should be allowed onto the site. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. » No fires to be allowed on site. » No firewood collection should be allowed on-site. » No dogs should be allowed on site. » Any accidental chemical, fuel and oil spills that occur at the site during decommissioning should be cleaned up in the appropriate manner as related to the nature of the spill. » No open excavations, holes or pits should be left at the site as fauna can fall in and become trapped. » All disturbed areas should be rehabilitated with a cover of indigenous grass.	
Cumulative Impacts	Cumulative impacts at the decommissioning phase are likely to be low.	
Residual Impacts	With avoidance measures there should be no residual impact on fauna.	

Impact Nature: Impacts on landscape connectivity and Broad-Scale Ecological Processes

Listed Activities:

» GN 544:10, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	Medium (30)	Low (27)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Only partly	
Mitigation	The facility should have an open-space management plan.	

Cumulative Impacts	The development is reasonably extensive and along with the other renewable energy facilities in the area, there would be some cumulative impact on landscape function. The surrounding landscape is however currently largely intact despite the large potential number of developments in the area.
Residual Impacts	There will be some residual impact as it is the presence of the facility that generates the impact and this cannot be mitigated.

8.2.3 Comparative Assessment of Access Road Alternatives

Both the northern and southern access routes are existing gravel routes. It might be required that certain sections of the existing gravel roads may need to be widened, which could result in the minimal removal of vegetation. Both alternatives may result in increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated. From an ecological perspective the road alternatives will have very low impact as they will not result in significant loss of habitat, disturbance of vegetation and the alternative access roads do not transverse any drainage lines. There is no significant difference in the potential impacts associated with the two access road alternatives. Therefore, there is **no preference** between the access alternatives.

8.3.4 Implications for Project Implementation

With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of ecological impacts of the wind energy facility can be significantly reduced or avoided.

» The development footprints will not impact on any botanical "no go" habitats or areas.
» The major sensitive feature of the site is the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass. The steeper, south-facing slopes are also considered sensitive on account of their woody biomass and more mesic environment. No turbines are located on very steep slopes or within drainage lines.
» The less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. .
» The remaining flats and gentle slopes are lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type. The majority of turbines are located within these lower sensitivity areas.
» Search and Rescue of certain translocatable flora occurring in permanent, hard surface development footprints (i.e. all buildings, new roads, and turbine

positions) should take place prior to construction within the entire development area.

» A preconstruction walk-through of the facility is required in order to locate species of conservation concern that can be translocated.
» Ensure compliance with the Northern Cape Nature Conservation Act and DAFF permitting requirements.
» Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained.
» All disturbed areas must be rehabilitated. Areas that can be re-vegetated must be determined during the construction phase.

8.3 Fresh Water Assessment

As there is usually flexibility relating to the location of the turbines within a large project site, it is usually easy to mitigation the impact of the turbines on the freshwater features within the site by locating them sufficiently far enough away from these features. Therefore, it is usually the associated infrastructure that potentially impacts on the freshwater features to a greater degree such as the roads and cables associated with the wind energy facility that usually need to traverse freshwater features. Such crossings and disturbances need to be minimised and mitigated as far as possible.

8.3.1 Specialist Findings

The Brak River, its tributaries and the associated wetland areas within the Castle Wind Energy Facility study area are considered to be in a largely natural to moderately modified ecological state. The Brak River system is deemed to have a moderate to low ecological importance and sensitivity. While there are a number of small depression wetlands, seeps and endorheic pans as well as valley bottom wetlands associated with the river systems, many of these systems have formed ideal features for the construction of small dams and are now highly modified.

The Brak River and its larger tributaries within the study area are considered to be of a moderate to low ecological importance and sensitivity. The ecological importance and sensitivity of the ephemeral tributaries are considered to be negligible. The ecological importance and sensitivity of the pans is very similar to that of the ephemeral streams and the impacts are considered marginal or negligible while the valley bottom wetlands are directly related to the Brak River and its larger tributaries and the impacts are considered to be moderate to low.

The expected impacts on the identified freshwater features are likely to mostly occur while construction activities are taking place. The primary negative impacts are the result of direct factors (including loss of natural vegetation adjacent to and within the freshwater features from the construction as well as longer term disturbance of these features by machinery) and indirect factors (including flow and water quality modification, erosion and invasive plant growth). All of these impacts can however be mitigated.

A water use authorisation application may need to be submitted to the Department of Water and Sanitation: Northern Cape Regional Office for approval of the water use aspects of the proposed activities. In all likelihood the proposed activities would be Generally Authorised for Section 21 (c) and (i) water use activities if the final layout plan for the facility is such that disturbance of the drainage lines is minimal and the recommended mitigation measures provided in this report are implemented.

8.3.2 Identified Impacts

Impact of proposed wind turbines or energy facilities and buildings associated with the wind energy facility (total combined impact for study area): Wind energy facilities require high intensity disturbance of a limited surface area at the site of the wind turbine. Concrete foundations for the turbine towers will need to be constructed as well as permanent hard standing bases of 20m by 20m made of compacted gravel and approximately 40 m x 40 m adjacent to each turbine location for use of the cranes used to construct the turbines. Permanent access roads between each turbine of approximately 7 m wide would also need to be constructed or existing roads upgraded. Activities during the construction phase of the project could thus be expected to result in some disturbance of cover vegetation and where access routes and cabling need to cross freshwater features, some disturbance to the bed and banks of the drainage features.

During the operation phase the turbines will operate continuously, unattended and with low maintenance required for more than 20 years. The wind energy facilities would be monitored and controlled remotely, with maintenance only taking place when required. The hard surfaces created by the development may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas.

Impact of the Access Routes and other linear infrastructure developments associated with the wind energy facility (total combined impact for study area): An impact of limited significance is expected at the points at which the infrastructure will need to cross of streams/drainage lines during and after the construction phase. The major impacts are associated with the access roads and relate to loss of habitat within streams, riparian areas and wetland/pan habitats, loss of indigenous vegetation within riparian zones and potential invasive alien plant growth as well as the potential for flow and water quality impacts and the direct impacts on the soil (erosion of drainage channels).

Nature of impact: Impact of the construction of the wind turbines and buildings associated with the wind energy facility during the construction phase		
Listed Activities: » GN 544:10, 11(iii)(iv)(x)(xi),47(ii), 18(i) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	
Mitigation	» Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facility. » A buffer of at least 35m (from centre of stream for smaller drainage lines and from top of bank for larger tributaries) should be maintained adjacent to the identified freshwater features, and 75m for the pans and wetland areas. » Any of the cleared areas that are not hardened surfaces are rehabilitated after construction is completed by re-vegetating the areas disturbed by the construction activities with suitable indigenous plants. » Invasive alien plants that currently exist within the immediate area of the construction activities should also be removed and the sites. » To reduce the risk of erosion, the locality of the turbines and structures should preferably not be on any steep slopes or within the wide wash areas on the plains. » Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines. » Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. » Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the river system and regularly serviced.	
Cumulative Impacts	Cumulative impacts are likely to very low after mitigation	

Residual Impacts	Limited, if the site is controlled and maintained.

Nature of impact: Proposed implementation and use of access routes and other linear infrastructure associated with the wind energy facility during the construction phase		
Listed Activities: » GN 544:10, 11(iii)(iv)(x)(xi),47(ii), 18(i) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (5)	Medium (5)
Probability	Probable (3)	Improbable (3)
Significance	**Low (27)**	**Low (27)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	
Mitigation	» The existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. » Where new roads need to be constructed the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area and within the stream beds. For new access roads to the turbines, these should rather be along the ridges of the hills than in the drainage/stream beds. Where access routes need to be constructed through streams/drainage lines, the disturbance of the channel should be limited. » Wetland and pan areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 75m buffer zone as far as possible. » All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. Road infrastructure, and cable alignments should coincide as much as possible to minimize the impact.	
Cumulative Impacts	Cumulative impacts are likely to very low after mitigation	
Residual Impacts	Limited, if the site is controlled and maintained.	

Nature of impact: Maintenance of wind energy facility during the operation phase		
Listed Activities: » GN 544:10, 11(iii)(iv)(x)(xi),47(ii), 18(i) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	
Mitigation	» Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified infrastructure routes. » Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants. » Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities site. Should any erosion features develop, they should be stabilised as soon as possible. » Water supply, sanitation services as well as solid waste management should preferably be provided by an off-site service provider.	
Cumulative Impacts	Cumulative impacts are likely to very low after mitigation	
Residual Impacts	Limited, if the site is controlled and maintained.	

8.3.3 Comparative Assessment of Access Road Alternatives

Both alternative access roads are existing gravel roads which will not impact on any of the freshwater features identified.There is therefore **no significant** difference in the potential impacts associated with the two access road routes and therefore, there is **no preference** between the alternatives.

8.3.4 Implications for Project Implementation

» The access routes and cables between turbines, as well as any other infrastructure associated with the wind energy facility should also preferably be located outside of the freshwater features and the recommended buffer zones.
» Use should be made of the existing roads and disturbed areas to limit increasing the disturbance to the area.
» A water use authorisation application may need to be submitted to the Department of Water and Sanitation: Northern Cape Regional Office for approval of the water use aspects of the proposed activities. In all likelihood the proposed activities could be authorised in terms of the General Authorisation for Section 21 (c) and (i) water use activities if the final layout plan for the wind energy facility is such that disturbance of the freshwater drainage lines is minimal and the recommended mitigation measures provided in this report are implemented.

Assessment of Potential Impacts on Avifauna

8.4.1 Specialist Findings

An approximate total of 209 bird species could occur in the study area, based on what has been recorded in the relevant six quarter degree squares by the first bird atlas project (Harrison *et al* 1997), and the second atlas project (www.sabap2.adu.org.za). This is a relatively good diversity of species, reflecting the diversity of habitats, including both mountains and low lying flats. In total 16 of these species could be considered threatened. This site falls within the SA037 Platberg-Karoo Conservancy Important Bird Area (Barnes 1998).

Pre-construction bird monitoring covering four seasons has been conducted on site, and was undertaken in compliance with the best practice guidelines written by Jenkins, van Rooyen, Smallie, Harrison, Diamond, and Smit (2012). This monitoring has included 32 days on site by a team of four skilled observers who worked in pairs. Small terrestrial species have been recorded on a total of approximately 12 km of walked transects (repeated 4 times). Large terrestrials species and raptors have been recorded on an approximate 47 km of driven transects (repeated 4 times). Eleven focal sites (ten of which are dams) were monitored in each season. Approximately 85 incidental records of target species and an additional five species considered relevant to record despite not being target species (i.e. African Harrier Hawk, Booted Eagle, Rufous-chested Sparrowhawk, Spur-winged Goose and Steppe Buzzard) were collected. A total of 192 hours of bird flight observation have been made on site and appropriately recorded.

The key findings arising from monitoring conducted on the site are as follows:

» A total of 26 target bird species were identified as potentially important at the outset of the programme. Fifteen of these were subsequently recorded on site, out of a total of 124 bird species recorded during the year.
» Walked transects on site recorded a total of 68 small bird species during the year, with a slight peak in species richness in autumn and winter (although abundance of individual birds was lower in winter). None of the species recorded were Red Listed small passerines.
» Driven transects on site recorded 15 bird species in total, with a slightly lower species richness in autumn and winter. Only two species were recorded in all four seasons, the Northern Black Korhaan, and Southern Pale Chanting Goshawk.
» None of the dams on or near the site held any water during the monitoring period, and as a result, held no significant birds. A Verreaux's Eagle nest was found approximately 2.2 km off site on the escarpment edge. Considering this distance of 2.2 km in combination with relatively infrequent records of this species flying on the site, no additional buffer is considered necessary.

- Most incidental sightings of target species were in the south-east of the site, in the flatter areas and no turbines are planned in the preliminary layout assessed.
- The species recorded flying most frequently on site were the Northern Black Korhaan, and Southern Pale Chanting Goshawk. The Lesser Kestrel and Amur Falcon were recorded infrequently on site, which may be as a result of low food occurrence during the monitoring programme, although it can be anticipated that these flocking species will occur in high numbers on the site at some point during the lifespan of this project when food is more abundant.
- Due to the overall low flight activity recorded on site, the collision risk index that was developed highlighted very little in the way of spatial patterns in flight activity. No turbine re-positioning is recommended as a result of the collision risk index.
- Based on a formal risk assessment, two species emerge as being of 'medium' risk of impact by the proposed wind farm, the Northern Black Korhaan and the Southern Pale Chanting Goshawk.
- The significance of impacts on avifauna as a result of habitat destruction, disturbance of birds, and displacement of birds is rated as medium significance. Collision of birds with turbines was rated as low significance.
- Site sensitivity mapping has identified buffers around dams, within which no turbines should ideally be built. There are no turbines located within these buffer areas.

8.4.2 Identified Impacts

Destruction of bird habitat during construction of the facility: Although the habitat on the project site is reasonably common throughout the Karoo, the De Aar area has been identified for the conservation of birds as indicated by its status as the Platberg Karoo Conservancy Important Bird Area. The removal and alteration of natural vegetation or habitat on the site is therefore considered to be of medium significance, and is difficult to mitigate.

Disturbance of birds during construction: Construction of a project of this magnitude will inevitably disturb birds on the site and in surrounding areas. This impact is of medium significance. This will most likely be a relatively short lasting impact and birds will recover thereafter.

Displacement of birds from the site and barrier effects: This impact is considered to be of medium significance, since the infrastructure will take up a large area, and is likely to exclude certain bird species from foraging in the area. Because no Red Listed or other target species have been found breeding on site, this impact is not anticipated to be of high significance.

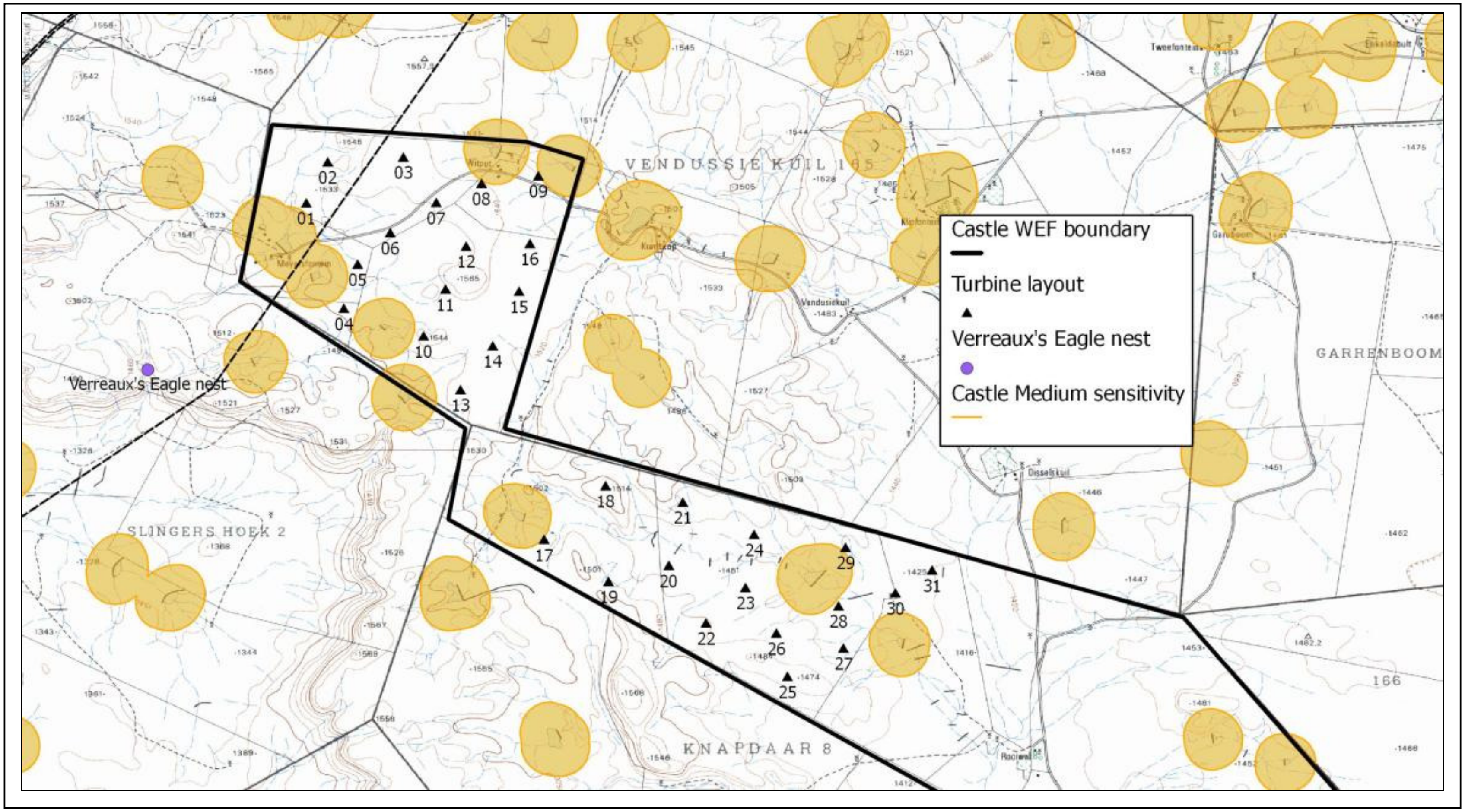


Figure 8.5: Avifaunal sensitivity analysis for the Castle Wind Energy Facility.

This impact is very difficult, if not impossible to mitigate for once the facility is built, and therefore remains at medium significance post mitigation.

Collision of birds with turbine blades: Due to the relatively low level of flight activity on site for most target bird species (the Verreaux's Eagle, Northern Black Kor haan and Jackal Buzzard), this impact is considered to be of low significance.

Nature of impact: Destruction of natural bird habitat on and near site – impact on sensitive and threatened species and habitat specialists		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without mitigation	**With mitigation**
Extent	Local (1)	N/A
Duration	Permanent (5)	N/A
Magnitude	Low (4) –	N/A
Probability	Definite (5)	N/A
Significance	**Medium (50)**	**N/A**
Status (positive or negative)	Negative	
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on.	
Mitigation: The impact cannot be fully avoided Avoid construction of infrastructure in sensitive zones identified (this has already been considered in the current layout) (refer to Figure 8.5).		
Cumulative impacts: High – the Castle site is almost surrounded by two other preferred bidder Round 3 wind energy facilities.		
Residual Impacts: High – difficult to rehabilitate vegetation.		

Nature of impact: Disturbance of birds on site and in surrounding area. Sensitive and threatened species are of most concern and particularly while breeding.		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without mitigation	**With mitigation**
Extent	Local – 1	N/A
Duration	Short – 1	N/A
Magnitude	Moderate – 6	N/A
Probability	Highly probable – 4	N/A

Significance	**Medium (32)**	**N/A**
Status (positive or negative)	Negative	
Reversibility	High	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on.	
Mitigation: Avoid construction of infrastructure in the sensitive areas identified – as per the 31 turbine layout (refer to Figure 8.5). The impacts cannot be fully avoided, therefore the significance rating pre and post mitigation will remain the same.		
Cumulative impacts: High – the Castle site is almost surrounded by two other authorized wind energy facilities.		
Residual Impacts: None		

Nature of impact: Displacement of birds from the site and barrier effects		
Listed Activities: » GN 545: 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i)		
	Without mitigation	**With mitigation**
Extent	Regional – 2	N/A
Duration	Long term – 4	N/A
Magnitude	Low – 4	N/A
Probability	Probable – 3	N/A
Significance	**Medium (30)**	**N/A**
Status (positive or negative)	Negative	
Reversibility	High	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on.	
Mitigation: Avoid construction of infrastructure in sensitive areas identified (refer to Figure 8.5). The impacts cannot be fully avoided, therefore the significance rating pre and post mitigation will remain the same.		
Cumulative impacts: High – the Castle site is almost surrounded by two other preferred bidder wind energy facilities.		
Residual Impacts: None		

Nature of impact: Collision of birds with turbine blades		
Listed Activities: » GN 545: 1,15		
	Without mitigation	**With mitigation**
Extent	Local – 1	Local – 1
Duration	Long term – 4	Long term – 4
Magnitude	Low – 4	Low – 4
Probability	Probable – 3	Possible – 2

Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	
Reversibility	Low – birds are killed	
Irreplaceable loss of resources?	High – birds are killed	
Can impacts be mitigated?	Partially	
Mitigation: Avoid construction of turbines in sensitive areas identified (refer to Figure 8.5).		
Cumulative impacts: High – the Castle site is almost surrounded by two other preferred bidder wind energy facilities.		
Residual Impacts: None - if turbines are decommissioned, impact will cease.		

8.4.3 Comparative Assessment of Impact of Access Road Alternatives on the birds

The alternative access roads are existing gravel roads and will therefore not result in the disturbance and displacement of the birds. There is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.3.5 Implications for Project Implementation

- » No infrastructure should be built in the medium to high sensitivity areas identified by this study (as identified on Figure 8.5).
- » On site sensitivity mapping has identified buffers around dam features which may hold water during high rainfall events, within which no turbines should ideally be built.
- » The Verreaux's Eagle nest located approximately 2.2 km off site on the escarpment edge does not require any additional buffer considering the distance from turbines and the infrequent records of this species flying on the site.
- » All power line linking the turbines and linking turbine strings to the on-site substation should be placed underground.
- » A final avifaunal walk through should be conducted prior to construction to ensure that all the above aspects have been adequately managed and to ground truth the final layout of all infrastructure. This will most likely be done as part of the site specific Environmental Management Programme. This will also allow the development of specific management actions for the Environmental Control Officer during construction, and training for relevant on site personnel if necessary.
- » The 'during' and post-construction bird monitoring programme outlined in the Avifaunal Assessment Report should be implemented by a suitably qualified and accredited avifaunal specialist. Post construction monitoring of live bird abundance and movement should be conducted for at least 1 year and carcass

searches for at least 2 -3 years and repeated every 5 years thereafter. This monitoring should be done in accordance with the latest version of the best practice guidelines available at the time (Jenkins et al, 2012).

8.4 Assessment of potential impacts on Bats

Bat activity has been monitored using active and passive bat monitoring techniques. Active monitoring has been carried out through site visits with transects made throughout the site with a vehicle mounted bat detector. Passive detection has commenced through the mounting of passive bat monitoring systems (SM2BAT+ time expansion type bat detectors) placed on four monitoring masts on site, specifically three short 11m masts and one meteorological mast.

One weatherproof ultrasound microphone was mounted at a height of 10 meters on each short mast, while two microphones were mounted at 10m and 50m heights on the meteorological mast. These microphones were then connected to the SM2BAT+ bat detectors.

Each detector was set to operate in continuous trigger mode from dusk each evening until dawn (times were correlated with latitude and longitude). Trigger mode is the setting for a bat detector in which any frequency which exceeds 16 KHz and 18 dB will trigger the detector to record for the duration of the sound and 500 ms after the sound has ceased. Based on the 12 months monitoring and the layout provided there are no turbines located in moderate or high bird sensitive buffers or areas.

8.5.1 Specialist Findings

There are three bat species recorded in the vicinity of the site that occur commonly in the area, that are likely to occur on site based on their probably of occurrence and widespread distribution. These species are of importance due to their likelihood of being impacted by the proposed wind energy facility, which is a combination of abundance and behaviour. The relevant species are listed below:

» *Miniopterus natalensis;*
» *Neoromicia capensis;* and
» *Tadarida aegyptiaca.*

The key findings arising from 12 month monitoring conducted on site are as follows:

» As mentioned above the *Neoromicia capensis* and *Tadarida aegyptiaca* are very common across the site, with *Miniopterus natalensis* occurring in significantly lower numbers. The common bat species, found in high numbers, are highly important ecologically, since they are mostly responsible for the ecosystem services provided by insectivorous bats. It is thus pertinent to conserve these species from the negative impacts of wind farms. Figure 8.6 below displays the sum total of bat passes for each species detected by each monitoring system

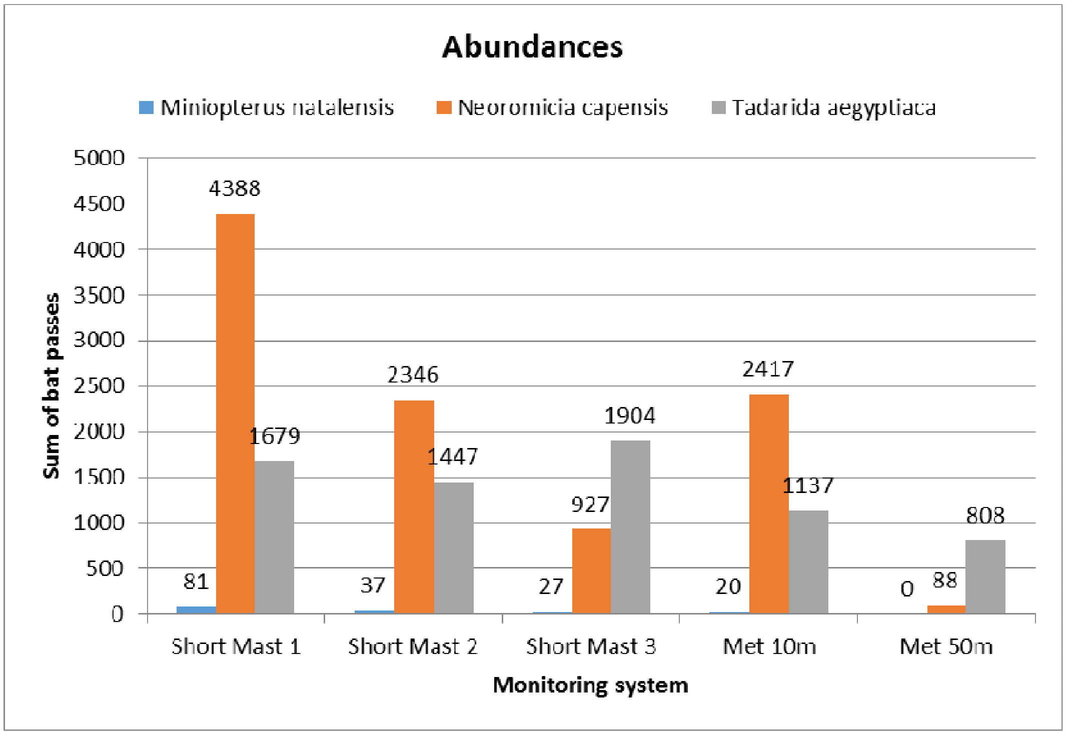


Figure 8.6: Sum of bat passes detected per species per monitoring system

The *Tadarida aegyptiaca* species showed declined activity levels over the winter months with a general increase over the spring season. The average number of passes was highest over summer from October to January (refer to Figure 8.7).

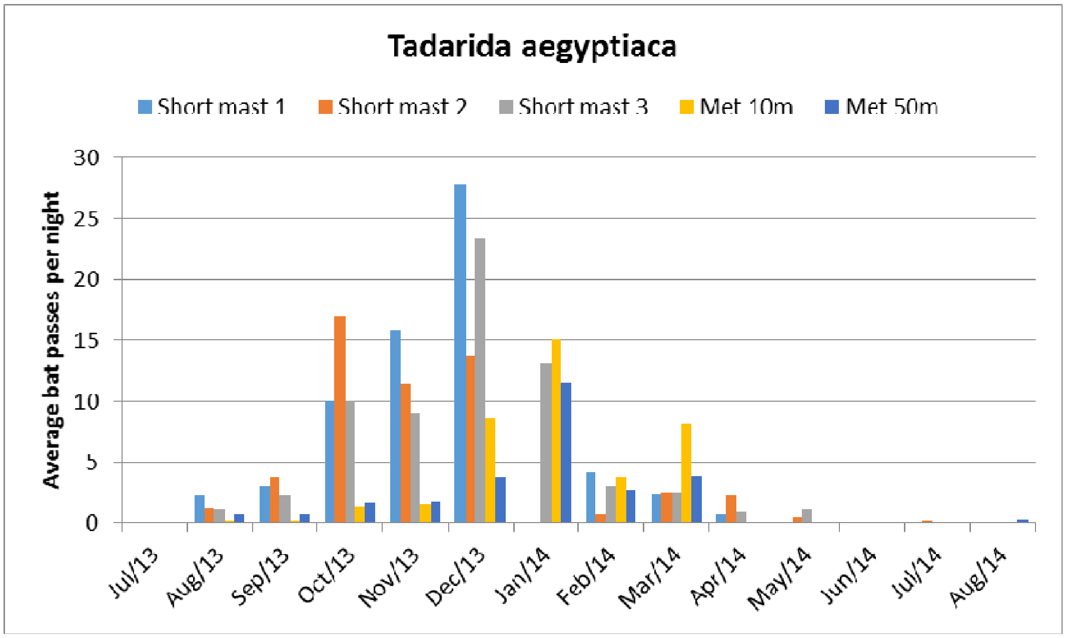


Figure 8.7: Average bat passes per night for *Tadarida aegyptiaca* over the full monitoring period

Neoromicia capensis species also displays lower activity over the cold winter months with a steady increase into spring. Highest activity levels were detected over the autumn months of February to May (Refer to Figure 8.8).

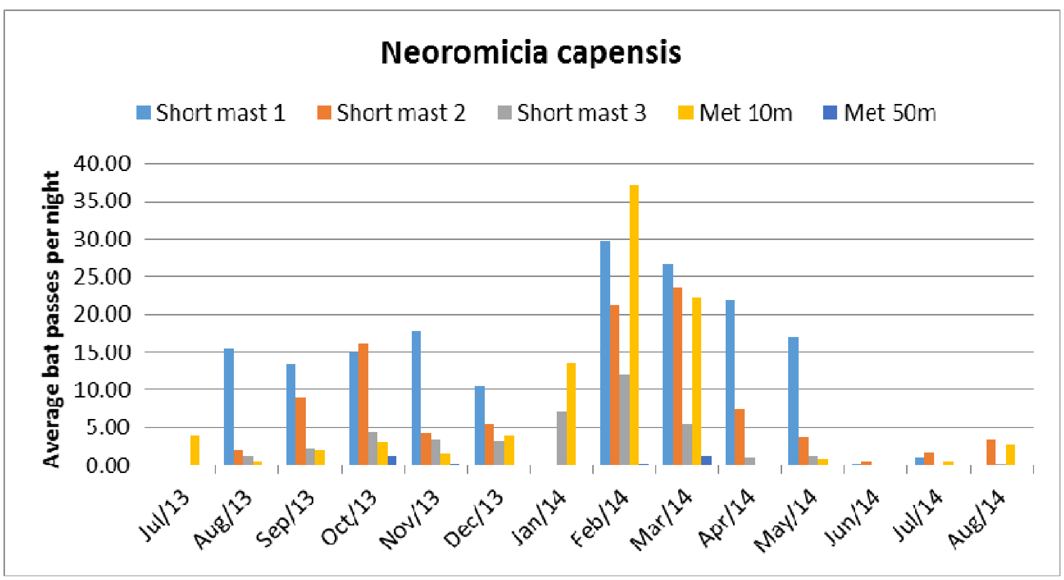


Figure 8.8: Average bat passes per night for *Neoromicia capensis* over the full monitoring period

The *Miniopterus natalensis* species was detected in low numbers over most of the year, with highest detections over the autumn months of February to May (refer to Figure 8.9).

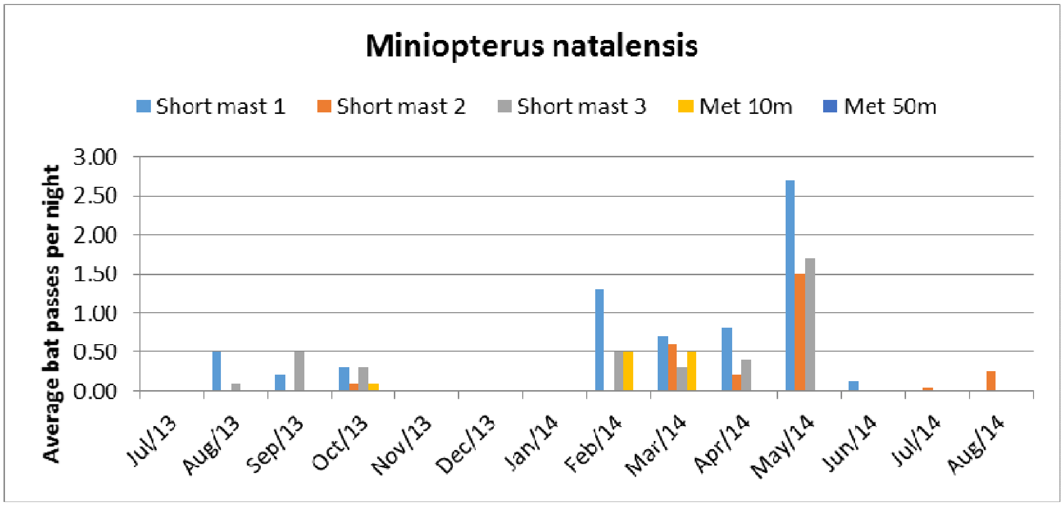
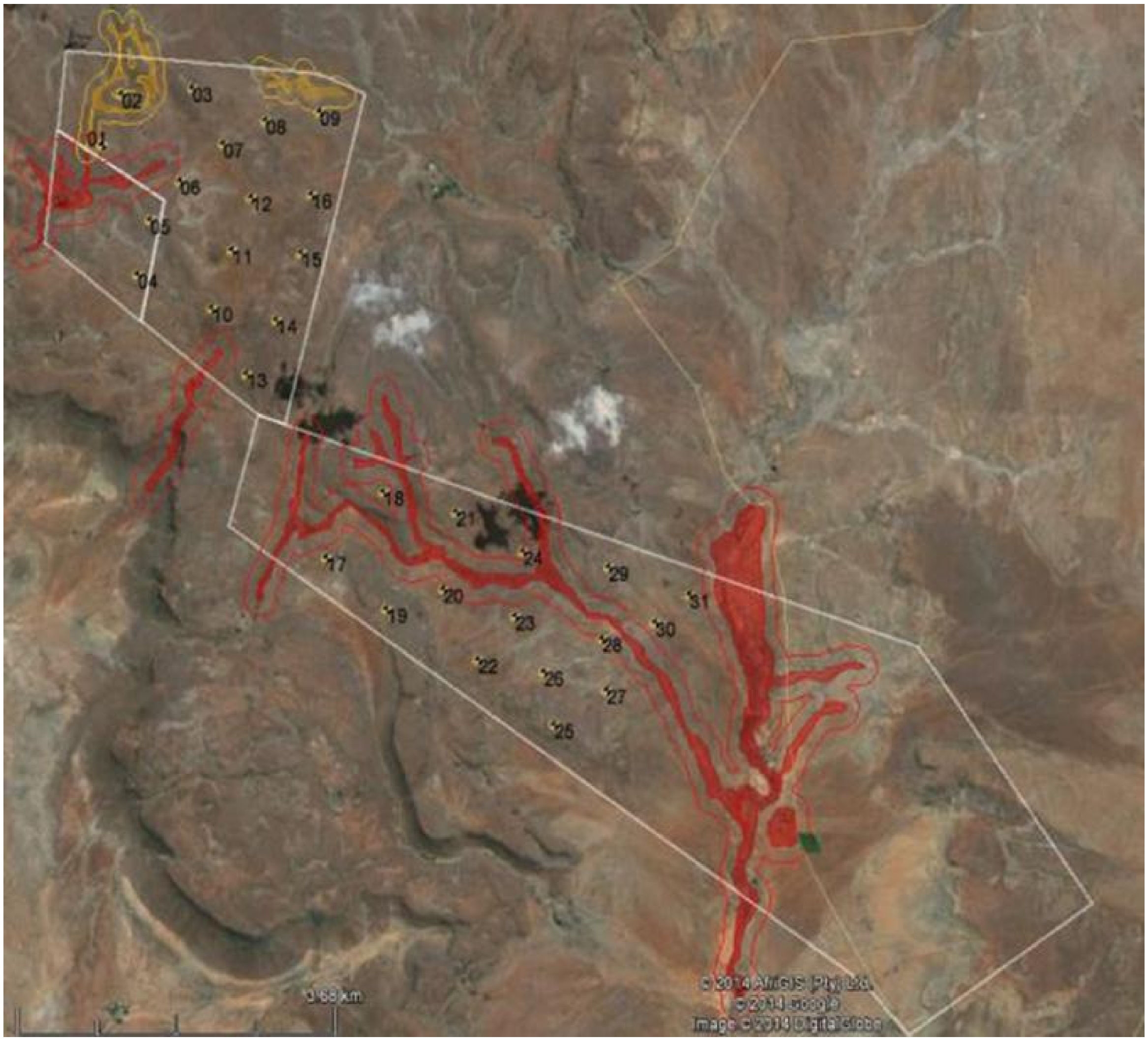


Figure 8.9: Average bat passes per night for *Miniopterus natalensis* over the full monitoring period



High bat sensitivity area

High bat sensitivity buffer

Moderate bat sensitivity area

Moderate bat sensitivity buffer

Proposed turbine locations

Figure 8.10: Areas of high and moderate bat sensitivity with associated buffers and proposed turbine layout

8.5.2 Identified Impacts

Destruction of bat roosts due to earthworks and blasting: During construction, the earthworks and especially blasting can damage bat roosts in rock crevices. Intense blasting close to a rock crevice roost can cause mortality to the inhabitants of the roost.

Impact of artificial lighting on bats: During construction and decomissioning the use of strong artificial lights used at the work environment during night time will attract insects and thereby also bats. Only certain species of bats will however readily forage around strong lights, whereas others avoid such lights even if there is insect prey available. This can draw insect prey away from other natural areas and thereby artificially favour certain species, affecting bat diversity in the area.

Foraging habitat loss during construction: Some foraging habitat will be permanently lost by construction of turbines and access roads. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles.

Bat mortality: The incident of bat fatalities for migrating species has been found to be directly related to turbine height, increasing exponentially with altitude, as this disrupts the migratory flight paths (Howe *et al*. 2002; Barclay *et al*. 2007). Although the number of fatalities of migrating species increased with turbine height, this correlation was not found for increased rotor sweep (Howe *et al*. 2002; Barclay *et al*. 2007). Despite the high incidence of deaths caused by direct impact with the blades, most bat mortalities have been found to be caused by barotrauma (Baerwald*et al*. 2008). This is a condition where low air pressure found around the moving blades of wind turbines, causes the lungs of a bat to collapse, resulting in fatal internal haemorrhaging (Kunz *et al*. 2007). Baerwald*et al*. (2008) found that 90% of bat fatalities around wind turbines involved internal haemorrhaging consistent with barotrauma.

<table>
<tr><td colspan="3">Nature of impact: Destruction of bat roosts due to earthworks and blasting</td></tr>
<tr><td colspan="3">Relevant Listed Activities:
» GN 544:10, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>High (3)</td><td>Low (2)</td></tr>
<tr><td>Duration</td><td>Long-term (4)</td><td>Long-term (4)</td></tr>
<tr><td>Magnitude</td><td>Moderate (6)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>Unlikely (2)</td></tr>
</table>

Significance	**Medium (52)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Very low	Very low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Adhere to the sensitivity map during turbine placement (refer to Figure 8.10). » Blasting should be minimised and used only when necessary.		
Cumulative impacts: Destruction of roosting space leads to increased inter and intra-specific competition resulting in decreased bat population sizes.		
Residual Impacts: Bat populations may be slow to recover resulting in depressed bat numbers over several years.		

Nature of impact:Artificial lighting during construction		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without mitigation	**With mitigation**
Extent	Low (3)	Low (1)
Duration	Construction period (1)	Construction period (1)
Magnitude	Low (2)	Very low (1)
Probability	Probable (4)	Probable (4)
Significance	**Low (24)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	**Yes**	
Mitigation: Limit the use of strong artificial lighting at night time during construction.		
Cumulative impacts: None		
Residual Impacts: None		

Nature of impact: Artificial lighting during operational phase		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without mitigation	**With mitigation**
Extent	Low(1)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (2)	Low (1)
Probability	Probable (4)	Probable (4)

Significance	**Low (24)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Consciously switch off all lights when not required and avoid allowing lights to burn throughout the night if not needed. » If suitable for the purpose utilise lighting temperatures (colours/wavelengths) that attract less insects, such products do exist.		
Cumulative impacts: None		
Residual Impacts: None		

Nature of impact: Foraging habitat loss		
Relevant Listed Activities: » GN 544:10 » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (3)	Very low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Adhere to the sensitivity map during turbine placement (refer to Figure 8.10). » Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. » Damaged areas not required after construction should be rehabilitated by an experienced vegetation succession specialist.		
Cumulative impacts: foraging habitat clearence due to the development of other renewable projects in the area could significantly affect the success of local bat populations such that declines in population sizes may occur.		
Residual Impacts: Bat populations may be slow to recover resulting in depressed bat		

numbers over several years.

Nature of impact: Temporary foraging habitat loss will occur during decommissioning due to storage areas and movement of heavy vehicles.		
Relevant Listed Activities: » GN 544:10 » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (3)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**30 (Low)**	**24 (Low)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	**Irreversible**	**Irreversible**
Irreplaceable loss of resources?	**Yes**	**Yes**
Can impacts be mitigated?	**Yes**	
Mitigation: » Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. » Damaged areas not required after decommissioning should be rehabilitated by an experienced vegetation succession specialist.		
Cumulative impacts: Foraging habitat clearence could significantly affect the success of local bat populations such that declines in population sizes may occur.		
Residual Impacts: Bat populations may be slow to recover resulting in depressed bat numbers over several years.		

Nature of the impact: Bat mortalities due to direct blade impact or barotrauma during foraging activities (no migration)		
Relevent Linsted Activities: » GN 545: 1		
	Without mitigation	**With mitigation**
Extent	High (3)	High (3)
Duration	Long-term (5)	Long-term (4)
Magnitude	High (9)	Low (4)
Probability	Probable (4)	Unlikely (2)
Significance	**68 (High)**	**22 (Low)**
Status (positive or negative)	**Negative**	**Negative**

Reversibility	**Irreversible**	**Irreversible**
Irreplaceable loss of resources?	**Yes**	**Yes**
Can impacts be mitigated?	**Yes**	
Mitigation: » Avoid areas of High bat sensitivity and their buffers as well as preferably avoid areas of Moderate bat sensitivity and their buffers – as taken into consideration in terms of the current layout.		
Cumulative impacts: This impact will affect both resident and migratory species. There is a significant potential for a long-term reduction in the size of the population of all impacted bat species. However there is very little information concerning population sizes of most South African bat species, making the significance of wind energy impacts on local bat populations very difficult to predict. Bat mortalities as a result of direct blade impact or barotrauma during foraging activities may have cumulative effects that may have greater consequences for long-lived, low-fecundity species such as bats.		
Residual Impacts: If the impact is too severe local bat populations will not recover from mortalities.		

8.5.3 Comparative Assessment of Impact of Access Road Alternatives on Bats

The alternative access roads are existing gravel roads and will therefore not result in the disturbance and displacement of the bats. There is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.4.4 Implications for Project Implementation

» High sensitivity areas and their respective buffers are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site. These areas are 'no-go' areas and turbines must not be placed in these areas.
» Areas of Moderate bat sensitivity and their buffers must be avoided.
» A minimum of two year operational monitoring must be undertaken as soon as turbines are functional, with auditing continuing throughout the lifespan of the Castle Wind Energy Facility.

8.5 Assessment of Potential Impacts on Soil, Land Use, Land Capability and Agricultural Potential

8.6.1 Specialist Findings

Land capability of the Castle Wind Energy Facility is limited by the mountainous, rocky terrain, the shallow soils and the aridity of the region. The site is used for sheep farming. The natural grazing capacity is low and varies between 18 - 30 hectares per large stock unit across the site. There is a very small area of cultivated, irrigated land surrounding the farm house (Rooi Kraal) which is located on the Farm Knapdaar. The low rainfall, high potential evaporation, high maximum and low minimum temperatures, coupled with shallow soils covering most of the site, limits any additional land-use activities. A small area of 7.5 ha near the Rooiwal homestead in the south-eastern part of the study area, is cultivated and irrigated using borehole/groundwater. A number of non-perennial streams are present on the site, but the dominant source of water for agricultural purposes is groundwater.

Three land types dominate the Castle Wind Energy Facility site, namely Fb72, Fb73 and Ae142. The agricultural potential of the land covered by Ae142 is low and land-use restricted to low intensity grazing due to the climatic constraints. The potential of large parts of the land type can however be dramatically increased should adequate irrigation water be available. The agricultural potential of the land covered by Fb72 and Fb73 is low due to the soil and climatic constraints.

Six soil types were identifies within the study area:

» **Cv/Hu**: These are deep (>1 000 mm) well drained soils of the Hutton and Clovely soil form. These soils are restricted to the south-western corner of the Castle Wind Energy Facility study area. The clay content of these soils is low and their morphology indicates that both internal and external drainage is good. They are not sensitive to erosion.
» **Du/Sw**: These soils of the Dundee and Swartland forms occur in valley bottom positions of the site. The Du formed to alluvial depositions and alluvial stratifications are still visible. Due to the duplex nature of the Swartland soils as well as high Na^+ contents in the B-horizon, these soils are susceptible to erosion.
» **Hu/Gs**: These soils have a small storage capacity which makes them sensitive to erosion with limited agricultural potential.
» **Ms/Gs**: The limited storage capacity of these soils limits the agricultural potential to natural grazing and makes these soils susceptible to erosion.
» **R/Ms**: Limited or no storage capacity will result in overland flow due to infiltration excess and this soil association is susceptible to erosion.

» **Sw**: These soils can be dispersive and susceptible to erosion. The strong structure of the pedocutanic B horizon will limit root penetration and water infiltration.

The overall agricultural potential of the site is very low, largely restricted by aridic climate conditions and shallow soils. The Cv/Hu soil associations are the only areas of the site suitable for crop production should adequate irrigation water be available. No turbines are proposed for the area associated with this soil association. Land capability is the combination of soil suitability and climate factors. The entire site has a land capability classification, on the 8 Category scale, of Class 7 (i.e. non-arable, low potential grazing land).

8.6.2 Identified Impacts

Impact of the construction of concrete foundations on agricultural potential
The proposed positions of the turbines are all on soils with very low agricultural potential, shallow and sensitive to erosion due to limited storage capacity and moderately steep slopes.

Construction of buildings and other infrastructure: The construction of workshop, offices and substation could lead to the loss of agricultural land and potential erosion. The impact of these constructions is expected to be medium as there are no mitigation measures that can be proposed that will reduce the impact.

Impact of the expansion on the road network: The impact of the construction of roads is expected to be low due to the low agricultural potential of the land. The site has a potential of experiencing extensive soil erosion, however the impact of soil erosion is expected to be low on condition that mitigation measures must be implemented.

Impact of increased vehicle activity during construction and operation:
A concern for sheep farmers are dust generation associated with more traffic on the farms, resulting in lower quality wool. If managed correctly the cumulative impact of vehicles on dust creation can be limited.

Nature of impact: Constructing concrete foundations for 31 turbines leading to the loss of agricultural land and increased potential erosion		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 10 (a)(ii)(bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**

Extent (E)	Site (1)	N/A
Duration (D)	Permanent (5)	N/A
Magnitude (M)	Medium (2)	N/A
Probability (P)	highly probable (4)	N/A
Significance (S)	**Medium (32)**	**N/A**
Status	Negative	
Reversal and mitigation	None; limit footprint and ensure that adequate erosion measures are in place	
Cumulative impact	The agricultural potential of the site and the soil erosion will be low and the cumulative impacts are therefore expected to be low.	
Residual impact	If surface water from concrete foundations and access roads are not managed correctly it might lead to severe erosion.	

Nature of impact: Constructing workshop, offices and substation leading to the loss of agricultural land and increased potential erosion		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent (E)	Site (1)	N/A
Duration (D)	Permanent (5)	N/A
Magnitude (M)	Medium (2)	N/A
Probability (P)	highly probable (4)	N/A
Significance (S)	**Medium (32)**	**N/A**
Status	Negative	
Reversal and mitigation	None; limit footprint and ensure that adequate erosion measures are in place	
Cumulative impact	None; limit footprint and ensure that adequate erosion measures are in place	
Residual impact	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	

Nature of impact: Constructing of access roads to turbines and new buildings leading to the loss of agricultural land and increased potential erosion.		
Relevant Listed Activities: » GN 544:11, 47(ii) » GN 545: 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent (E)	Site -2 dimensional (1)	N/A
Duration (D)	Permanent (5)	N/A
Magnitude (M)	Medium (2)	N/A

Probability (P)	highly probable (4)	N/A
Significance (S)	**Medium (32)**	**N/A**
Status	Negative	
Reversal and mitigation	None; use existing roads as far as possible, adequate erosion measures are vital (especially at river channel crossings and towards turbines at high elevations against steep slopes)	
Cumulative impact	None; limit footprint and ensure that adequate erosion measures are in place	
Residual impact	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	

Nature: Increased vehicle activity and associated dust generation.		
Relevant Listed Activities: » GN 545: 1, 15		
Extent (E)	Local (2)	N/A
Duration (D)	Short term, generally restricted to construction period (2)	N/A
Magnitude (M)	Medium (2)	N/A
Probability (P)	Improbable (2)	N/A
Significance (S)	**Low** (12)	N/A
Status	Negative	
Reversal and mitigation	None; limit vehicle movement and ensure that road surfaces are moist during maximum vehicle movement periods	
Cumulative impact	None; limit footprint and ensure that adequate erosion measures are in place	
Residual impact	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	

8.6.3 Comparative Assessment of Access Road Alternatives

Both the northern and southern access routes alternatives may result in increased erosion risk as a result of soil disturbance as well as increased runoff generated. It is anticipated that the impact will be low, there is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.6.4 Implications for Project Implementation

Due to the arid climate of the study area, coupled with shallow soils the agricultural potential is limited to low intensity grazing. The impact of the proposed development agricultural resources is therefore considered to be small. It is however important that the direct footprint of infrastructure be kept to a minimum and that adequate erosion measures and mitigation strategies are in place to ensure that the proposed project and current agricultural practices continue in sustainable symbioses. There are therefore no implications for the project development from an agricultural perspective.

8.6 Assessment of Potential Social Impacts

8.7.1 Specialist findings

The construction phase for the proposed Castle wind energy facility is expected to extend over a period of ~ 18 months and create approximately 250 construction related jobs. Of this total approximately ~25 % (62) will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 35 % (88) to semi-skilled personnel (drivers, equipment operators), and ~ 40% (100) to low skilled personnel (construction labourers, security staff). The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from De Aar and Philipstown. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low. This is an issue that will need to be addressed during the recruitment process. The proponent will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community.

The key positive social issues associated with the construction and operation phase include:

Potential positive impacts- Construction Phase

» Creation of employment and business opportunities and opportunity for skills development and on-site training.

Potential positive impacts- Operation Phase

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a Community Trust; and
» The establishment of renewable energy infrastructure.

The significance of the majority of potential negative impacts with mitigation was assessed to be of Low significance. All of the potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. In addition, given that the majority of the low and semi-skilled construction workers can be sourced from the local area the potential risk at a community level to local family structures and social networks is regarded as Low negative significance. However, the impact on individuals who are directly impacted on by construction workers and or job seekers (i.e. contract HIV/ AIDS) was assessed to be of High negative significance. The Castle Wind Energy Facility will create a limited number of employment opportunities during the operation phase (~ 16-20). The potential socio-economic benefits will therefore be limited. However, the majority of the employment opportunities are likely to benefit HD members of the community. The proponent has also indicated that they are committed to implementing a training and skills development programme during the operational phase and are also required, as part of the REIPPP process, to ensure that the community development targets are met as presented to the DOE during the bidding programme. Such a programme would support the strategic goals of promoting local employment and skills development contained in the municipal IDP.

The key positive social issues associated with the construction and operation phase include:

Potential negative impacts- Construction Phase

» Impacts associated with the presence of construction workers on site
» Influx of job seekers to the area;
» Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site;
» Increased risk of veld fires associated with construction-related activities;
» Threat to safety and security of farmers associated with the presence of construction workers on site;
» Impact of heavy vehicles, including damage to roads, safety, noise and dust; and
» Potential loss of grazing land associated with construction-related activities.

Potential negative impacts- Operational Phase

» The visual impacts and associated impact on sense of place;
» Potential impact on tourism (however this impact could also be positive as the facility could attract visitors);
» Influx of job seekers to the area; and

8.7.2 Identified Impacts

Creation of employment and business opportunities: The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from De Aar. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low. This is an issue that will need to be addressed during the recruitment process. The proponent will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community. Implementation of the enhancement measures listed below can enhance these opportunities.This issue also highlights the importance of implementing a training and skills development programme before the construction phase commences.

Presence of construction workers in the area: The presence of construction workers poses a potential risk to family structures and social networks in the area, specifically local communities in De Aar and possibly Phillipstown. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can affect the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks.

While the potential threat posed by construction workers to the community as a whole is likely to be low, the impact on individual members who are affected by the behavior of construction workers has the potential to be high, specifically if they are affected by STDs etc.

Influx of job seekers to the area: Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed Castle Wind Energy Facility may, on its' own, not result in an influx of significant numbers of job seekers to De Aar, the establishment of a number of other renewable energy projects in the area has the potential to attract job seekers to the area. Given the number of renewable energy projects in the area this has in all likelihood already occurred.

The potential social impacts associated with the influx of job seekers include:

- » Impacts on existing social networks and community structures;
- » Competition for housing, specifically low cost housing;
- » Competition for scarce jobs;
- » Increase in incidences of crime; and
- » An increase in sexually transmitted diseases (STDs).

Loss of farm labour: Experience from other projects indicates that the loss of farm workers is an issue of concern. In most instances local farmers are unlikely to be in a position to compete with the salaries offered by the renewable energy companies during the construction phase. As a result farm laborers may be tempted to resign from their current positions on farms. The loss of skilled and experienced farm labor would have a negative impact on local farmers.

The potential impacts for the affected farmers associated with the loss of permanent farm labour to the construction phase are exacerbated by the security of tenure that permanent farm laborers enjoy in terms of the Extension of Security and Tenure Act (ESTA). Farm labourers who are eligible under ESTA and who take up jobs during the construction phase will be entitled stay on in their houses on the farms in question. The net effect is that the farmer may have to incur costs associated with the construction of new dwellings for new labour appointed to replace the labour lost to the construction phase. The farmer may also have to continue subsidizing services such as potable water to people who are no longer in his employ.

While the proposed Castle Wind Energy Facility on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of renewable energy projects in the area has the potential to impact on the farming sector. However, at the end of the day farm labor can be replaced. The potential impacts on farm operations are therefore likely to be temporary. In addition, the findings of the Social Impact Assessment indicate that the farming activities in the area are not labor intensive. In this regard the majority of the farms in the study area are not occupied.
The farm workers that take up jobs during the construction phase are also at risk. While some farm workers may be re-employed once the construction has been completed, others may not be so fortunate. The low education levels associated with the farm worker community would effectively mean that alternative employment opportunities outside the agricultural sector will not be accessible to them. These farm workers and their families therefore stand to be negatively impacted upon in the medium to long term. The low education levels of local farm workers are however also likely to reduce the chances of them being employed during the construction phase.

On the positive side, some farm workers may view work associated with the construction phase as an opportunity to gain skills and relocate to De Aar and other towns in the area.

While the proposed wind energy facility on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of renewable energy projects in the area has the potential to impact on the farming sector. . Farm labour is replacable, however and the potential impacts on farm operations are therefore likely to be temporary.

Increased risk of stock theft, poaching and damage to farm infrastructure: The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Livestock and game losses may also result from gates being left open and/or fences being damaged. The local farm owners in the area who were interviewed indicated that stock theft was currently not a major concern. However, concerns were raised regarding the presence of construction workers in the area. As indicated above, all of the local farmers in the area noted that no construction workers should be allowed to stay on the site overnight with the exception of security personnel.

The local farmers also indicated that the developer should compensate local farmers for any losses that could be attributed to the activities undertaken during the construction phase.

Increased risk of veld fires: The presence of construction workers and construction-related activities on the site poses an increased risk of veld fires that in turn pose a threat to the livestock, wildlife, and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened.

» The potential risk of veld fires is heightened by windy conditions in the area, specifically during the dry, windy winter months.
» The dominant agricultural activity in the broader area is stock farming (sheep). As such, the livelihoods of the farmers in the area are dependent on grazing on their farms. Any loss of grazing due to a fire would therefore impact negatively on the affected farmers livelihoods; and
» The risk of fire related damage is exacerbated by the limited access to fire-fighting vehicles.

However, it should be noted that the low, Karoo scrub is not highly prone to run-away fires. Despite this fact, appropriate precautions would however need to be taken by the contractor during the construction phase to avoid fire.

Impacts associated with construction phase and movement of construction vehicles: Each wind turbine is comprised of the wind tower (approximately 120m tall), the nacelle and rotor, and three blades. Abnormally sized vehicles will be required to transport these components to site, because of their size and weight. In addition, further trips will be required to transport construction equipment (graders, excavators and cement trucks), as well as electrical infrastructure where necessary (cables, substations and transformers) and construction materials (cement etc). Based on traffic study undertaken for a similar sized Wind Energy Facility, over the construction period of 18 months it is expected that in the region of 173 trucks would travel to the site every month, or 40 per week, or 8 per day. It expected that 20% of the above would be heavy truck traffic (Arup, September, 2012).

Based on the information from the proponent, the majority of the components associated with the proposed wind energy facility are likely to be transported to the site by road from Port Elizabeth via the N10, which links Port Elizabeth in the south east with De Aar in the north-west. The movement of large heavy loads during the construction phase, has the potential to create delays and safety impacts for other road users travelling along either of the two routes. These impacts can however be mitigated by timing the trips to avoid times of the year when traffic volumes are likely to be higher. For instance this could be at the start and end of school holidays, long weekends and weekends in general etc.

The option of railing material from Port Elizabeth should also investigated. This would reduce the potential impact on other road users along the N10. Based comments from interviews undertaken for other renewable energy projects near De Aar, Mr. Bangani (NAFCOC representative) and Mr Jack (the then Emthanjeni Local Municipality IDP and LED Manager) both indicated that the option of using rail to transport equipment to the Pixley ka Seme District Municipality should be investigated. Mr Bangani indicated that the establishment proposed of a Renewable Energy Hub centred around De Aar also created an opportunity to revitalise the railway sector in De Aar.

In terms of access to the site, the site will be accessed from the N10 via the R389, which links the N10 with Philipstown, which is located to the north east of De Aar. The findings of the SIA indicate that the volume of traffic on the R389 is low. The social impacts associated with the movement of construction related traffic along this road are therefore likely to be low.

The movement of heavy vehicles along the local farm road in the area will however damage the road surfaces. This damage will impact on local farmers in the area and will need to be addressed before the contractor leaves site.

The issue of dust impacts was also raised. Dust and impacts on vegetation and local roads were key issues raised by all interviewees. These comments were based on experience with the solar projects constructed in the area (De Aar Solar, Solar Capital, Kalkbult). Dust impacts affect farm houses and productive vegetation. Due to arid climate, vegetation is not regularly “washed” by rainfall, and thus some dieback may occur. Vegetation could also be affected by heavy vehicles not sticking to designated roads.

Damage to and loss of farmland: The activities associated with the construction phase have the potential to result in the loss of land available for grazing. Mr van der Merwe, the farm owner indicated however that the project would unlikley affect his farming activities and that the carrying capacity of the veld was low. Only one landowner is affected by the WEF development namely Mr van der Merwe, who has entered into a lease agreement with the proponent. The loss of productive farmland would therefore be offset by the income from the lease agreement.

The final disturbance footprint can also be reduced by careful site design and placement of the wind turbines and associated infrastructure. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

Benefits associated with the establishment of a community trust: In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a community trust which is funded by revenue generated from the sale of energy. The proponent has indicated that they are committed to establishment of a community trust.

Community Trusts provide an opportunity to generate a reliable and steady revenue stream over a 20 year period. This revenue can be used to fund development initiatives in the area and support the local economic and community development. The 20 year timeframe also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed wind energy facility can be used to support a number of social and economic initiatives in the area, including:

» Education (adult and child);
» Health care;
» Training and skills development; and
» Support for SMME’s.

Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust. In addition, there may be delays in the setting up of Community Trusts.

Impact on tourism: The Northern Cape PGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile ecosystems and vulnerability to climatic variation. The document also indicates that due to the provinces exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Therefore caution must be taken to ensure that the development of renewable energy projects, such as the proposed wind energy facility, do not impact negatively on the tourism potential of the Province.

Based on the findings of the site visit however, the proposed facility is not likely to impact on the tourism sector in the area or the Province. This is linked to the remote location of the site and the negative impact of the existing power lines on the visual character of the area and its sense of place. In addition, the area has been identified as a Renewable Energy Hub and the site is surrounded by other renewable energy projects. The significance of this issue is therefore rated as Low negative. The findings of the Social Impact Assessment also indicate that the establishment of the proposed wind energy facility may also attract tourists to the area. The significance of this potential benefit is also rated as Low positive.

Assessment of no-development option: The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producers of carbon emissions in the world, this would represent a negative social cost. In addition, the employment opportunities associated with the construction and operational phase, as well as the benefits associated with the establishment of a Community Trust would be forgone.

Nature of impact: Creation of employment and business opportunities during the construction phase		
Relevant Listed Activities: » ***GN 545: 1, 15***		
	Without Enhancement	**With Enhancement**
Extent	Local – Regional (2)	Local – Regional (3)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Enhancement : In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented: **Employment** » Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. » Where feasible, efforts should be made to employ local contactors that are compliant		

with Black Economic Empowerment (BEE) criteria; » Before the construction phase commences the proponent and its contractors should meet with representatives from the Emthanjeni Local Municipality to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase. » The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase. » Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. **Business** » The proponent should seek to develop a database of local companies, specifically BEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work; and » The Emthanjeni Local Municipality, in conjunction with the local Chamber of Commerce and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.
Cumulative impacts: Opportunity to up-grade and improve skills levels in the area.
Residual impacts: Improved pool of skills and experience in the local area.

Nature of impact: Creation of employment and business opportunities associated with the operational phase		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15		
	Without Enhancement	**With Enhancement**
Extent	Local (1)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (24)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	

Can impact be enhanced?	Yes	
Enhancement: See below		
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area		
Residual impacts: None		

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
Relevant Listed Activities: » GN 545: 1, 15		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STD's etc. (5)	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STD's etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)** **Moderate-High for specific individuals who may be affected by STD's etc. (57)**	**Low for the community as a whole (24)** **Moderate-High for specific individuals who may be affected by STD's etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: The potential risks associated with construction workers can be mitigated. The aspects that should be covered include:		

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks; » The proponent and the contractors should develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation; » The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; » The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis; » The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks; » The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks; and » As per the agreement with the local farmers in the area, no construction workers will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.
Cumulative impacts: Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community. The development of other solar energy projects in the area may exacerbate these impacts.
Residual impacts: Community members affected by STDs etc.

Nature of impact: Potential impacts on family structures, social networks and community services associated with the influx of job seekers- Construction.		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)

Magnitude	Minor for the community as a whole (2) High-Very High for specific individuals who may be affected by STD's etc. (10)	Minor for community as a whole (2) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole** **(27)** **Medium -High for specific individuals who may be affected by STD's etc.** **(54)**	**Low for the community as a whole (27)** **Medium-High for specific individuals who may be affected by STD's etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

» **Mitigation:** It is almost impossible to stop people from coming to the area in search of a job, specifically given that the Pixley ka Seme District Municipality and Emthanjeni Local Municipality have identified renewable energy as a future growth sector. However, as indicated above, the proponent should ensure that the employment criteria favour local residents in the area. In addition the proponent should implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in De Aar and other towns in the Emthanjeni Local Municipality.

Cumulative impacts: Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

Residual impacts: The proposed development is of such a nature that the status quo could be regained after decommissioning the plant.

Nature of impact: Potential impacts on family structures, social networks and community services associated with the influx of job seekers- Operation

Relevant Listed Activities:

» GN 545:1, 15.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)

Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)	Minor for community as a whole (2) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	Medium for the community as a whole (33) Medium -High for specific individuals who may be affected by STD's etc. (51)	Low for the community as a whole (27) Medium-High for specific individuals who may be affected by STD's etc. (51)
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: • » Implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in De Aar and other local towns in the Emthanjeni and Renosterberg Local Municipalities.		
Cumulative impacts: Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.		
Residual impacts: The residual impact of health related risks cannot be reversed to the status quo after the construction or decommissioning of the plant has taken place.		

Nature of impact: Potential impact on local farmers associated with loss of farm labour to the construction and operation phase		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local and Regional (2)	Local and Regional (1)

Duration	Medium Term (3) (Assumed that farm labour can be replaced)	Medium Term (3) (Assumed that farm labour can be replaced)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (24)
Status	Negative	Negative
Reversibility	Yes, if farm workers return of are replaced	Yes, if farm workers return of are replaced
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: While the proponent can liaise with local farmers in the area and take steps not to employ local farm worker were possible, it is not possible to prevent farm workers from applying for work for self-improvement. There are therefore no recommended mitigation measures. Also farm labour can be replaced. The impacts would therefore be temporary. Farm workers who apply for construction related work should also be informed that the nature of the work is temporary. In addition they should be informed of the potential negative consequences of their actions, which include the potential loss of their permanent farm job.		
Cumulative impacts: Impacts on farm operations due to loss of experienced farm labour.		
Residual impacts: Increase in unemployment amongst local farm workers who are not rehired once construction worker comes to an end. On positive side, may result in increased skills for local farm workers and improve their economic mobility.		

Nature of impact: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)

Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (33)	Low (24)
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes

Mitigation: The mitigation measures that can be considered to address the potential impact on livestock, game, and farm infrastructure include:

- » The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase;
- » The proponent should develop a Code of Conduct for construction workers before the contractors move onto site;
- » The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities;
- » The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;
- » Contractors appointed by the proponent should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- » Contractors appointed by the proponent should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; and
- » The housing of construction workers on the site should be limited to security personnel.

Cumulative impacts: No**,** provided that losses are compensated.

Residual impacts: None

Nature of impact: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages. This includes losses associated veld fires. In addition, the potential increased risk of veld fires can be effectively mitigated. Mitigation measures include: » A fire-break should be constructed around the perimeter of the site office area prior to the commencement of the construction phase; » Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas; » Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months; » Contractor to provide adequate firefighting equipment on-site; » Contractor to provide fire-fighting training to selected construction staff; » No construction staff, with the exception of security staff, to be accommodated on site over night; and » As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also		

compensate the firefighting costs borne by farmers and local authorities. In addition the landowners and developers should also ensure that they join the local fire protection agency.
Cumulative impacts: No, provided losses are compensated for.
Residual impacts: None

Nature of impact: Potential noise, dust and safety impacts associated with construction related activities and the movement of construction related traffic to and from the site		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: The proponent should enter into an agreement with the local municipalities whereby the company will compensate for proven damage to local roads as a result of construction vehicle traffic. In addition, the potential impacts associated with heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include: » Abnormal loads should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.; » The contractor must ensure that all damage caused to local farm roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor; » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; and		

» All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.
Cumulative impacts: If damage to roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were no responsible for the damage.
Residual impacts: Reduced quality of road surfaces and impact on road users

Nature of impact: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development

Relevant Listed Activities:

» GN 545: 1

	Without Enhancement	**With Enhancement**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Mitigation Measures: In order to maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented:

» The proponent in consultation with the Emthanjeni and Renosterberg Local Municipalities should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; and
» The proponent in consultation with the Emthanjeni and Renosterberg Local Municipalities should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the wind energy facility are managed for benefit of the community as a whole and not individuals within the community.

Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community

Residual impacts: None

***Nature*: Potential impact of the wind energy facility on local tourism**		
Relevant Listed Activities: » GN 545: 1		
	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24) (Applies to both – and +)**	**Low (27) (Applies to both – and +)**
Status	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Mitigation Measures: The recommendations contained in the Visual Impact Assessment should be implemented. In terms of efforts to enhance the proposed benefits to tourism: » The proponent should liaise with representatives from the Emthanjeni and Renosterberg Local Municipalities and local tourism representatives to raise awareness of the proposed facility; and » The proponent should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.		
Cumulative impacts: Potential negative and or positive impact on tourism in the Emthanjeni and Renosterberg Local Municipal areas.		
Residual impacts: None		

***Nature*: The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy**
Relevant Listed Activities:

» GN 545: 1, 15		
	Without Mitigation	**With Mitigation**
Extent	Local-International (4)	Local-International (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (54)**	**Medium (54)**
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Mitigation measures: The development of the proposed wind energy facility would represent an enhancement measure. However, the impact of large facilities on the sense of place and landscape are issues need to be addressed in the location, design and layout of the proposed plant.		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: There will not be any residual impacts as no development would have taken place.		

8.7.3 Comparative Assessment of Impact of Access Road Alternatives on Social Impact

Both the northern and southern access routes are existing gravel routes which are used regularly by farm owners and occupiers in the area. The utilisation of existing roads is supported, and the use of one designated route is supported in order to keep all construction traffic limed to a single corridor. The influx of construction vehicles will negatively impact on the local farm owners. As the roads are currently utilised by local traffic, this needs to be considered in the construction phase and during traffic control and planning. **Alternative 2** is considered the preferred alternative as there are no homesteads situated along the access road. Where either alternative is used, the proponent would be required to ensure that damage to the road surface is monitored and repaired on a regular basis, and that the road is returned to its original state once the construction phase is completed.

» **Access Road Alternative 1 (referred to as the Northern Access Road):** the site will be accessible from northern gravel access road from the R389 to

Philipstown and Hanover, via existing gravel farm roads. There are several homesteads located along the access road and the homesteads will most likely have a negative impact on traffic, generate noise and dust in the area.

» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from southern gravel access road from the R389 to Philipstown from the N10, via an existing gravel road. The southern access road has been identified as a preferred alternative as there are no homesteads located along the access roads.

8.7.4 Implications for Project Implementation

» The developer in consultation with the Emthanjeni and Renosterberg Local Municipalities should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the Community Trust from the wind energy facility are managed for benefit of the community as a whole and not individuals within the community.
» The developer in consultation with the Emthanjeni and Renosterberg Local Municipalities should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community.
» The developer should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.
» The developer should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase.

8.8 Assessment of Potential Visual Impacts

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General. The approach utilised to identify issues related to the visual impact included the following activities:

» The creation of a detailed digital terrain model (DTM) of the potentially affected environment;

- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The identification of sensitive environments upon which the proposed facility could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses should take into account the dimensions of the proposed structures.

8.8.1 Specialist findings

The results of the viewshed analyses for the proposed facility is shown in Figure 8.11 and Figure 8.12. The viewshed analyses were undertaken from the 31 wind turbine positions within the proposed development area at an offset of 120m above average ground level (i.e. the approximate hub-height of the wind turbine infrastructure). This was done in order to determine the visual exposure (visibility) of the area under investigation, simulating the height of the proposed structures associated with the facility.

The viewshed not only indicates areas from which the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed). The dark orange areas indicate a high frequency (i.e. 29-31 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-3 turbines or parts thereof may be visible).

It must be noted that the viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed facility, therefore signifying a worst-case scenario.

It is evident from the viewshed analyses that the proposed facility would have a large area of potential visual exposure within the central to southern sections of the study area. This is attributed to the sizable wind turbine structures, the location of the structures on top of the plateau and the generally flat topography to the south. The visual exposure to the north is effectively interrupted by the northern escarpment due to the relative setback distance of the wind turbines from this escarpment. The visually exposed terrain, for the most part, falls within vacant natural land, although some sensitive visual receptors may be encountered at farm residences and along major roads.

Within a **5km radius** from the proposed facility, the wind turbines would likely be exposed to a number of farm residences and sections of secondary roads traversing near or over the development site. Affected farmsteads, excluding the ones located within the development site, may include: *Kranskop, Klipfontein, Vendusiekraal, Disselskuil* and *Slingershoek*.

Visibility within the **5-10km** radius from the development site becomes scattered due to the shielding effect of the escarpment surrounding the site. This is quite evident to the north, where the wind turbines are not expected to be visible at all, and some sections to the south. Sections of secondary roads may experience views of the facility where it traverses within this zone. Affected homesteads, from where the turbine structures may be visible, includes: *Tweefontein, Enkeldebult, Garrenboom, Groenpan, Die Dam* and *Matjiesfontein.*

The intensity of visual exposure is expected to subside beyond a **10km** radius. This zone contains large tracts of natural land, limited sections of the R389 and other secondary roads, and a number of farm residences. These include: *Leeuwkuil, Trekpoort, Plessisvlakte, Rooidam, Skietkuil, Sipreshof, Bloemhof, Rusoord* and *Jakkalsfontein.*

Visibility beyond a **radius of 20km** from the facility is deemed to be negligible, as the structures are unlikely to be visible with the naked eye, or totally absorbed within the landscape.

It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact. It must however be noted that a large section of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall within farms earmarked for the development of the two Longyuan Mulilo De Aar North and South Wind Energy Facilities (which will be constructed in 2015) future/possible wind energy facilities. The construction of the Mulilo facilities will greatly affect the visual experience (and potential visual impact) of the Castle Wind Energy Facility. There will be an increased cumulative visual exposure of turbines within the region and, depending on the number of turbines erected, even a negation of the individual visual exposure associated with this Wind Energy Facility. A number of wind turbine positions (21), associated with the Longyuan Mulilo De Aar South Wind Energy Facility were however made available to perform a cumulative visual exposure calculation. The results are is discussed below.

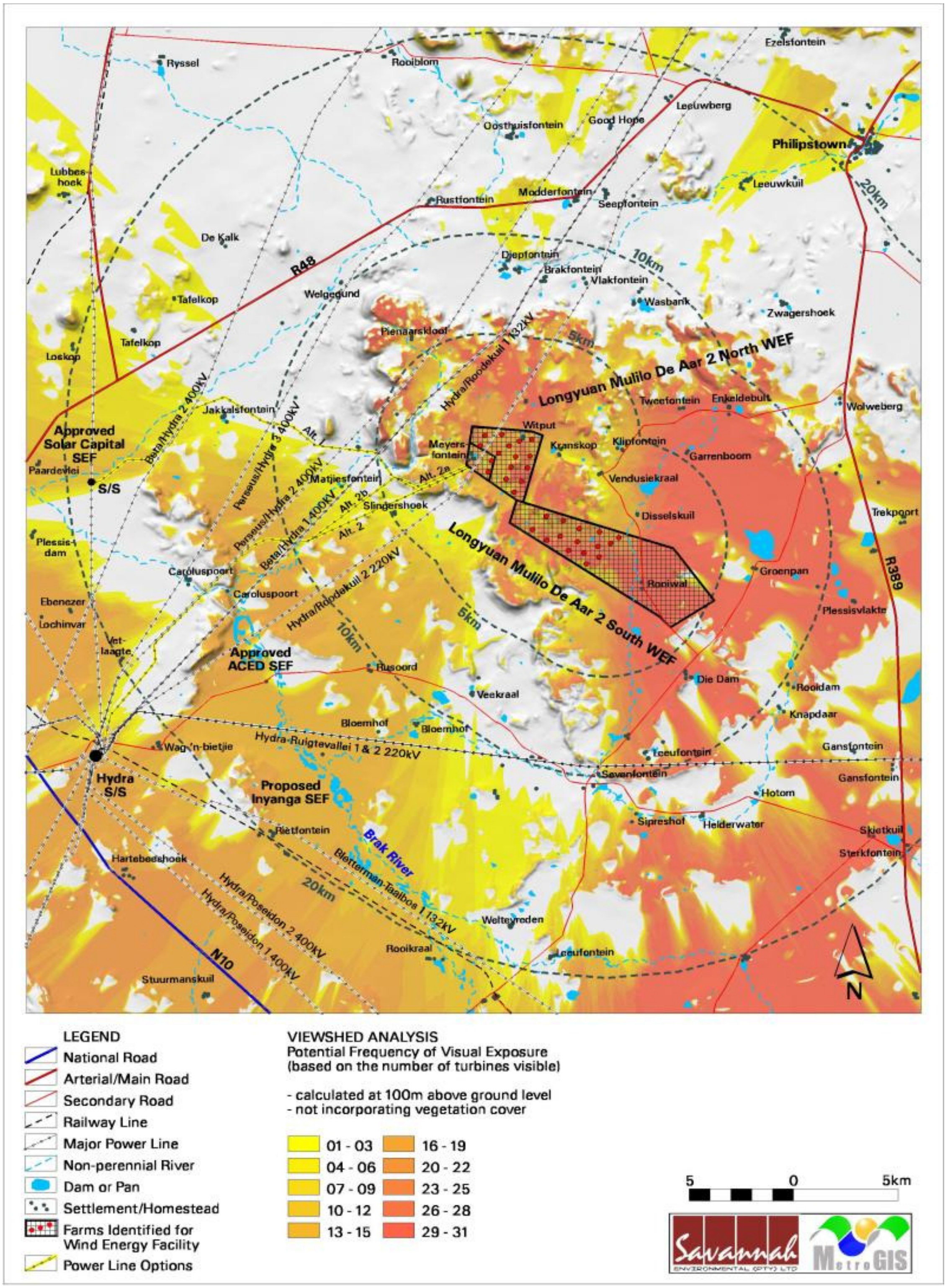


Figure 8.11: Potential visual exposure of the proposed wind energy facility.
(Note: the visible area indicates areas from which any number of wind turbines (with a minimum of one turbine) may be visible.

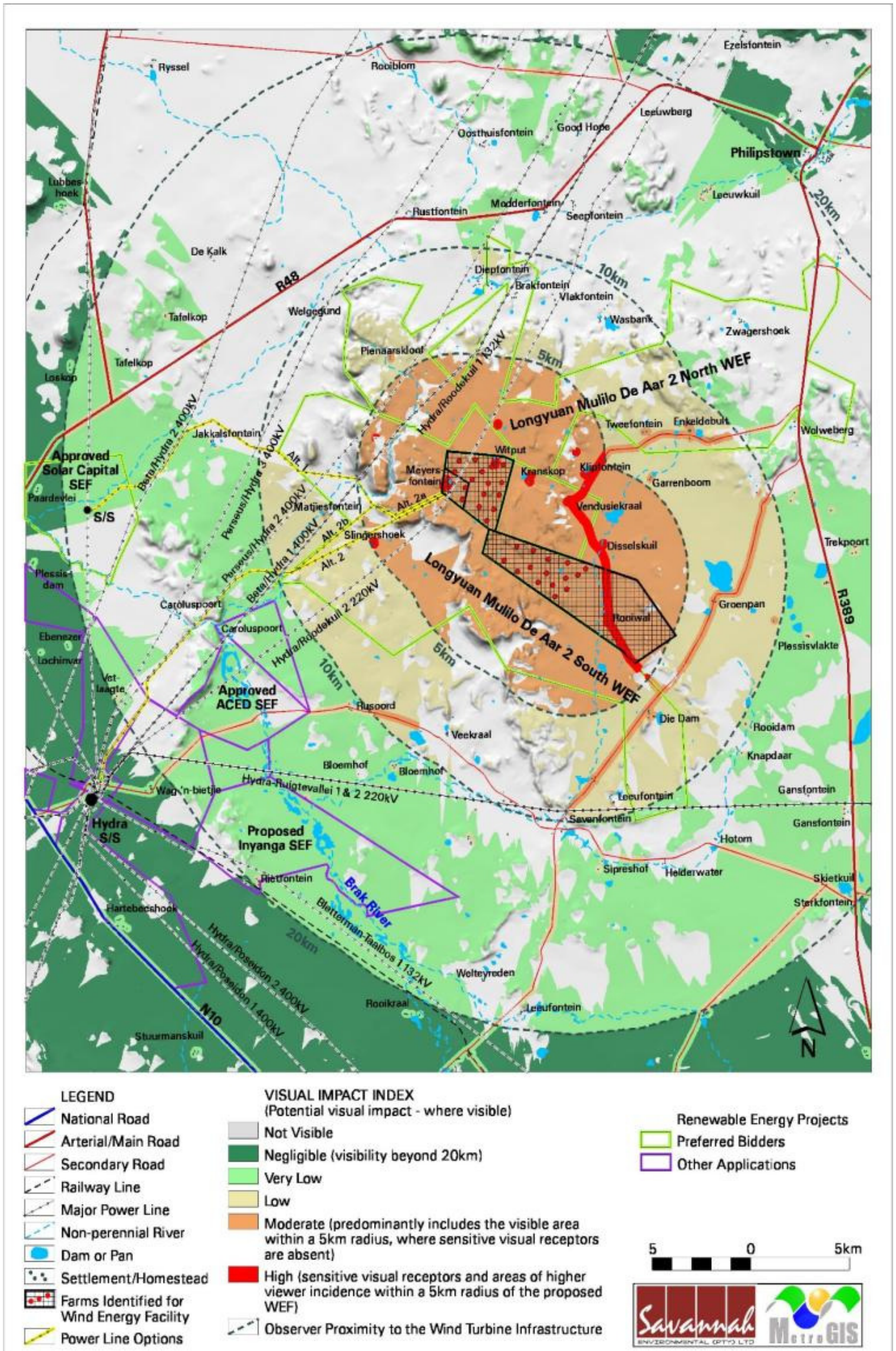


Figure 8.12: Visual impact index of the proposed Castle Wind Energy Facility.

8.8.2 Identified Impacts

Potential visual impact on users of arterial and secondary roads in close proximity to the proposed facility: The visual impact of the wind energy facility on the secondary road traversing the proposed development site is expected to be of high significance, especially within a radius of 5km from the proposed facility. The relatively low anticipated usage of this road reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice.

Potential visual impact on residents of homesteads and settlements in close proximity to the proposed facility: The potential visual impact on residents of settlements and homesteads within a 5-10km radius of the proposed wind energy facility is expected to be of high significance. These settlements and homesteads include *Klipfontein, Disselskuil, Vendusiekraal*, *Rooiwal, Slingershoek, Pienaarskloof, Tweefontein, Garrenboom, Groenpan,* and *Die Dam* (amongst others).

The location of these homesteads (excluding *Klipfontein* and *Disselskuil*) on properties earmarked for future or potential wind energy facility developments reduces the probability of this impact occurring. Others, e.g. *Vendusiekraal* and *Kranskop*, are believed to be derelict or uninhabited. In the event that the homesteads are deserted, the visual impact will be non-existent, until such time as it is inhabited again. No mitigation of this impact is possible, but measures are recommended as best practice.

Potential visual impact on sensitive visual receptors within the region: The visual impact on the users of roads and the residents of settlements and homesteads within the region (i.e. beyond the 10 km radius) is expected to be of low significance, considering the generally remote location of the proposed wind energy facility. The potential future development of neighbouring wind energy facilities may drastically change the overall cumulative visual impact within the region.

Currently, the relatively low incidence of visual receptors within this environment reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice.

Potential visual impact of onsite ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility: In site ancillary infrastructure associated with the wind energy facility includes the substation, internal access roads, workshop and office. This infrastructure will be located within the facility footprint, but may still be visible to visual receptors in close proximity to the proposed wind energy facility.

The roads have the potential of manifesting as landscape scarring. Other infrastructure have the potential of creating visual clutter, contributing to cumulative impacts, therefore having the potential of visual impact within the viewshed areas.

No dedicated viewsheds have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure is likely to be of low significance both before and after mitigation.

Potential visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility: Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, a 480m buffer along the edge of the outer most turbines is submitted as the zone within which there is a risk of shadow flicker occurring. There are no roads or places of residence within the 480 m buffer. The significance of shadow flicker is therefore anticipated to be **low**.

Potential visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility: Lighting impacts relate to the effects of glare and sky glow. Sources of glare light include both direct lighting and the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance.

Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The wind energy facility may contribute to the effect of sky glow within this environment.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light. The assessment of this anticipated impact, which is likely to be of moderate significance, and may be mitigated to low.

Potential visual impact of construction on sensitive visual receptors in close proximity to the proposed facility: During construction, there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance a visual nuisance to other road users and land owners in the area. The clearing of vegetation during construction is unavoidable. Given the large footprint of wind energy facility development, it is likely that large tracks of land may be affected. The rehabilitation of vegetation in this region is difficult, given the hot, dry climatic conditions. Dust from construction work could also result in potential visual impact. This anticipated impact is likely to be of moderate significance, and may be mitigated to low.

Potential visual impact of the proposed facility on the visual quality of the landscape and sense of place of the region: An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has a rural and undeveloped character. Settlements, where these occur, are limited in extent and domestic in scale. These vast, generally undeveloped landscapes are considered to have a high visual quality, except where structures (such as power lines and the Hydra Substation and the existing PV facilities in the area) represent existing visual disturbances.

A specific sense of place related to the wide open, undeveloped space characterises the region, but is not particular to this study area. The anticipated visual impact of the facility on the regional visual quality, and by implication, on the sense of place, is expected to be of low significance.

The low incidence of visual receptors within this environment and the relatively remote location of the proposed facility reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice.

Nature of Impact: Visual impact on users of secondary roads within 5km to the proposed facility		
Relevant Listed Activities: » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without mitigation	***With mitigation***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	High (8)	N/a
Probability	Highly probable (4)	N/a
Significance	**High (64)**	N/a
Status (positive, neutral or negative)	Negative	N/a
Reversibility	Recoverable	N/a

Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: Planning: » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities which are due to commence construction in 2015, and other renewable energy facilities proposed and approved in the region.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: Visual impact on residents of homesteads and settlements 10 to 50km to the proposed facility		
Relevant Listed Activities: » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	High (8)	N/a
Probability	Highly probable (4)	N/a
Significance	**High (64)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management: <u>Planning:</u> » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. <u>Operations:</u> » Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities which are due to commence construction in 2015, and other renewable energy facilities proposed and approved in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on sensitive visual receptors within the De Aar Area.		
Relevant Listed Activities: » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/a
Duration	Long term (4)	N/a
Magnitude	Moderate (6)	N/a
Probability	Improbable (2)	N/a
Significance	**Low (26)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	Yes	
Mitigation / Management: <u>Planning:</u> » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. <u>Operations:</u> » Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		

Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities which are due to commence construction in 2015, and other renewable energy facilities proposed and approved in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of on-site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 10 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (28)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation / Management: Planning: » Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Construction: » Rehabilitation of all construction areas. » Ensure that vegetation is not cleared unnecessarily to make way for access roads and ancillary buildings. Operation: » Maintenance of roads to avoid erosion and suppress dust. Decommissioning: » Removal of infrastructure and roads not required for post decommissioning use and rehabilitation of the footprint areas. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		

Cumulative impacts: The construction of the substation, internal access roads, workshop and office will increase the cumulative visual impact of buildings and industrial type infrastructure within the region. This is relevant in light of existing roads and power lines already present in the area.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors located approximately 5km from the proposed facility.		
Relevant Listed Activities: » GN 545: 1		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	None (0)	N/a
Probability	Very Improbable (1)	N/a
Significance	**Low (8)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: None required.		
Cumulative impacts: None.		
Residual impacts: None.		

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.		
Relevant Listed Activities: » GN 545: 1		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (48)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes
Mitigation: Planning & operation: » Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). » Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. » Make use of minimum lumen or wattage in fixtures. » Make use of down-lighters, or shielded fixtures. » Make use of Low Pressure Sodium lighting or other types of low impact lighting. » Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.	
Cumulative impacts: The two preferred bidder Round 3 wind energy facilities (Longyuan Mulilo De Aar 2 North and South Wind Energy Facility) will be commence construction in 2015 and will require lighting on turbines as well as other night-lighting at the facility. An additional facility to be constructed directly adjacent to these facilities may potentially increase the visual impacts associated with light pollution within an otherwise rural setting, however, as the extent of lighting is limited, the cumulative impact at night will be moderate to low..	
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.	

Nature of Impact: Visual impact of construction activities and equipment on sensitive visual receptors in close proximity to the proposed facility.		
Relevant Listed Activities: » GN 545: 1, 15		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Moderate (56)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
Planning:
» Retain and maintain natural vegetation in all areas outside of the development footprint.
Construction:
» Ensure that vegetation is not unnecessarily removed during the construction period.
» Reduce the construction period through careful logistical planning and productive implementation of resources.
» Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
» Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
» Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.
» Rehabilitate all disturbed areas immediately after the completion of construction works.
Cumulative impacts: None.
Residual impacts: None, provided rehabilitation works are carried out as specified.

Nature of Impact: Impact of the proposed facility on the visual quality of the landscape and sense of place of the region		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/a
Duration	Long term (4)	N/a
Magnitude	Low (4)	N/a
Probability	Improbable (2)	N/a
Significance	**Low (22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management: Planning: » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of wind energy facilities together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as two Longyuan Mulilo De Aar 2 North and South Wind Energy Facility and other renewable energy facilities which are to be constructed in 2015 and authorised in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.8.3 Comparative Assessment Impact of Access Road Alternatives Visual Impact

Both the northern and southern access routes are existing gravel routes. In terms of visual impacts as a result of potential upgrading of the road, there is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.8.4 Implications for Project Implementation

- Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas wherever possible.
- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
- During the decommissioning phase all areas must be rehabilitated. An ecologist should be consulted regarding rehabilitation specifications.

8.9 Assessment of Potential Noise Impacts

8.9.1 Specialist Findings

With wind energy facilities potential for environmental and economic advantages, wind power generation has significant potential to become a large industry in South Africa. However, when wind farms are near to potential sensitive receptors, consideration must be given to ensuring a compatible co-existence. The potential sensitive receptors should not be adversely affected and yet, at the same time the wind farms need to reach an optimal scale in terms of layout and number of units.

Wind turbines produce sound, primarily due to mechanical operations and aerodynamic effects at the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that can impact on areas at some distance away. When potentially sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not cause undue annoyance or otherwise interfere with the quality of life of the receptors.

It should be noted that this does not suggest that the sound from the wind turbines should not be audible under all circumstances - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source – but rather that the sound due to the wind turbines should be at a reasonable level in relation to the ambient sound levels. There are no noise sources of significance in the area and relative low ambient sound levels are expected, especially at night.

8.9.2 Identified Impacts

Impact Assessment: Construction Phase: Only the calculated daytime ambient noise levels are presented, as construction activities that might impact on sensitive receptors should be limited to the 06:00 – 22:00 time period. The worst case scenario is presented with all activities taking place simultaneously at each proposed wind turbine location during wind-still conditions, in good sound propagation conditions (20ºC and 80% humidity).

Impact Assessment: Operational Phase: The Environmental Noise Impact Assessment focused on the impacts on the surrounding sound environment during times when a quiet environment is highly desirable. Noise limits are therefore appropriate for the most noise-sensitive activity, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc).

Appropriate Zone Sound Levels are therefore important, yet it has been shown that the SANS recommended (fixed) Night Rating Level ($L_{Req,N}$ = 35 dBA) might be inappropriate due to the increased ambient sounds relating to wind action. A more appropriate method to determine the potential noise impact would be to make use of the projected noise levels due to the operation of the WEF as well as the likely ambient sound levels due to wind induced noises.

The C-weighted sound power levels were also evaluated and estimated to be less than 55 dBC (at all NSD) with a 7 m/s wind. Fieldwork has shown that ambient C-weighted sound levels during periods that wind speeds exceed 5 m/s is often higher than 70 dBA and the *projected* C-weighted noise levels are less than the expected C-weighted levels and the risk of low-frequency issues is considered to be low.

Impact tables summarising the significance of impacts on noise resources (with and without mitigation)

Nature: Numerous simultaneous construction activities that could impact on receptors.	
Relevant Listed Activities: » GN 544: 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)	
Acceptable Rating Level	Rural district (excluding construction traffic): 45 dBA outside during day. Use of $L_{Req,D}$ of 45 dBA for rural areas. Ambient sound level = 35 - 45 dBA, used 35 dBA for modelling.
Extent ($\Delta L_{Aeq,D}$>7dBA)	Regional (3)– Because of the quiet ambient sound levels (during periods when wind speeds are less than 4 m/s) measured in the area the change in ambient sound levels could extend further than 1,000 m from activities
Duration	Short (2)– Noisy activities in the vicinity of the receptors would last the duration of the construction period, more likely only a portion of the construction period
Magnitude	Low (2) – Noise Rating Levels << Rating Level
Probability	Possible (2) - While it is likely that the receptors may hear construction noises at times during the construction phase, it is considered unlikely that the noise levels will change the ambient sound levels sufficiently to result in complaints. Considering the precautionary approach the level is raised by 1 – unlikely to possible.
Significance	**Low (14)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of	Not relevant.

resources?	
Comments	Modelling considered a worse-case scenario with significant activities taking place for 16 hours each day at all possible locations
Can impacts be mitigated?	Mitigation not required.
Mitigation:	Not required.
Effectiveness of mitigation:	Not applicable, mitigation not required
Cumulative impacts:	This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area.
Residual Impacts:	This impact will only disappear once construction activities cease.

Nature: Numerous wind turbines operating simultaneously during a period when a quiet environment is desirable.

Relevant Listed Activities:
- GN 544: 47(ii)
- GN 545: 1, 15.
- GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)

Acceptable Rating Level	Rural district
Extent ($\Delta L_{Aeq,n}$>7dBA)	Local (2) – Impact will extend less than 1,000 meters from activity.
Duration	Long (4) – Facility will operate for a number of years
Magnitude	Low (2) – All NSDs
Probability	**Possible (2**) - Considering the precautionary approach the level is raised by 1 – unlikely to possible.
Significance	**Low (16) for all NSD**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	*Not relevant.*
Comments	-
Can impacts be mitigated?	Yes, not required
Mitigation:	Possible, but not required.
Cumulative impacts:	This impact is cumulative with existing ambient background noises.
Residual Impacts:	This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

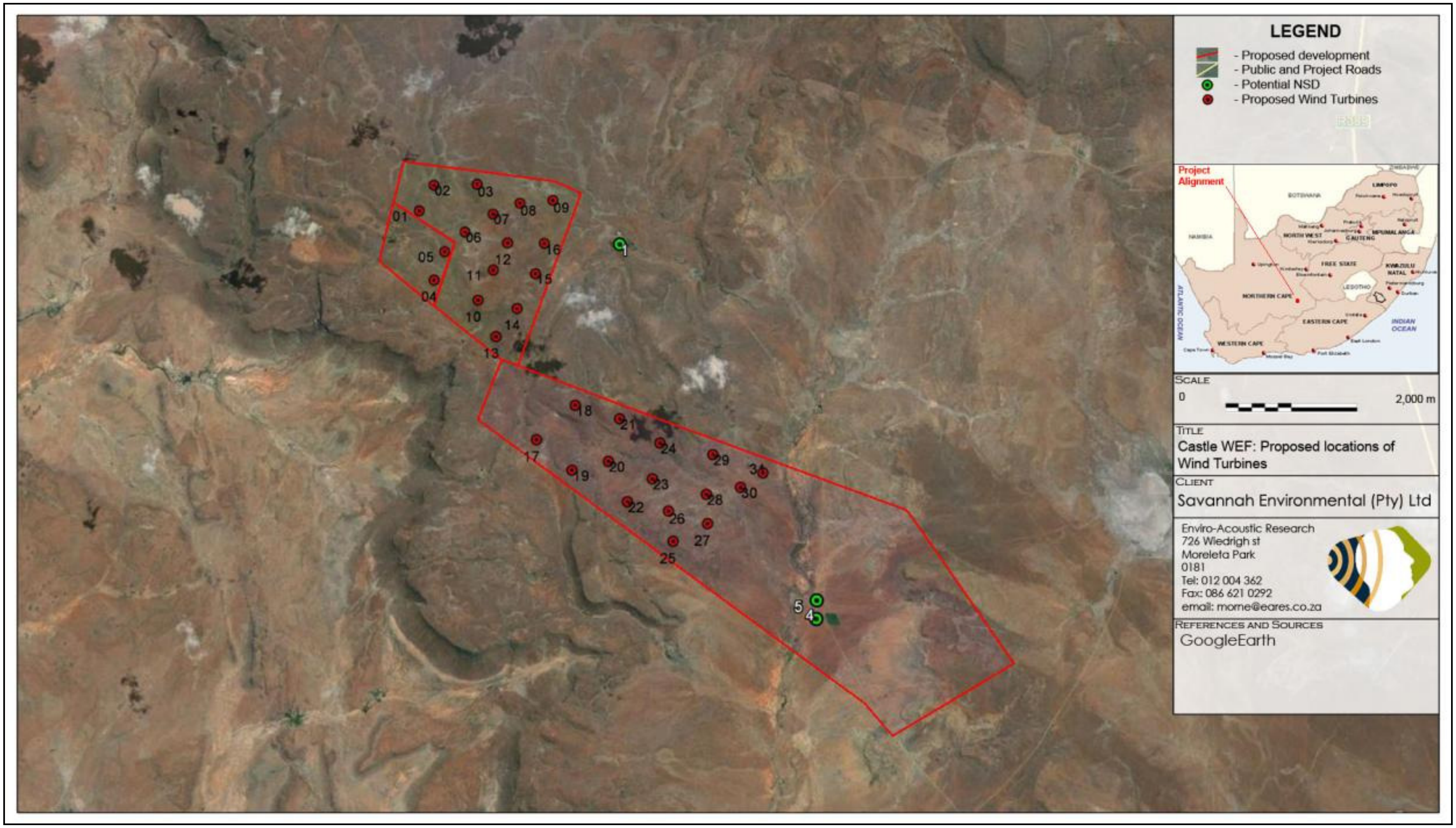


Figure 8.13: Proposed layout of the Castle Wind Energy Facility indicating the noise sensitive developments

8.9.3 Comparative Assessment Impact of Access Road Alternatives on Noise Levels

Both the northern and southern access routes are existing gravel routes. The influx of construction vehicles will result in a negative impact on the local farm owners. Alternative 1 is likely to have a higher negative impact, as it will generate noise which will have an impact on the homesteads along the route and is therefore nominated as the preferred alternative in terms of noise impacts.

8.9.4 Implications for Project Implementation

» Community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon; as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself. Wind projects offer a benefit to the environment and the energy supply for the greater population, and offer economic benefits to the land owners leasing installation sites to the wind farm. A positive community attitude throughout the greater area should be fostered, particularly with those residents near the wind farm.

  The developer must implement a line of communication (i.e. a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers. The Wind Energy Facility should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop. For example, sudden and sharp increases in sound levels could result from mechanical malfunctions or perforations or slits in the blades. Problems of this nature can be corrected quickly, and it is in the developer’s interest to do so.

8.10 Assessment of Potential Impacts on Heritage - Archaeology

8.10.1 Specialist Findings

The footprint of the proposed turbine positions as indicated in Figure 8.14 and 8.15 were surveyed. At the start of the survey Stone Age material was immediately noticed scattered in varying densities throughout the study area. Low density scatters (between 3 - 5 artefacts per m²) were recorded as find spots. Scatters higher than 5 artefacts per m² were given site numbers and areas where quartzite and quartz outcrops were exploited were also recorded as sites. Scatters with densities less than 3 artefacts per m² were not recorded as they occur throughout the area. Individual occurrences were not point plotted within the recorded scatters; however an attempt was made to determine site extent.

From the site distribution map (Figure 8.14 and 8.10) most of the recorded find spots and sites occur within the southern portion of the surveyed area where the calcrete is eroding from under the Aeolian sands or in areas where hard packed Aeolian sands are found. In the northern portion the Aeolian sands are much deeper, in some cases deeper than 30-40 cm; vegetation in this area is also much higher with grasses and shrubs standing 50-70 cm high hampering archaeological visibility. Artefact counts drops drastically as one move from south to north into this sandy area, however, the occasional MSA or LSA flake was noted in these areas, where the Aeolian sands most probably buried most of the MSA and ESA artefacts.

Nine sites were recorded consisting of six Stone Age sites (Sites 1, 3, 4, 6, 7, 9) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 5) as well as historical/recent exploration or quarrying (Site 8). A further total of 3 find spots were mapped, recorded and digitally photographed. Again, assemblages at the locations are mixed, mainly consisting of MSA and LSA artefacts with some ESA artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure.

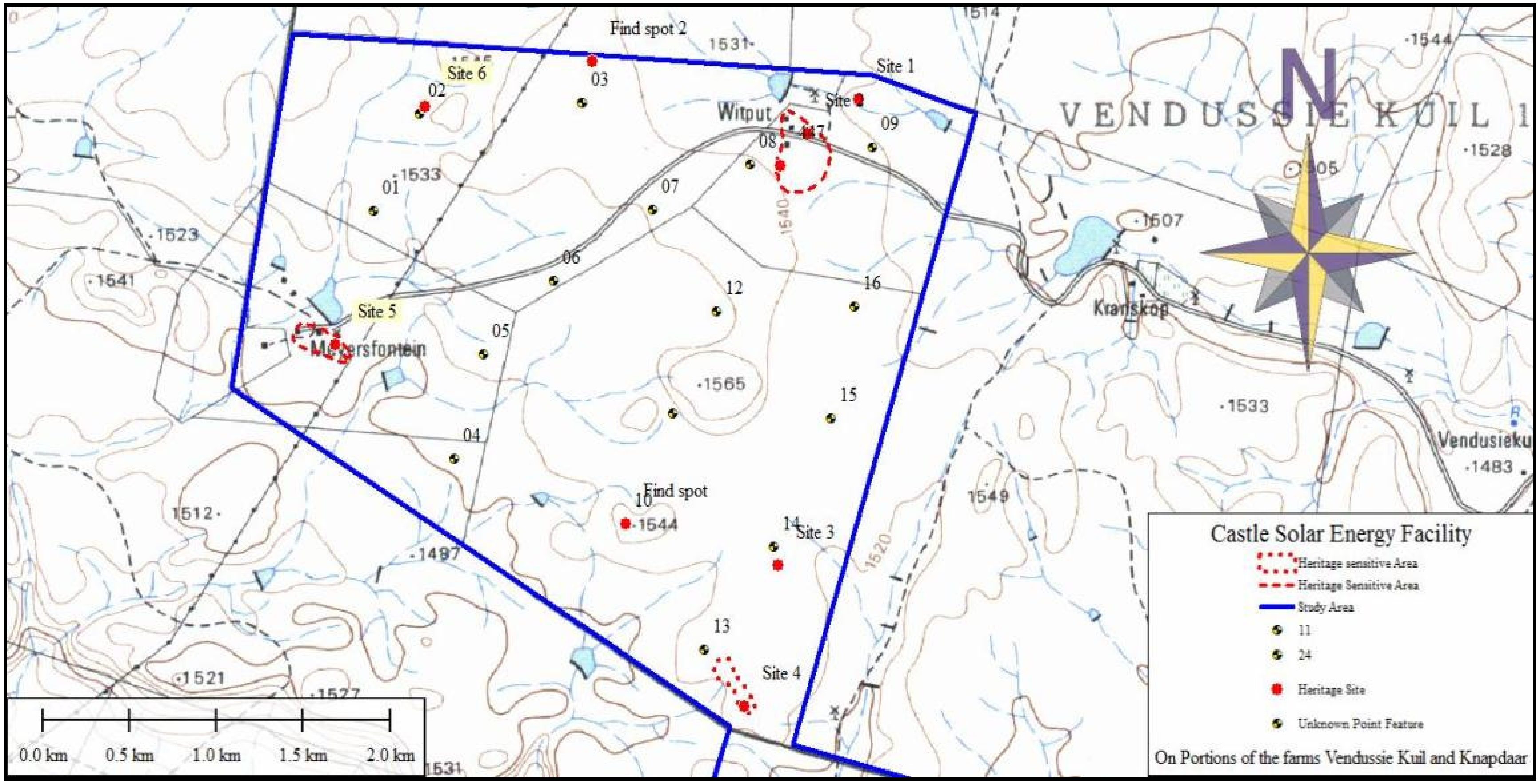


Figure 8.14: Showing the location of recorded sites in relation to turbine positions on the farm Vendussie Kuil.

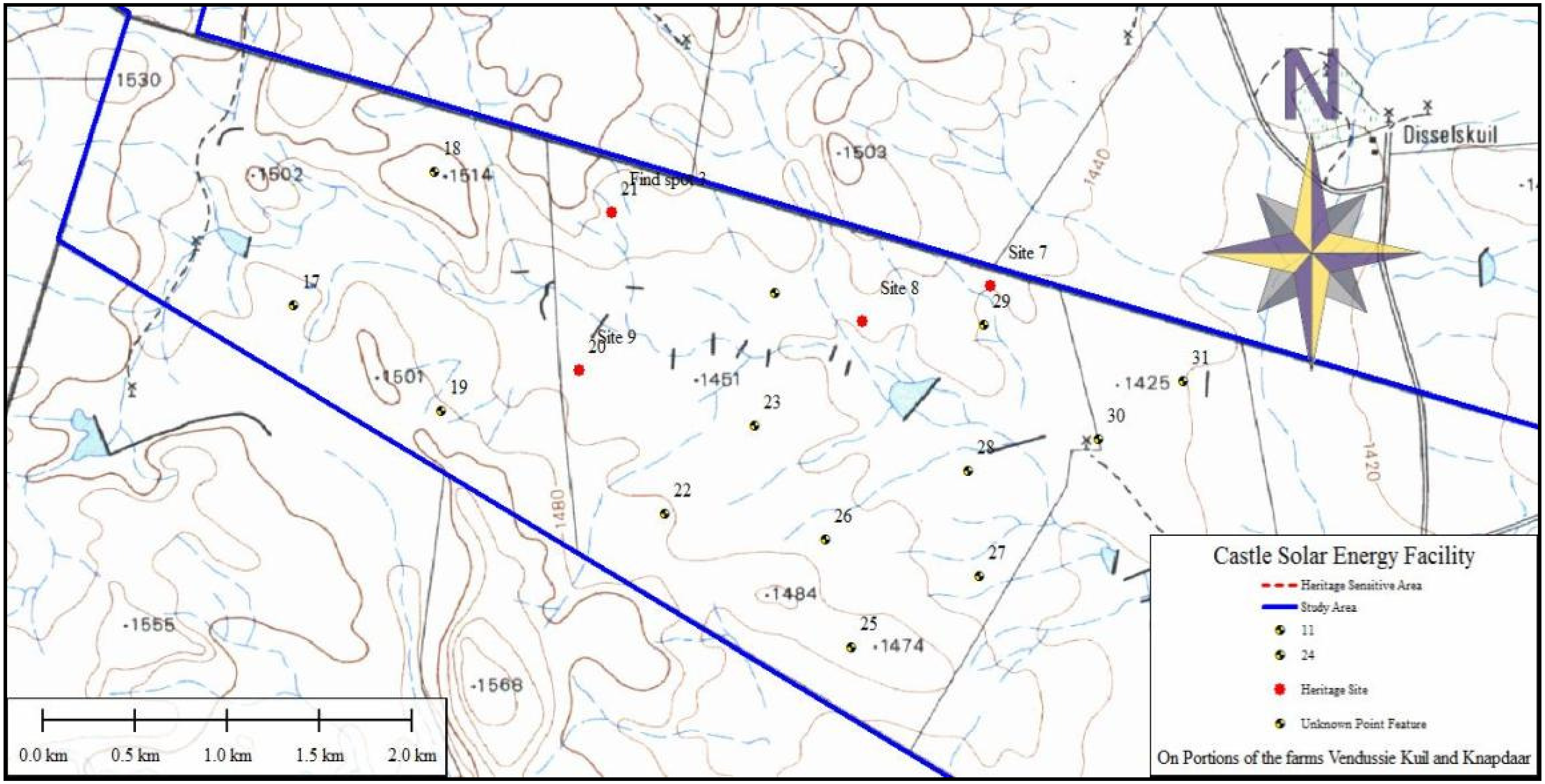


Figure 8.15: Showing the location of recorded sites in relation to turbine positions on the farm Knapdaar.

List of identified sites

Site Number	Landscape	Type Site	Cultural Markers
Site 1	Archaeological	Middle Stone Age	Stone tools with facets on the striking platform scattered around pan
Site 2	Historical	Witput Farm complex	Vernacular buildings
Site3	Archaeological	Stone Age quarry/workshop site	Hornfell outcrop with scar flaking. Low density of MSA flakes
Site 4	Archaeological	Stone Age quarry/workshop site	Hornfell outcrop with scar flaking. Low density of MSA flakes
Site 5	Historical	Meyersfontein Farm complex	Vernacular buildings
Site 6	Archaeological	Later Stone Age	Engravings
Site 7	Archaeological	LSA	Stone enclosure with lithics
Site 8	Historical	Large Kraal	Dry stone walling
Site 9	Archaeological	Stone Age quarry/workshop site	Hornfell outcrop with scar flaking. Medium high density of flakes

List of Find spots

Site Number	Landscape	Type Site	Cultural Markers
Find spot	Archaeological	Middle Stone Age	Stone tools with facets on the striking platform. Snapped blades with dorsal flaking and scrapers
Find spot 2	Archaeological	Middle Stone Age	Rough flakes and chunks, almost no formal tools although some show signs of use.
Find spot 3	Archaeological	MSA/LSA	Highly weathered as well as fresh looking flakes, mostly blades and triangular flakes

8.10.2 Impact tables summarising the significance of impacts on heritage resources (with and without mitigation)

Nature of Impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.

Relevant Listed Activities:

» GN 544:10,13, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (2)
Probability	Improbable (3)	Improbable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	The site will not be impacted - no action will be required.	

Mitigation:

There are no sensitive sites located close to any turbine and no impact is foreseen on the site and therefore no mitigation is required. However the general location should be demarcated to avoid impact on the site.

Cumulative impacts:

None.

Residual Impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive

Nature of impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Historical Material or objects.

Relevant Listed Activities:

» GN 544:10, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)

Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Improbable (2)	Improbable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes. However, the sites will not be impacted - no action will be required.	
Mitigation: No turbine is located close to the sites and no direct impact is foreseen on the site. The area should be demarcated to avoid impact on the site.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. The cumulative impacts will be low.		
Residual Impacts: Depletion of archaeological record of the area.		

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.		
Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (45)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: At Site 9 surface sampling should be conducted and the site should be monitored during		

construction. Preferably, the area should be demarcated to avoid impact on the site. Site 3 and 4 are not impacted by a proposed turbine position and no impact is foreseen on the site but the sites should be demarcated and avoided during construction.
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. The cumulative impacts will be low.
Residual Impacts: Depletion of archaeological record of the area.

Nature impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.		
Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (5)
Probability	Probable (4)	Probable (3)
Significance	**High (60)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: The site is located close to turbine 2 and a direct impact is foreseen on the site. Ideally the area should be demarcated to avoid impact on the site. Alternatively the engraving must be traced and documented and the boulder relocated to a museum.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive, this site is unique and should be recorded as part of the heritage landscape of the area. .		
Residual Impacts: Depletion of Archaeological record of the area.		

Nature impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.

Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: The site is located 200m from turbine 29 and an indirect impact is foreseen on the site. The site should be demarcated to avoid impact on the site.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of Archaeological record of the area.		

8.10.3 Comparative Assessment of Impact of Access Road Alternatives on Heritage resources

The scattered/isolated finds during the field survey are not noted to be of major heritage significance. In terms of impacts arising from disturbance and loss as a result of the access roads, there is **no significant** difference. Therefore, there is **no preference** between the alternatives.

8.10.4 Implications for Project Implementation

» At Site 9 (Stone Age quarry/workshop site): the area should be demarcated to avoid impact on the site. Surface sampling should be conducted to record the site.

» Site 3 and 4 (Stone Age quarry/workshop site): these sites are not impacted by a proposed turbine position, however the sites should be demarcated and avoided during construction.

- A direct impact is foreseen on the site 6 (Later Stone Age) located close to turbine 2. Ideally the area should be demarcated to avoid impact on the site. Alternatively the engraving must be traced and documented and the boulder relocated to a museum.
- The site is located 200 m from turbine 29 and an indirect impact is foreseen on the site. The site should be demarcated to avoid impact on the site.
- The location of all the recorded features should be taken into account in the future planning of the wind farm project, especially for internal roads, underground cabling and construction camps as it is recommended that the sites are preserved in situ, and demarcated for future protection.
- The possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded. If during construction any possible finds are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find.

10.11 Assessment of potential impacts on Palaeontology

10.11.1 Specialist Findings

The Castle Wind Energy Facility area is underlain only by the rocks of the Adelaide Subgroup which are fossiliferous and the sands of the Cenozoic regolith are potentially fossiliferous and may, therefore, be negatively impacted by the proposed project. The fossils vertebrate and plant macrofossil assemblages known to occur within the Adelaide Subgroups are highly scientifically significant as they document the early phases of the evolutionary transition from reptile to mammals and are part of the famous *Glossopteris* flora respectively. Should any fossils be present within the regolith they would be potentially highly scientifically significant as they may provide valuable insights into the paleoclimate and paleoecology of the region during the Cenozoic.

There is a potential for negative impact on the palaeontological heritage of the project area throughout the majority of its extent (due to the extensive coverage of the Adelaide Subgroup in particular) and the overall potential risk of a negative impact is categorised as probable. However, the fossils that may be anticipated to be present within these units are potentially highly significant to the cultural and scientific heritage of South Africa. As such, the risk of a negative impact is improbable, but the significance of any negative impact on the fossil assemblages could potentially be high. Any damage that occurs to such fossil material during the excavation and construction phase of the project would be permanent and irreversible.

The potential negative impact to the palaeontological heritage of the area can be substantially mitigated by the implementation of appropriate mitigation processes. A potential positive outcome of these mitigation protocols could be that fossil materials become available for scientific study that would otherwise have been hidden within or beneath the regolith. Should such new palaeontological material be located as a result of this site investigation this could prove to have a positive effect on the understanding of the fossil record of South Africa and positively affect the palaeontological heritage of the country.

10.11.2 Identified Impacts

The potential negative impacts of the proposed project on the palaeontological heritage of the area are:

- Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of those excavations (i.e., the upper-most few meters). Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of the projects infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).
- Movement of fossil materials during the construction phase, such that they are no longer *in situ* when discovered. The fact that the fossils are not *in situ* would either significantly reduce or completely destroy their scientific significance.
- The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities.

Impact tables summarising the significance of impacts on palaeontological resources (with and without mitigation)

Nature of impact: Destruction, damage and loss of provenance of fossil materials		
Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without Mitigation	**With Mitigation**
Extent:	Low (2)	Low (2)
Duration:	Permanent (5)	Permanent (5)
Magnitude:	High (10)	Minor (2)
Probability:	Probable (3)	Improbable (2)
Significance:	**Moderate (51)**	**Low (18)**
Status:	Positive	Positive
Reversibility:	Impossible	Impossible
Irreplaceable loss of resources:	Low	Low
Can impacts be mitigated:	Yes	
Mitigation: » Selected line staff of the developer should be trained to the types of fossils that may be encountered within the geological units present in the project area. » A close examination of all excavations should be made by the trained line staff while they are occurring. Should any fossil materials be identified, the particular excavation should be halted and SAHRA informed of the discovery.		

» Should any fossil materials be identified during the construction phase a palaeontologist should be appointed to evaluate its significance. » Should scientifically or culturally significant fossil material exist within the project area any negative impact upon it could be mitigated by its excavation (under permit from SAHRA) by a palaeontologist and the resultant material being lodged with an appropriately permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality could be protected and the site of any planned construction moved. » It would be preferential if the deeper excavations particularly those associated with the foundations for the wind turbines were regularly inspected by a palaeontologist during their excavation.
Cumulative impacts: None
Residual impacts: Permanent loss of palaeontological heritage

10.11.3 Comparative Assessment of Access Road Alternatives

The scattered/isolated finds during the field survey are not noted to be of major palaeontological significance. In terms of impacts arising from disturbance and loss as a result of the access roads, there is **no significant** difference. Therefore, there is **no preference** between the alternatives.

10.11.4 Implications for Project Implementation

It is anticipated, herein, that most infrastructural elements will only directly affect the surface of the site to a relatively shallow depth (upper few meters of the land surface). Any fossil materials that remain undiscovered after the construction of the project and which are located beneath the maximum depth of the anticipated excavations will only be negatively affected in so far as they will be unavailable for scientific study for the life expectancy of the infrastructural elements that comprise the project. As such this study has not identified any palaeontological reason to prejudice the progression of the Castle Wind Energy Facility, subject to adequate mitigation programs being put in place. Therefore there are no implications for the project development.

ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS CHAPTER 9

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R543) as meaning "the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

There has been a steady increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. The Department of Energy has, under the REIPPP Programme released requests for proposals to contribute towards Government's renewable energy target of 3725 MW and to stimulate the industry in South Africa.

Due to the growth in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. This chapter considers whether the proposed wind energy facility project's potential impacts become more significant when considered in combination with the other approved or proposed wind energy facility projects within the area.

9.1 Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[5].

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially as a result of the cumulative effects of the Project Castle Wind Energy Facility to be developed in the centre of the two Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility (Round 3 preferred bidder).

» Cumulative impacts potentially as a result of the cumulative effects of the Project Castle Wind Energy Facility added to all other renewable energy facilities proposed to be developed in and around the De Aar area.

Table 9.1 provides details of other known authorised renewable energy applications in the vicinity of the Castle Wind Energy Facility. These projects were identified by CSIR

[5] Definition as provided by DEA in the EIA Regulations.

using the Department of Environmental Affairs Geographic Information System digital data (CSIR, 2013).

Significant cumulative impacts that could occur due to the development of the wind energy facilities and its associated infrastructure in proximity to each other include impacts such as:

» Visual impacts;
» Socio-economic impacts;
» Loss of vegetation and impacts on ecology;
» Impact on bats;
» Impact on birds;
» Impacts to soil;
» Impacts on freshwater resources; and
» Impacts on heritage and palaeontological resources.

9.2 Cumulative Impacts of Renewable Energy Facilities in the De Aar area

As can be seen from Figure 9.1, there are proposed wind and solar developments (which fall within a 50km radius of the Castle Wind Energy Facility) to the north, northwest, west, south and southwest of the current site. While most of the proposed developments have been authorised and are likely to proceed, six wind and solar projects have been awarded a preferred bidder status in Round 1, 2 and 3 of the DoE REIPPP Programme. In the long term, the development of a large number of facilities in the area is likely to occur on account of the numerous power lines which can be used to evacuate the generated power. The Hydra substation is also located at the centre of the transmission grid and has excellent solar and wind resources. It is therefore a preferable location for renewable energy projects. All these projects may not however be able to connect to the Hydra Substation, and therefore, this, together with a number of other factors, are likely to contribute to the potential for cumulative impacts to occur in the area.

Cumulative effects within approximately 50km from the study area (accounting primarily for avifauna, noise, bats, soil, visual, palaeontology, heritage and ecological impacts) have been assessed. The significance of the cumulative impact will be directly influenced by the proximity of two Round three preferred bidder projects (Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility) to the proposed development site.

Several renewable energy projects are being proposed in the De Aar area, with several projects already constructed (solar PV projects only), and others to commence construction in 2015 (includes wind projects). Authorised projects within a 50km radius of the Castle Wind Energy Facility site include (refer to **Figure 9.1**):

Table 9.1: Proposed authorised renewable energy projects within the vicinity of the Castle Wind Energy Facility

Project	Applicant	Technology	DEA Ref. No	Status
Round 1, 2 and 3 Preferred Bidder Projects				
1. Longyuan Mulilo De Aar North Wind Energy Facility	Mulilo Renewable Energy (Pty) Ltd	Wind	12/12/20/2463/2	Authorised Preferred Bidder Round 3
2. Longyuan Mulilo De Aar South Wind Energy Facility	Mulilo Renewable Energy (Pty) Ltd	Wind	12/12/20/2463/1	Authorised Preferred Bidder Round 3
3. De Aar Solar 1 PV power project	South Africa Mainstream Renewable Power Development	Solar PV	12/12/20/2025/2	Phase 2- preferred bidder round 1 (reached COD)
4. Ilanga Lethemba PV Solar Energy Facility in De Aar	Solar Capital (Pty) Ltd	Solar PV	12/12/20/2048/2	Authorised Phase 2 preferred bidder round 3
5. Ilanga Lethemba PV solar energy facility and associated infrastructure on site north East of De Aar	Solar Capital (Pty) Ltd	Solar PV	12/12/20/2048/3	Authorised, Phase 3 is a preferred bidder round 2 & project under Construction
6. Photovoltaic solar Energy Facility on a site southeast of De Aar, Northern Cape	Mulilo Renewable Energy Solar (Pty) Ltd	Solar PV	12/12/20/1673	Authorised and preferred bidder round 1
Authorised Projects				
7. Ilanga Lethemba PV solar energy facility and associated infrastructure on site north East of De Aar	Solar Capital (Pty) Ltd	Solar PV	12/12/20/2048/1&4	Authorised
8. De Aar Solar 1 PV power project	South Africa Mainstream	Solar PV	12/12/20/2025/1	Phase 1 Authorised

Project	Applicant	Technology	DEA Ref. No	Status
	Renewable Power Development			
9. Inyanga Solar Energy Project 1, on the farm Riet Fountain	Islandsite Investment 519 (Pty) Ltd	Solar PV	12/12/20/2497	Authorised
10. Wind power generating facility near De Aar	Mulilo Renewable Energy (Pty) Ltd	Wind	12/12/20/1651	Authorised
11. Solar energy facility (Phase 1-5) on a site near of De Aar	ACED Renewables De Aar,	Solar PV	12/12/20/2250/1-5	Authorised
12. PV Plant on the farm Vetlaagte 4	Inqwaba Energy (Pty) Ltd	Solar PV	14/12/16/3/3/2/382/1-6	Authorised
13. Photovoltaic solar Energy Facility on a site southeast of De Aar, Northern Cape	Inca De Aar Solar (Pty) Ltd	Solar PV	12/12/20/2177	Authorised
14. Renosterberg Wind Farm	Renosterberg Wind Energy Company (Pty) Ltd (RWEC) in partnership with the Industrial Development Corporation of South Africa (IDC).	Wind	14/12/16/3/3/2/404	Authorised

(These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR.)

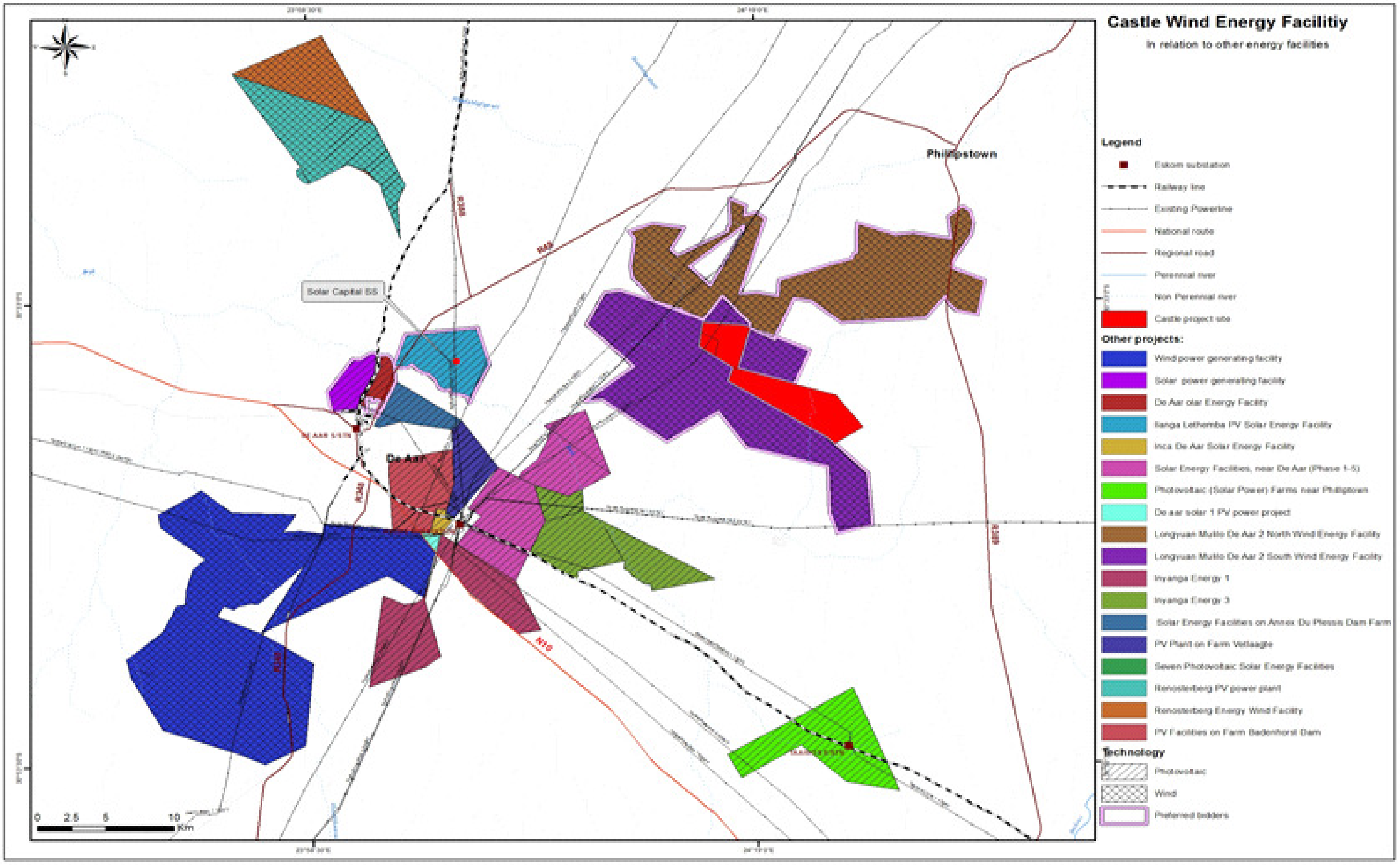


Figure 9.1: Map showing other renewable energy projects within a 50km radius from the Castle Wind Energy Facility (refer to Appendix Q to view the A3 map).

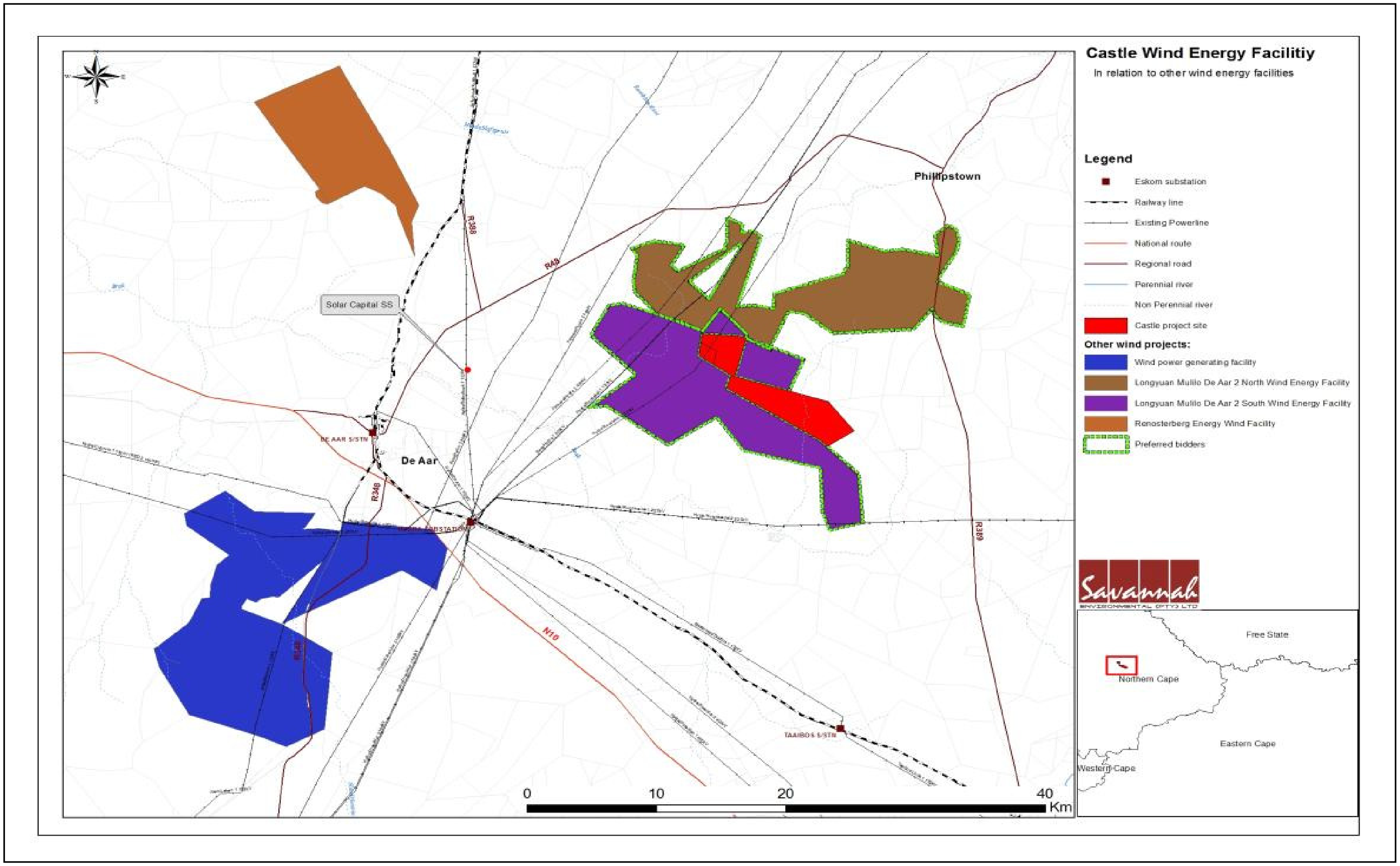


Figure 9.2: Map showing other wind energy projects within a 50km radius from the Castle Wind Energy Facility (refer to Appendix Q to view the A3 map).

The section below explores potential cumulative impacts of other renewable projects within the immediate vicinity (i.e. within 50km) of the proposed Castle Wind Energy Facility. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment due to the limited information available on what is planned for these facilities.

9.2.1. Visual impacts

It is envisaged that the Castle Wind Energy Facility structures (where visible from shorter distances-0- 5km) may constitute a high visual prominence, potentially resulting in a high visual impact. A large portion of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall between farms earmarked for the development of the two De Aar North and South Wind Energy Facilities (Longyuan Mulilo) which are scheduled to be constructed in 2015. A number of wind turbine positions (21), associated with the Longyuan Mulilo De Aar South Wind Energy Facilities were however made available[6] to perform a cumulative visual exposure calculation (refer to Figure 9.3). It should be noted that most of the wind turbine layouts (wind turbine positions) were not available at the time of compiling this report. It is expected that the development of the Castle Wind Energy Facility may contribute to the frequency of visual exposure of turbine structures. It should however also be noted that the Castle Wind Energy Facility will not significantly contribute to the increase in the area of exposure (i.e. the visual exposure is generally expected to be consolidated within an area of existing visual impact), and as such will not contribute to the proliferation of wind turbine structures within the surrounding wind energy facilities within the region.

Depending on the number of applications that are approved in future, the landscape surrounding De Aar may be transformed significantly in order to accommodate these developments. It can therefore be concluded that the construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as other renewable energy facilities proposed in the region. Due to the close proximity of the proposed Castle Wind Energy Facility to the two Longyuan Mulilo De Aar North and South Wind Energy Facility projects, it is expected that the cumulative impact will be **high**.

[6] The Longyuan Mulilo De Aar South Wind Energy Facility layout was provided by juwi (Pty) Ltd

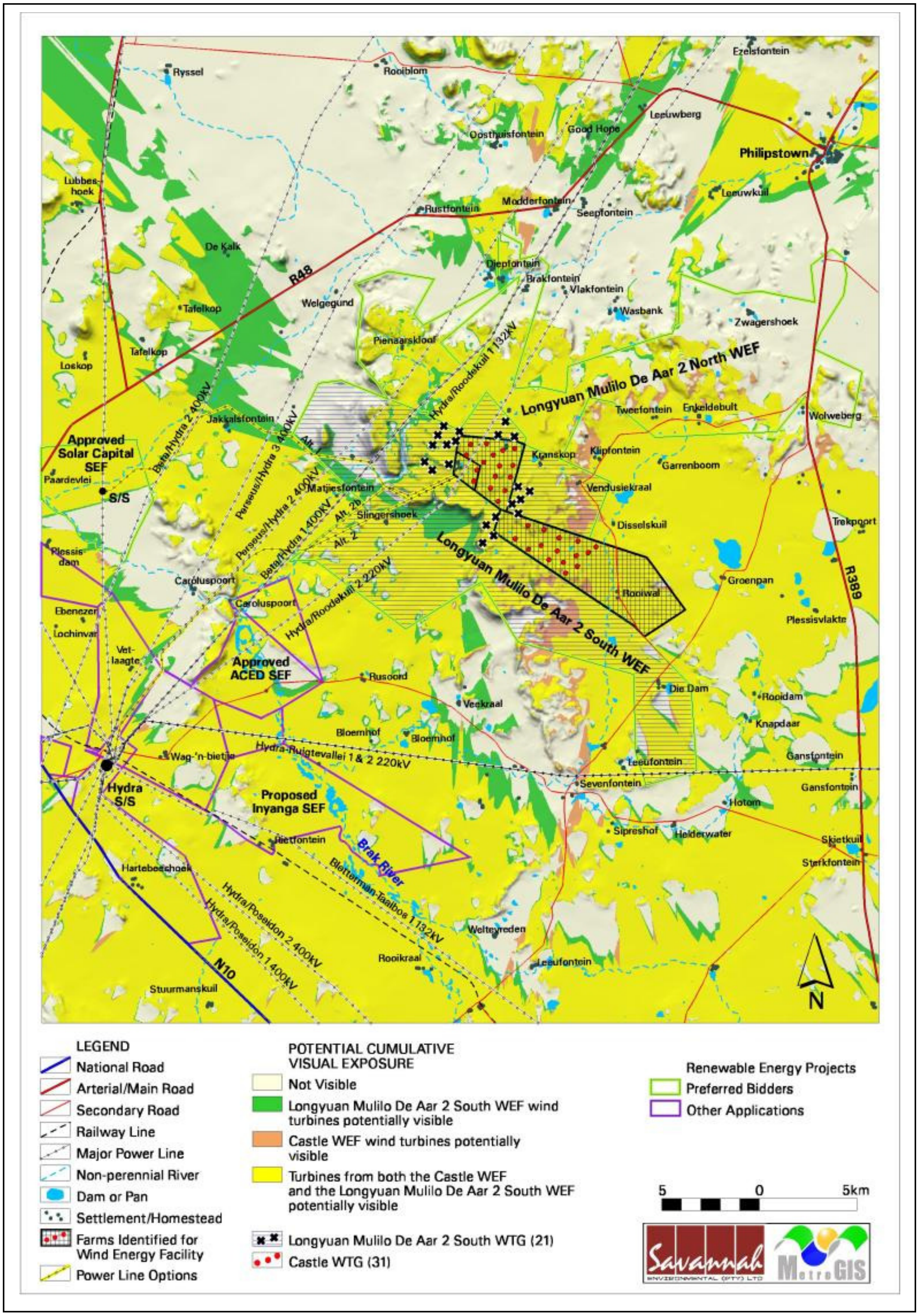


Figure 9.3: Potential cumulative visual exposure of the proposed Castle Wind Energy Facility and 21 turbines located within the Longyuan Mulilo De Aar 2 South Wind Energy Facility

9.2.2. Noise impact

The noise limits are considered appropriate for the most noise-sensitive activitites, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc). Cumulative impacts are therefore considered to be of **low significance**. Considering **Figure 9.4** the following observations are possible:

- The ambient sound levels in the area will increase as wind speeds increase, with all measurements recording sound levels higher than 35 dBA with wind speeds faster than 4.5 m/s;
- At a wind speed of 7 m/s, ambient sound levels is expected to be 37 – 39 dBA. The cumulative noise rating level at NSD01 is calculated to be 37 dBA, similar to the ambient sound level. This will raise the ambient sound levels with approximately 3 dBA and this change is considered as insignificant;
- The cumulative noise rating levels will not be higher than the noise levels recommended at all Noise-sensitive developments (NSDs) for all wind speeds;
- Cumulative noise rating levels is projected not to exceed 45 dBA at any receptor; and
- The operations of the three facilities are unlikely to change the ambient sound levels sufficiently to create annoyance with the facility.

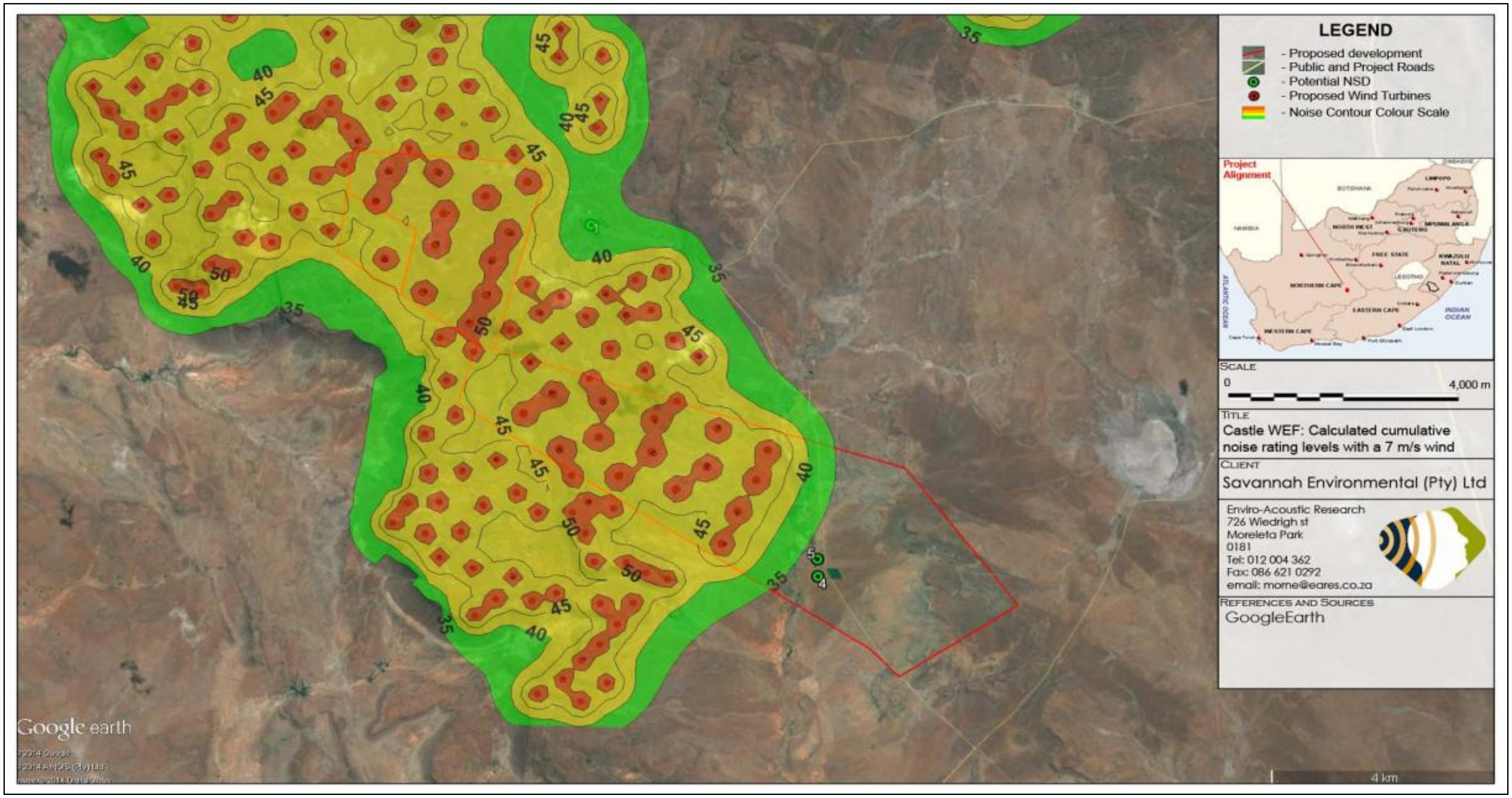


Figure 9.4: Projected Cumulative Night-time Noise Rating Levels; Contours of constant sound levels for a 7 m/s wind (Castle, Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities)

9.2.3. Social impacts

The establishment of the other renewable energy projects in the area also have the potential to result in significant positive cumulative socio-economic impacts for the local municipalities. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. As indicated above, a total of 18 proposed renewable energy projects (excluding the Castle Wind Energy Facility) are located in the vicinity of De Aar. The cumulative positive social and economical impacts will be of **high significance** and the cumulative negative social impacts (visual, sense of place, noise and disturbance during construction) will be of **low significance**.

9.2.4. Ecological impact

Given the abundance of other Renewable Energy applications in the area, with particular reference to the two Round 3 preferred bidder projects (Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities) which are planned to commence construction in 2015, the potential for cumulative impacts is relatively high. This is to some extent moderated by the widespread nature of the Northern Upper Karoo vegetation type which is among the most extensive in the country and the association of Besemkaree Koppies Shrubland with steep slopes which are not suitable for turbine placement, as well as the generally low abundance of species of conservation concern in the area. Furthermore, at a broad level, a concentration of development in the area is not likely to generate significant disruption of most ecological processes as the surrounding landscape is still largely intact and the type of habitats affected are also widely available outside of the affected area. This is specifically applicable to terrestrial ecology. Smaller fauna such as rodents are not likely to be significantly impacted wind energy facilities, while PV facilities will certainly represent some habitat loss for certain species. Medium and larger fauna are likely to be most vulnerable to development as they would be affected by habitat loss, difficulty in passing security fencing as well as noise and disturbance. It can therefore be concluded that the cumulative impact will be of **medium significance**.

9.2.5. Impacts on soil and agricultural potential

The arid climate of the study area coupled with shallow soils limits the agricultural potential to low intensity grazing. Therefore, the cumulative impact of the renewable energy project in the area is expected to be **low** due to the low agricultural potential of the land. Due to the presence of the Ms/Gs soils type (Mispah and Glenrosa forms) which is found in and around the study area has been found to have limited storage capacity and therefore limits the agricultural potential to natural grazing and makes these soils susceptible to erosion.

Therefore, surface water from concrete foundations and access roads must be managed correctly as it might lead to severe erosion. The cumulative impacts on agricultural potential and soil erosion will be of **low significance** (on condition that appropriately mitigation measures are implemented).

9.2.6. Impact on Bats

Development of a number of neighbouring wind farms (the Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities) and including that of the Castle Wind Energy Facility may result in cumulative negative impacts on bats.

Cumulative impacts are direct mortality from collision with turbine blades, and loss or fragmentation of roosting and foraging habitat. These impacts will affect both resident and migratory species. There is a significant potential for a long-term reduction in the size of the population of all impacted bat species. Currently there is very little information concerning population sizes of most South African bat species, making the significance of wind energy impacts on local bat populations very difficult to predict. It is certain that cumulative effects may have greater consequences for long-lived, low-fecundity species such as bats, though this cannot be assessed in a single study, or by considering a single wind farm only.

Wind energy facility development is only one impact affecting bat populations in the region and country, and is likely minor compared to other past, present, and future impacts, including large-scale conversion of native habitats and expansion of urban areas and rural subdivisions. This analysis does not account for the beneficial impacts on habitat associated with a wind energy facility, both from adding value to land and therefore preserving it from subdivision and further habitat fragmentation, or from replacing fossil fuel sources and its associated greenhouse gas emissions. The cumulative impact relating to bat mortality due to direct blade or barotrauma during foraging is considered to be of **high significance pre-mitigation** and **low post-mitigation**.

9.2.7. Cumulative impacts on Birds

The proposed Castle Wind Energy Facility site falls within an Important Bird Area (SA037 Platberg-Karoo Conservancy). This area holds vital populations of two Globally Threatened species, the Lesser Kestrel and the Blue Crane. The Karoo population of Blue Crane is really the only strong population remaining on natural vegetation in southern Africa. Lesser Kestrels are known to roost in both De Aar and Phillipstown, either side of the proposed site. Other important threatened species that the area is important for include Tawny and Martial Eagles, Kori and Ludwig's Bustard, Pallid and Black Harriers, Blue Korhaan, Greater Flamingo, Black Stork, Secretarybird, South African Shelduck and Lanner Falcon (Barnes, 2000; Taylor, 2014). Although most of these threatened species are physically large, a host of small terrestrial species are also found in this area, including: Karoo Long-billed Lark, Karoo Lark, Karoo Chat, Tractrac Chat, Sickle-winged Chat, Layards Titbabbler, Namaqua Warbler, Pale-winged Starling, and Black-headed Canary. Many of these smaller species rely upon riverine woodland (e.g. Karoo Lark), thicket found mostly on slopes, and/or rocky slopes and outcrops (e.g. Karoo Long-billed Lark, Karoo Chat).

There are numerous renewable energy projects currently proposed within this Important Bird Area or conservancy and it is difficult to place in perspective the potential effect of the proposed facilities against the conservation effort of declaring the Platberg Karoo Conservancy and the Important Bird Area. The Important Bird Areas Programme is one of BirdLife International's most important conservation initiatives. It identifies and works to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes/vegetation types. The network of sites is critically important for the survival of naturally occurring populations of threatened species. South Africa currently has 124 IBA's, of which the Platberg Karoo Conservancy is one of the largest.

It could argue at face value that no developments such as the proposed one should be allowed within the Important Bird Area, this is a massive area in which to limit development. On the counter side, there is a danger that if each proposed project is assessed in isolation of the others, its impact on the Important Bird Area (and hence obviously the birds) will appear minimal. However if all of these projects are permitted to proceed, the cumulative impact on birds will be substantial.

The cumulative effects of several facilities on the same species could be considerable, particularly if these are sited in the same region and impact on the same regional population of the species. Also most long-lived slow reproducing Red List species may not be able to sustain any additional mortality factors over and above existing factors. The overall cumulative effects of wind energy facilities on birds in the De Aar area is likely to be of **medium significance prior to mitigation**. It is unlikely that this impact can be mitigated to below medium significance.

9.2.8. Heritage and Impacts

Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. Very sparse heritage traces were found on the site and from an archaeological perspective the observed heritage resources may be regarded as being of generally **low** significance. It still remains important for each facility to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible.

9.2.9. Paleontological Impacts

It is probable that there will a negative impact on the palaeontological heritage of the Adelaide Subgroup. As the Adelaide Subgroup underlies the majority of the project area and is likely to be affected by the construction of project's infrastructure with the overall probability of a negative impact is assessed as being probable. Should any undiscovered fossil materials be impacted upon they may well be of high scientific and cultural significance. An assessment of the significance of any negative impacts made against standardised criteria has indicated that the potential negative impacts resulting from the project are calculated at value of 51 (moderate), but should appropriate mitigation procedures be enacted this value declines to 18 (Low).The project is assessed as having a being positive status and the risks posed by the project are not sufficient to outweigh the positive social value it would provide. Therefore, there are either immediate, or mostly irreversible impacts or there are no impacts at all. The overall significance of the impact can be considered as medium based on the archaeological features located on site, however it is concluded that there are **no cumulative impacts.**

9.2.10. Impact on Freshwater Resources

A number of power projects have been proposed in the area surrounding De Aar, particularly towards the east and south east where they can link up with the existing Hydra substation and transmission lines. Within the immediate surrounding area of the proposed Castle Wind Energy Facility, the other proposed projects are also for wind energy facilities. The nature of these projects allows them to have minimal impact on the surface water features as the turbines can be placed in safe distance from the freshwater features so as to not impact on them. The largest potential impact of these projects is as a result of the associated infrastructure which can be mitigated such that its impact on the aquatic ecosystems is of a **low significance**.

9.3 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Castle Wind Energy Facility falls within the De Aar area which has been earmarked for the development of renewable energy projects (i.e. considered as a Renewable Energy Hub) within the Northern Cape Province. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 50km radius will be built in the short to medium term (i.e. in the next five years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential cumulative impacts of the proposed Castle Wind Energy Facility. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Castle Wind Energy Facility have been summarised below:

Table 9.1: Summary of cumulative impacts associated with the Castle project

Cumulative impacts	**Significance rating - Pre Mitigigation**	**Significance rating - Post Mitigigation**
Visual impact	High	High
Noise impact	Low	Low
Social impact- positive impact (social and economical value)	High	High
Social Impact- negative impacts (visual, sense of place, noise and disturbance diring construction)	Low	Low
Ecological Impact	Medium	Medium
Impact on soil and agricultural potential	Low	Low
Impact on Bats	High	Low
Impact on Birds	Medium	Medium
Heritage impact	Low	Low
Palaeontological impact	No cumulative impacts anticipated	No cumulative impacts anticipated
Impact on freshwater resources	Low	Low

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 10

Castle Wind Farm (Pty) Ltd is proposing the establishment of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project is referred to as the Castle Wind Energy Facility. This development is proposed to comprise a cluster of up to 31 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed within an area of approximately ~3257ha in extent.

The wind energy facility is proposed to be located on the following farm portions:

- Portion 12 of Farm 165 (Vendussie Kuil);
- Portion 13 of Farm 165 (Vendussie Kuil); and
- The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

Infrastructure associated with the wind energy facility is proposed to include:

- **31 wind turbines** with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 132m. The generating capacity of the facility will depend on the final turbine selected for implementation by Castle Wind Farm (Pty) Limited;
- Turbine foundation/footprint;
- Temporary Batching plant
- 31 Crane hardstand areas
- **Cabling** between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation;
- Temporary Laydown areas;
- **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m)
- **Internal access roads** (approximately 7m wide) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. Due to the dispersed distribution pattern of the wind turbines however, this will necessitate the construction of new access roads in some areas.
- Workshop area / office for control, maintenance and storage.

The environmental impact assessment (EIA) for the proposed Castle Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 33306, in terms of Section 24(5) of the National

Environmental Management Act (NEMA; Act No 107 of 1998) and the EIA Regulations of June 2010.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed development forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

10.1 Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies and addendums to these studies as contained within **Appendices F-O,** provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA Report by providing a summary of the conclusions of the assessment of the Castle wind energy facility and associated infrastructure on the site near De Aar. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

A 28 turbine layout was developed to ensure maximum wind farm efficiency during the Final Scoping Phase, with the use of an initial road layout and the use of the sensitivities which had been identified during this phase. Subsequent to submitting the layout however, the landowner requested a larger buffer around his homestead, new sensitivities were identified and further discussion with the Project's civil engineering consultants necessitated an amendment to the layout. The final layout was amended to 31 turbines after it was concluded that the construction challenges will be significantly less than previously expected, primarily due to the improved road design, and that the previous turbine spacing had been unnecessarily large.

The section which follows provides a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

10.1.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of 31 turbines and associated infrastructure, Table 9.1 indicates the significance ratings for the potential environmental and social impacts associated with the project.

As indicated in Chapter 6, the significance weightings for potential impact have been rated as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

Table 10.1: Summary of potential impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Impacts on Ecology		
Impacts on vegetation and protected plant species	Medium (52)	Low (27)
Faunal impacts due to construction activities	Medium (48)	Low (30)
Faunal impacts due to operational activities	Medium (36)	Low (24)
Faunal impacts due to decommissioning activities	Low (24)	Low (15)
Increased alien plant invasion risk	Medium (40)	Low (21)
Increased erosion risk due to presence and operation of the facility.	Medium (44)	Low (14)
Impacts on Avifauna		
Destruction of natural bird habitat on and near site – impact on sensitive and threatened species and habitat specialists	Medium (50)	Medium (50)
Impact on birds due to disturbance of habitat	Medium (32)	Medium (32)
Displacement of birds from the site and barrier effects	Medium (30)	Medium (30)
Collision of birds with turbine blades	Low (27)	Low (18)
Impacts on Bats		

Nature	Without mitigation	With mitigation
Disturbance and/or destruction of bat roosts due to construction activities	Medium (52)	Medium (20)
Strong artificial lights used at the work environment during night time	Low (16)	Low (12)
Foraging habitat loss	Low (30)	Low (24)
Bat mortalities due to direct blade impact or barotrauma during foraging activities	High (68)	Low (22)
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with agricultural potential and land capability and impact on land-use	Medium (32)	N/A
Soil contamination / soil erosion during the construction of the facility	Medium (32)	N/A
Increased vehicle activity and associated dust generation	Low (12)	Low (12)
Social Impacts		
Creation of Employment and Business Opportunities during the construction and operation phase **(Positive Impact)**	Medium (32)	Medium (36)
Potential impacts on family structures and social networks associated with the presence of construction workers	Low (27)	Low (24)
Potential impact on local farmers associated with loss of farm labour to the construction and operation phase	Low (27)	Low (24)
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	Medium (33)	Low (24)
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires	Medium (36)	Low (24)
Potential noise, dust and safety impacts associated with construction related activities and the movement of construction related traffic to and from the site	Low (27)	Low (24)
Damage to and loss of farmland during construction	Medium (36)	Low (28)
Benefits associated with the establishment of a community trust **(Positive Impact)**	Medium (36)	High + (65)
Operational Phase -Creation of Long-	Low (21)	Medium (24)

Nature	Without mitigation	With mitigation
Term employment and business opportunities (Positive Impact)		
Impact of the wind energy facility on tourism in the region	Low (24)	Low (27)
Visual Impacts		
Visual impact on sensitive visual receptors within the region	Low (26)	N/A
Change in visual character and sense of place	Low (22)	N/A
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	High (64)	N/A
Visual impact of onsite ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility	Low (28)	Low (12)
Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility	Low (8)	N/A
Visual impact of the proposed facility on the visual quality of the landscape and sense of place of the region	Low (22)	N/A
Noise Impacts		
Noise impacts due to construction activities	Low (14)	N/A
Noise impacts from the wind turbines – operational phase	Low (16)	N/A
Impacts on Heritage Artefacts		
Disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position stone age material, historical material or objects.	Medium (30)	Low (24)
Destruction, damage and loss of provenance of fossil materials	Medium (51)	Low (18)

Based on the specialist findings, no environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix Q**.

10.1.2 Comparison of Access Road Alternatives

The primary access road to the site would be off the R389 to Philipstown and Hanover. Two reasonable and feasible alternatives have been considered:

» **Access Road Alternative 1 (referred to as the Northern Access Road):** The site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 19.5km from the R389 to the proposed site and several homesteads are situated along this access roads.
» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 18.5km from the R389 to the proposed site.

Based on the assessment of the access roads in Chapter 8, there are no impacts of unacceptably high significance associated with either access road alternative assessed for the proposed project. In addition, there is little or no difference between the impacts associated with the two access road alternatives as both routes are existing gravel routes, an there is no significant difference in the potential impacts associated with the two access road alternatives. Therefore, there is **no preference** between the access alternatives. However from a social perspective, **Alternative 2** is considered the preferred alternative as there are no homesteads situated along the access road.

10.1.3 Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind energy facility relate to the direct loss of vegetation and species of concern, disturbance of animals and loss of habitat and impacts on soils. A wind energy facility is, however, dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 32.6km^2 was considered for the facility, of which ~1.3% will be utilised for the development footprint of the proposed wind energy facility, and will be permanently transformed. The bulk of the development site would not suffer any level of disturbance as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

Permanently affected areas comprise 31 turbine footprints (31 foundation areas & 31 crane hardstand areas), access roads (up to 7m in width), one 132 kV substation footprint and an operations and service building area. It should be noted that the site currently has several access roads which are used for farming activities. It is planned that where existing access roads are able to be utilised within the development footprint, these are utilised, widened and upgraded where possible. The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m²)**
31 turbine footprints (each 20m x 20m) and crane hardstand areas (each 70 x 30)	77500
Permanent access roads underlain with cabling where possible (7 m wide and 42.145 km long)	295015
One on-substation footprint (100m x 100m)	40000
Operations and service building area (30m x 30m)	900
TOTAL	422515m² (of a total area of 32570000m²) **i.e. 3.07% of site**

Approximately 3.07% of the entire extent of the site can be anticipated to be permanently disturbed during the construction/operation by the development footprint Castle Wind Energy Facility.

Temporarily affected areas comprise laydown areas for turbines (i.e. each with a minimum footprint of 52 m² per turbine). The underground cabling to connect the turbines to the on-site substations will make use of the permanent access roads to be constructed on site. A trench of approximately 1 m deep will be excavated in which the cabling will be laid; thereafter the area will be rehabilitated.

Facility component - temporary	**Approximate area/extent (in m²)**
Laydown areas for turbines (i.e. each 2100 m²)	65100
Internal access roads during construction	295015
Batching plant	2500
TOTAL	**362 615 m²** (of a total area of 32570000m²) = **~1.1 % of site**

Temporarily affected areas of the proposed wind energy facility will amount to ~0.9 % of the total ha of the broader site.

10.2 Cumulative Impacts

Cumulative impacts of a development project consider impacts resulting from incremental actions from the development, in addition to other past, present or future impacts resulting from other developments/actions/projects. This assumes the knowledge of other developments or actions whose effects could be cumulative to the ones resulting from the project being assessed. As it is not reasonably viable to consider all the varying existing or proposed developments for a certain area, the consideration of cumulative impact will focus on impacts arising from developments which are similar in nature.

The main known activities or projects, relevant for the cumulative impacts analysis, known in the broader area of the Castle Wind Energy Facility are the disturbance to or altering of the environment, as well as impacts arising from other proposed wind energy facilities. Based on the information available at the time of undertaking the EIA, two other wind energy facilities have been authorised and are planned on adjacent farm portions to the Castle Wind Energy Facility site (shown in Figure 10.2). These two facilities include:

» The Longyuan Mulilo De Aar 2 North Wind Energy Facility- is a Round 3 preferred bidder of the REIPPP Programme.
» The Longyuan Mulilo De Aar 2 South Wind Energy Facility- is a Round 3 preferred bidder of the REIPPP Programme.

Cumulative impacts are summarised below and have been considered within the detailed specialist studies, where applicable (refer to **Appendices F – O** and Chapter 9):

The potential cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» *Visual impact* - A large portion of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall between farms earmarked for the development of the two De Aar North and South Wind Energy Facilities (Longyuan Mulilo) which are scheduled to be constructed in 2015. The development of the Castle Wind Energy Facility will not significantly contribute to the increase in the area of exposure (i.e. the visual exposure is generally expected to be consolidated within an area of existing visual impact), and as such will not contribute to the proliferation of wind turbine structures within the surrounding wind energy facilities within the region. It is therefore expected that the cumulative impact will be **high**.
» *Social impacts* - The establishment of the other renewable energy projects in the area also have the potential to result in significant positive

cumulative socio-economic impacts (creation of employment, skills development and training opportunities creation of downstream business opportunities and stimulation of the local property market) for the local municipalities. The cumulative positive social and economical impacts will be of **high positive significance** and the negative social impacts (visual, sense of place, noise and disturbance during construction) will be of **low negative significance**.

» *Ecological impacts* - Given the abundance of other Renewable Energy applications in the area, with particular reference to the two Round 3 preferred bidder projects (Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities) which are planned to commence construction in 2015, the potential for cumulative impacts is relatively high. At a broad level, a concentration of development in the area is not likely to generate significant disruption of most ecological processes as the surrounding landscape is still largely intact and the type of habitats affected are also widely available outside of the affected area. This is specifically applicable to terrestrial ecology and may not apply to volant mammals and birds. It can therefore be concluded that the cumulative impact will be of **medium significance**.
» *Impact on Freshwater Resources* - The nature of the two wind energy projects to be constructed will result in minimal cumulative impacts on the surface water features as the turbines can be placed in safe distance from the freshwater features so as to not impact on them. The largest potential impact of these projects is as a result of the associated infrastructure which can be mitigated such that its impact on the aquatic ecosystems is of a **low significance**.
» *Impact on birds* - The proposed Castle Wind Energy Facility site falls within an Important Bird Area (SA037 Platberg-Karoo Conservancy). This area holds vital populations of two Globally Threatened species, the Lesser Kestrel and the Blue Crane. There are numerous renewable energy projects currently proposed within this Important Bird Area or conservancy and it is difficult to place in perspective the potential effect of the proposed facilities against the conservation effort of declaring the Platberg Karoo Conservancy and the Important Bird Area. There is however a danger that if each proposed project is assessed in isolation of the others, its impact on the Important Bird Area (and hence obviously the birds) will appear minimal. However, if all of these projects are permitted to proceed, the cumulative impact on birds will be substantial. The overall cumulative effects of wind energy facilities on birds in the De Aar area is likely to be of **medium significance prior to mitigation**. It is unlikely that this impact can be mitigated to below medium significance.
» *Impact on Bats* - Cumulative impacts are direct mortality from collision with turbine blades, and loss or fragmentation of roosting and foraging habitat. These impacts will affect both resident and migratory species.

There is a significant potential for a long-term reduction in the size of the population of all impacted bat species. It is certain that cumulative effects may have greater consequences for long-lived, low-fecundity species such as bats, though this cannot be assessed in a single study, or by considering a single wind farm only. The cumulative impact relating to bat mortality due to direct blade or barotrauma during foraging is considered to be of **high significance pre-mitigation** and **low post-mitigation**.

» *Soils and agricultural potential* impacts - The arid climate of the study area coupled with shallow soils limits the agricultural potential to low intensity grazing. Therefore, the cumulative impact of the renewable energy project in the area is expected to be **low** due to the low agricultural potential of the land. Due to the presence of the Ms/Gs soils type which is found in and around the study area has been found to have limited storage capacity and therefore limits the agricultural potential to natural grazing and makes these soils susceptible to erosion. The cumulative impacts on agricultural potential and soil erosion will be of **low significance** (on condition that appropriately mitigation measures are implemented).
» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Noise modelling of the Castle Wind Energy Facility revealed that the projected cumulative noise levels due to the operation of the Castle and the Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities due to the wind turbines is not significant when considering the ambient sound levels as measured on-site.), The cumulative impacts are therefore considered to be of **low significance**
» *Heritage impacts:* Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. Very sparse heritage traces were found on the site and from an archaeological perspective the observed heritage resources may be regarded as being of generally **low** significance.
» *Palaeontological impacts* – It is probable that there will a negative impact on the palaeontological heritage of the Adelaide Subgroup. As the Adelaide Subgroup underlies the majority of the project area and is likely to be affected by the construction of project's infrastructure with the overall probability of a negative impact is assessed as being probable. Should any undiscovered fossil materials be impacted upon they may well be of high scientific and cultural significance. An assessment of the significance of any negative impacts made against standardised criteria has indicated that the potential negative impacts resulting from the project are calculated at value of 51 (moderate), but should appropriate mitigation procedures be enacted this value declines to 18 (Low).The project is assessed as having a being positive status and the risks posed by the project are not sufficient

to outweigh the positive social value it would provide provided that the mitigation protocols are emplaced.

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Castle Wind Energy Facility falls within the De Aar area which has been earmarked for the development of renewable energy projects (i.e. considered as a Renewable Energy Hub) within the Northern Cape Province. It should also be noted that the Castle Wind Energy Facility will be located between the Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility preferred bidder projects (the construction of the Castle Wind Energy Facility would be considered as infill) which are scheduled to be constructed in 2015. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 50km radius will be built in the short to medium term (i.e. in the next five years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential cumulative impacts of the proposed Castle Wind Energy Facility. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Castle Wind Energy Facility have been summarised below:

Table 10.2: Significance of potential cumulative impacts identified

Cumulative impacts	Significance rating - Pre Mitigigation	Significance rating - Post Mitigigation
Visual impact	High	High
Noise impact	Low	Low
Social impact- positive impact (social and economical value)	High	High

Social Impact- negative impacts (visual, sense of place, noise and disturbance diring construction)	Low	Low
Ecological Impact	Medium	Medium
Impact on soil and agricultural potential	Low	Low
Impact on Bats	High	Low
Impact on Birds	Medium	Medium
Heritage impact	Low	Low
Palaeontological impact	No cumulative impacts anticipated	No cumulative impacts anticipated
Impact on freshwater resources	Low	Low

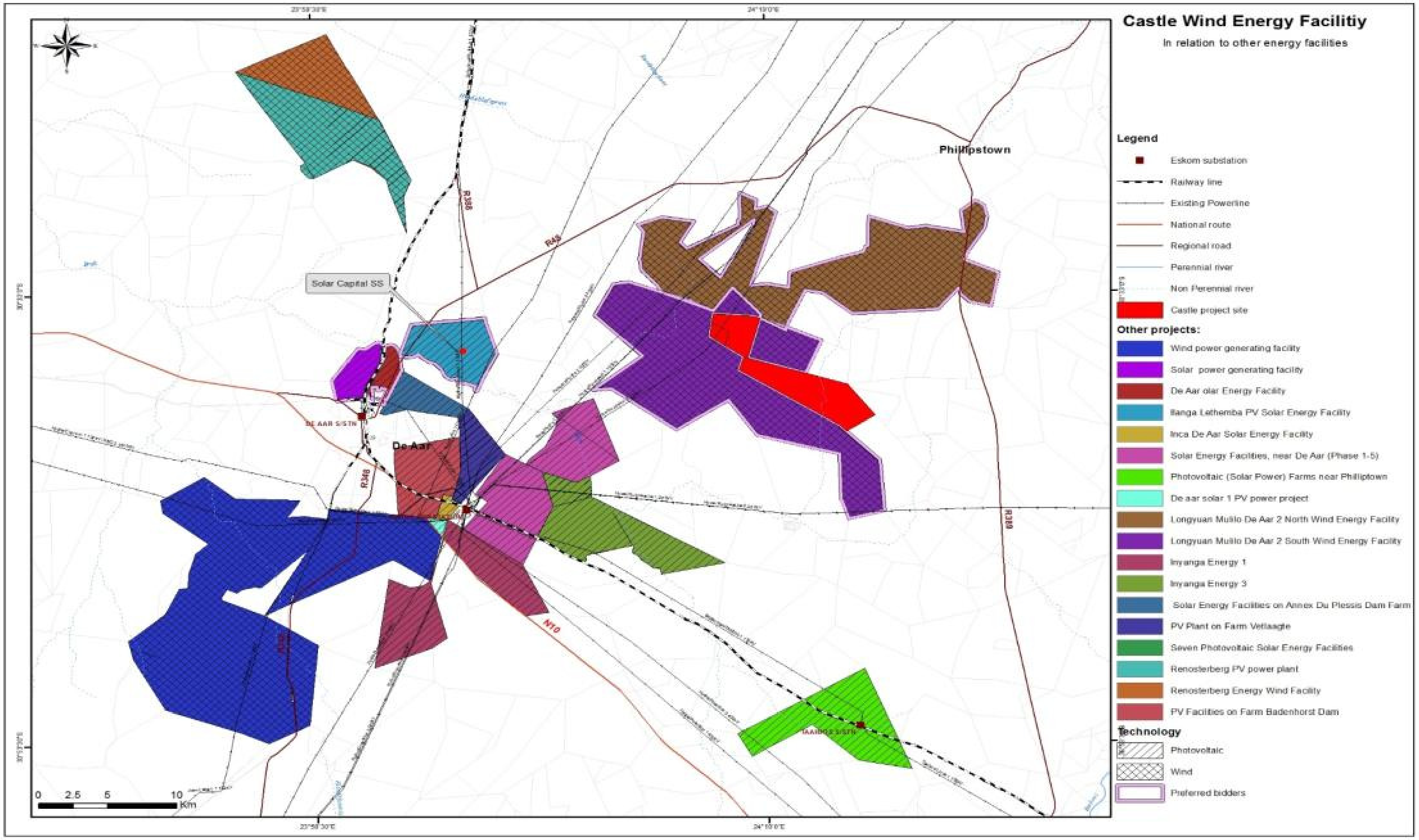


Figure 10.1: Map showing other renewable energy projects in the study area (refer to **Appendix P** for an A3 map)

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Figure 10.2: Layout indicating the location of the Castle Wind Energy Facility in relation to two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities (Preferred bidder round 3) (refer to **Appendix P** for an A3 map)

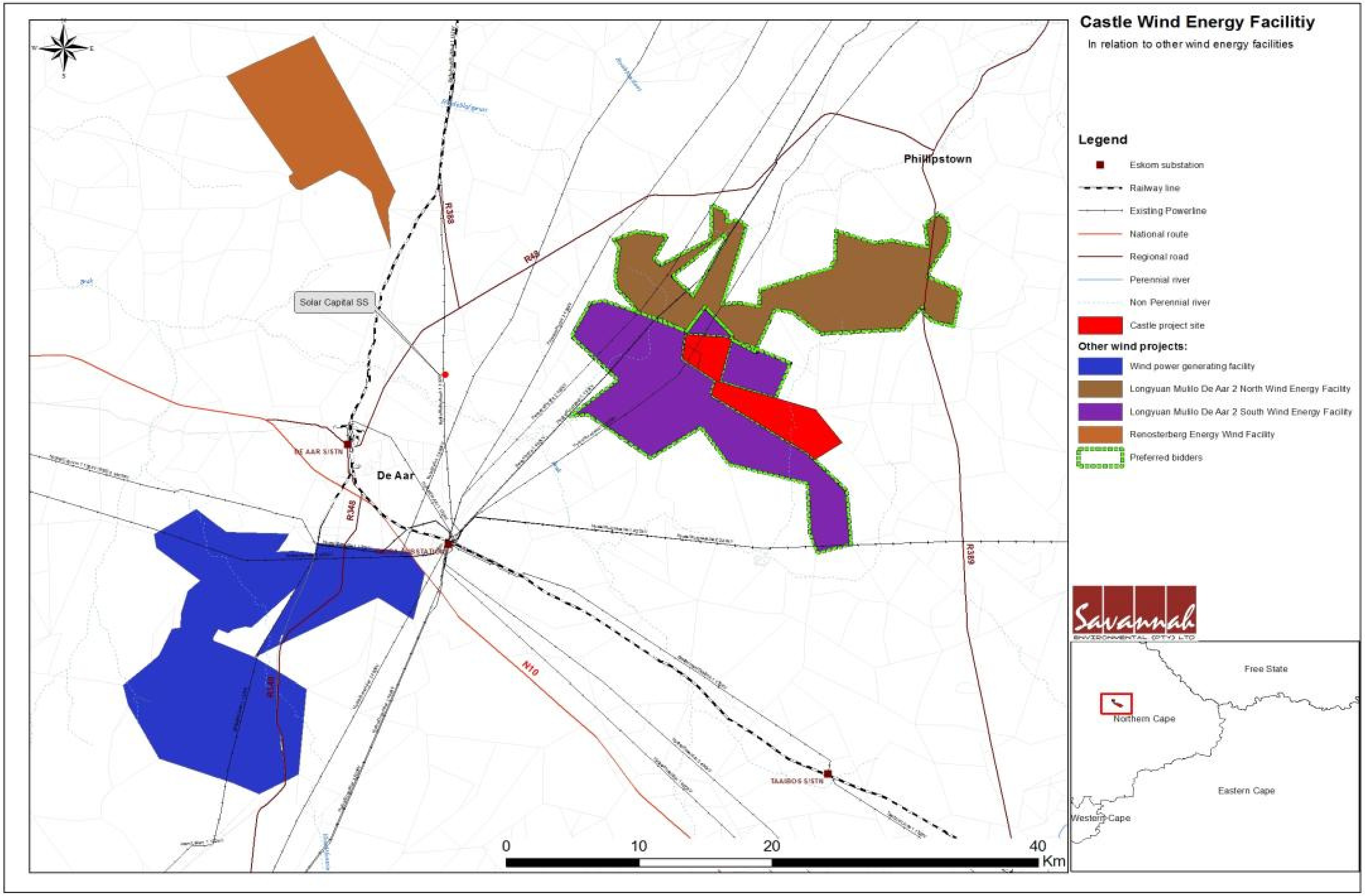

Figure 10.3: Map showing other wind energy projects in the study area (refer to **Appendix P** for an A3 map)

10.3 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Castle Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to Figure 10.3 and A3 map in Appendix P). The following sensitive areas/environmental features have been identified on the site and are able to be mapped:

» **Ecology*:*** The major sensitive feature of the site are the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass which contrasts with the surrounding landscape. The steeper, south-facing slopes are also considered ecologically sensitive on account of their woody biomass and more mesic environment. The less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. The remaining flats and gentle slopes are of lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type (which is a least threatened vegetation type). The majority of the turbines are located within these lower sensitivity areas. There are 4 turbines located within the moderately sensitive rocky areas, and no turbines are located on very steep slopes or within drainage lines (i.e. within highly sensitive areas).

» **Freshwater ecosystems:** The Brak River and its larger tributaries within the study area are considered to be of a moderate to low ecological importance and Sensitivity. The ecological importance and sensitivity of the ephemeral tributaries are considered to be negligible. The ecological importance and sensitivity of the pans is very similar to that of the ephemeral streams, which is, marginal or negligible while the valley bottom wetlands are directly related to the Brak River and its larger tributaries, that is, moderate to low. There are no turbines located within the a 100m of any delineated drainage line/ streams or wetlands/pans. It is recommended that the turbine be shifted further southwards. Initially turbines 27 and 28 were located approximately 30m and 70m away from small drainage lines respecitvely, however as a mitigatory strategy, the turbines have been relocated further away from these drainage lines as recommended.

» ***Bats sensitive areas:*** Potential roosting sites are present along several drainage lines and rocky elevations found throughout the proposed study site. These areas often have favourable weather conditions which cause increases in insect abundance and thus possible increases in bat activity. No turbines are located within any of the bat high sensitivity areas and their respective buffers, which are considered to be critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site. These areas are 'no-go' areas and turbines should not be located in these areas.

» ***Bird Habitat and Sensitive Areas:*** The species recorded flying most frequently on site were the Northern Black Korhaan, and Southern Pale Chanting Goshawk. The Lesser Kestrel and Amur Falcon were recorded infrequently on site, which may be as a result of low food occurrence during the monitoring programme (and these flocking species may occur in high numbers on site at some point during the lifespan of this project when food is more abundant). Due to the overall low flight activity recorded on site, the collision risk index that was developed highlighted very little in the way of spatial patterns in flight activity. No turbine re-positioning is recommended as a result of the collision risk index. Most flight activity recorded was in the flatter lower lying areas to the east, which are not targeted for turbine placement. Based on a formal risk assessment, two species emerge as being of 'medium' risk of impact by the proposed wind farm, the Northern Black Korhaan and the Southern Pale Chanting Goshawk. The significance of impacts on avifauna as a result of habitat destruction, disturbance of birds, and displacement of birds is rated as medium significance. Collision of birds with turbines is rated as low significance. Site sensitivity mapping has identified buffers around dams, within which no turbines should ideally be built. The Avifaunal Assessment Report identified three turbines: T3; T4; and T13 which were slightly located within the bird sensitive buffer areas. As a mitigatory strategy the turbines have subsequently been relocated outside the sensitivity buffer areas previously identified.

» ***Heritage artefacts:*** Nine sites were recorded consisting of six Stone Age sites (Site 1, 3, 4, 6, 7, 9) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 5) as well as historical/recent exploration or quarrying (Site 8). A further total of 3 find spots were recorded. Assemblages at the locations are mixed, mainly consisting of Middle (MSA) and Late Stone Age (LSA) artefacts with some Early Stone Age (ESA) artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure. No graves were observed in the study area. Artefacts consist mostly of blades, triangular flakes (some with dorsal flaking) and cores (identified as site 9) and site also consists of a large boulder with the engravings of two elephants on it (site 6) were found located in close proximity to turbine 2, however the area can be demarcated to avoid impacts.

» ***Noise Sensitive Receptors (NSEs):*** Noise sensitive receptors do occur in and around the site. The significance of the noise impact is considered to be of a low significance for all Noise Sensitive Developments.

» ***Visual receptors:*** The wind turbines would likely be exposed to a number of farm residences and sections of secondary roads traversing near or over the development site. Affected farmsteads, excluding the ones located within the development site, may include: Kranskop, Klipfontein, Vendusiekraal, Disselskuil and Slingershoek. It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact. It must however be noted that a large section of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall within farms earmarked for construction of the Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility in 2015.

Turbine positioning should take cognisance of sensitive areas (as indicated on Figure 10.4). Should mitigation measures in the EMPr be adhered to, impacts on the identified sensitive areas can be adequately managed.

Planning of infrastructure location on the site needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure is planned to be used as far as possible for providing access to proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats and that the risk of erosion or down-slope impacts are not increased. Road infrastructure and underground cable alignments should coincide as much as possible.

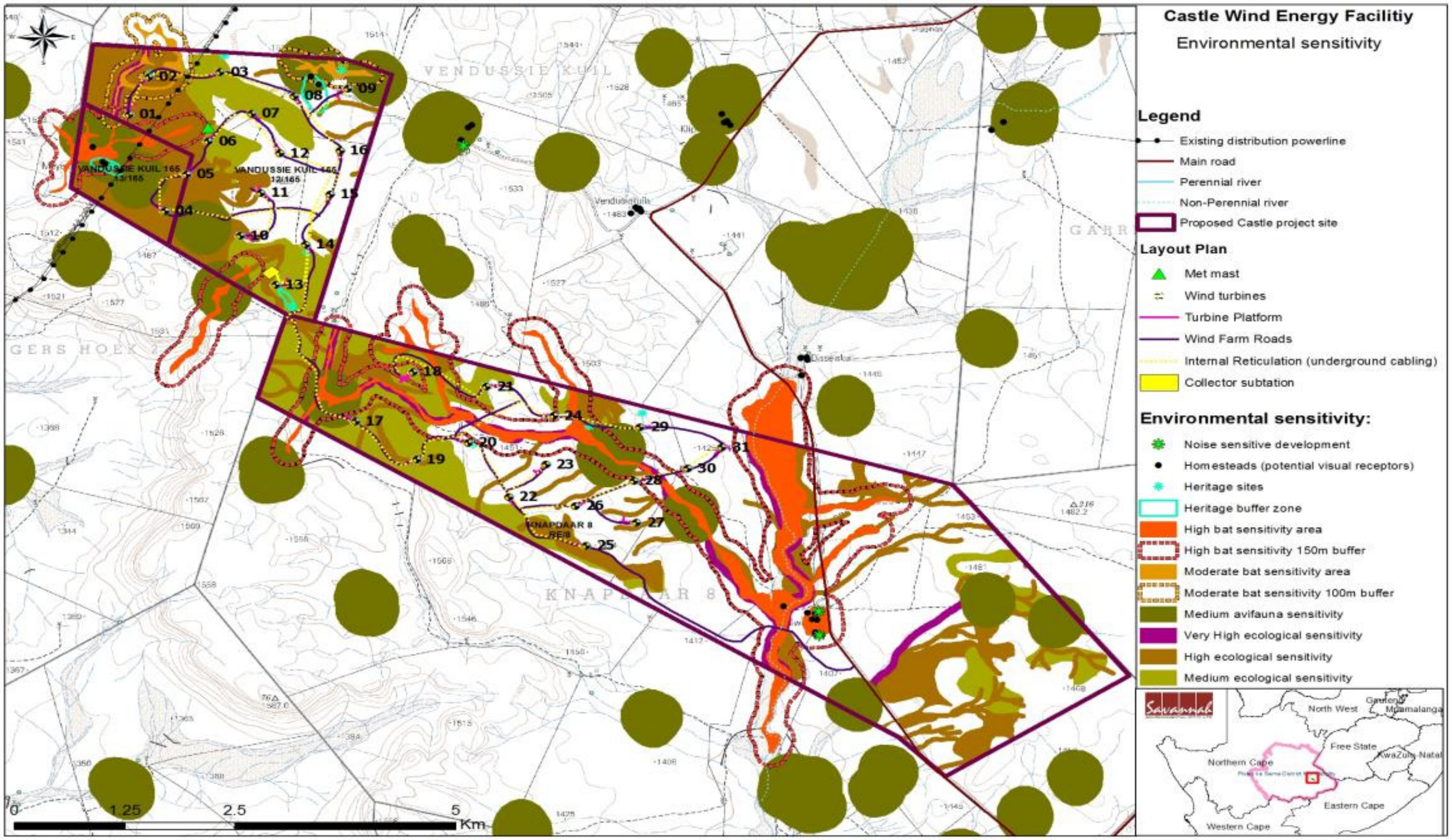

Figure 10.4: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed development footprint for the Castle Wind Energy Facility (**Appendix P** contains an A3 map)

10.4 Overall Conclusion (Impact Statement)

The principles of NEMA have been considered in this assessment through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation at a national scale.

The EIA process has been undertaken in accordance with the requirements of the EIA Regulations and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority. The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the biophysical environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of sustainable environmental management.

Through pre-feasibility assessments and research, the viability of establishing the Castle Wind Energy Facility in the Northern Cape has been established by Castle Wind Farm (Pty) Ltd. The positive implications of establishing the Castle Wind Energy Facility on the demarcated site include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise excellent wind energy resources on this site would be realised.
» The National electricity grid in the Northern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are no environmental fatal flaws that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation, monitoring and management measures are implemented.

» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» The Castle Wind Energy Facility site is located between the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities, which have been awarded preferred bidder status in Round 3 of the DoE REIPPP Programme. Due to the close proximity of the two facilities to the proposed wind energy facility and other numerous wind and solar facilities within the area, this area could be considered as a renewable energy development zone, and consolidates impacts in a single node with a proven wind resource. The development of facilities in viable nodes presents some benefits to the environment through minimisation of the extent of impacts.

The significance levels of the majority of identified negative impacts can generally be reduced to acceptable levels by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the confidence in the environmental assessment undertaken is regarded as acceptable.

The identified 'no go' areas for the construction of infrastructure (including turbines) to be observed during construction and operation include:

» High sensitivity areas and their respective buffers are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site.
» Buffer around dams, streams, rivers and wetland, within which no turbines should be constructed. There are no turbines located within the a 100m of any delineated drainage line/ streams or wetlands/pans, Artefacts consist mostly of blades, triangular flakes (some with dorsal flaking) and cores (identified as site 9) and site also consists of a large boulder with the engravings of two elephants on it (site 6) were found located in close proximity to turbine 2, however the area can be demarcated to avoid impacts.

10.5 Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Castle Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level, provided appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

The following infrastructure would be included within an authorisation issued for the project:

» **31 wind turbines** with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 132m. The generating capacity of the facility will depend on the final turbine selected for implementation by Castel Wind Farm (Pty) Limited;
» **31 crane hardstand areas** for turbines
» Turbine foundation/footprint;
» **Cabling** between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation;
» Temporary Laydown areas ;
» **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m)
» **Temporary Batching plant**
» **Internal access roads** (approximately 7m wide) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
» Workshop area / office for control, maintenance and storage.

The following conditions would be required to be included within an environmental authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within **Appendices F - O** must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The

implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained to carry out a restricted activity involving a specimen of a listed threatened or protected species.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» The final location of the wind turbines and associated infrastructure within identified sensitive areas must be informed by walk-through surveys to be undertaken by ecological, heritage and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
» Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bats.
» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
» Adequate stormwater management measures to be put in place as the soils on the site are prone to erosion.
» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
» Construction managers should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
» Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

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ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
ENVIRONMENTAL IMPACT ASSESSMENT REPORT
PROPOSED CASTLE WIND ENERGY FACILITY NEAR DE AAR, NORTHERN CAPE PROVINCE
DEA REFERENCE NUMBER:
14/12/16/3/3/2/278

FINAL EIA REPORT
FOR SUBMISSION TO DEA
FEBRUARY 2015

Prepared for:
Castle Wind Farm (Pty) Ltd
(a juwi Renewable Energies (Pty) Ltd initiative)
7 Walter Sisulu Avenue
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Prepared by:

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/278
Title	:	Environmental Impact Assessment Process Draft Environmental Assessment Report: Proposed Castle Wind Energy Facility Near De Aar, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Karen Jodas Tebogo Mapinga John von Mayer
Sub-consultants	:	Simon Todd Consulting WildSkies Ecological Services Animalia MetroGIS (Pty) Ltd Tony Barbour Consulting and Research Heritage Contracts and Archaeological Consulting CC HydroPedological Solutions Blue Science Enviro Acoustics Research Barry Millsteed
Project Developer	:	Castle Wind Farm (Pty) Ltd (A juwi Renewable Energies (Pty) Ltd initiative)
Report Status	:	<u>Final Environmental Impact Assessment Report to DEA for review</u>
Submission Date	:	<u>February 2015</u>

When used as a reference this report should be cited as: Savannah Environmental (2015) Final Environmental Impact Assessment Report: Proposed Castle Wind Energy Facility near De Aar, Northern Cape Province

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Castle Wind Farm (Pty) Limited commissioned an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind farm on a site near De Aar in the Northern Cape Province. The project will be referred to as the "Castle Wind Energy Facility". The purpose of the proposed wind energy facility is to sell the electricity generated to Eskom under the Renewable Energy Independent Power Producers (IPP) Procurement Programme. The IPP Procurement Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities (derived from) by IPPs in South Africa. Castle Wind Farm has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of the Final EIA Report prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project, provided stakeholders with an additional opportunity (21 days) to verify that the issues they had raised to date have been captured and adequately considered within the study. This Final EIA Report has incorporated all issues and responses received throughout the EIA process. Any changes made from the Draft EIA Report to this Final EIA Report **have been underlined throughout** this Final EIA Report for ease of reference.

EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

As outlined in the Acceptance of the scoping report dated 30 January 2014, Savannah Environmental has compiled a table (refer to Table 1 below) which outlines the requirements as well as where in the final EIR the requirements have been addressed for ease of reference.

TABLE 1: INFORMATION REQUESTED BY DEA

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
a)	i. All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the Draft Scoping Report and submitted as part of the FSR must be taken into consideration when preparing an environmental impact assessment report in respect of the proposed development. ii. Please ensure that all mitigation measures and recommendations in the specialist studies are addressed and included in the final EIAr and Environmental Management Programme (EMPr).	i. Refer to Chapter 6 ii. Refer Chapter 8,9,10 and Appendix Q (EMPr)
b)	i. Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final EIAr. This includes but not limited to the Northern Cape Department of Environmental Affairs and Nature Conservation, the Department of Agriculture, Forestry & Fisheries (DAFF), the South African Civil Aviation Authority (SACAA), the Department of Transport, the Local Municipality, the District Municipality, the Department of Water and Sanitation (DWS), the Department of Communications, SENTECH, Eskom Holdings SOC Limited, the South African National Roads Agency Limited (SANRAL), the South African Heritage Agency (SAHRA) and the Square Kilometre Array (SKA). ii. You are also required to address all issues raised by organs of state and Interested and Affected Parties (I&APs) prior to the submission of the EIAr to the Department. iii. Proof of correspondence with the various stakeholders must be included in the FEIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. iv. The EAP must, in order to give effect to Regulation 56(2), give registered interested and affected parties access to, and an opportunity to comment on the report in writing within 21 days before submitting the final environmental impact assessment report to the Department.	i. Refer to Appendix C & E (Organs of State Correspondence) and Appendix E Comments Received) ii. Refer to Chapter 8 (assessment of impacts) and Appendix E - Comments & Response Report iii. Refer to Appendix E (stakeholder correspondence) and E (organs of state correspondence) iv. N/A
c)	Please ensure that the Final EIAr includes at least one legible A3 regional map of the area and the site layout map to illustrate the turbine positions and associated infrastructure. The maps must be of acceptable quality and as a minimum, have the following attributes:	Refer to Appendix P

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	» Maps are relatable to one another; » Cardinal points; » Co-ordinates; » Legible legends; » Indicate alternatives; » Latest land Cover; » Vegetation types of the study area; and » A3 size locality map.	
d)	Proof of newspaper clippings for public participation must be eligible and clearly show the name of the newspaper where the advert was placed and the date that the advert was placed.	Refer to Appendix E
	The EIAr must also include a comments and responses report in accordance with Regulation 28(m) of the Regulations, 2010	Refer to Appendix E
	The EIAr must include the detail inclusive of the PPP in accordance with Regulation 54 of the EIA Regulation.	Refer to Chapter 6 and Appendix E
d)	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Refer to Chapter 2.
	The EIAr must provide an assessment on the glint and glare and provide mitigation measure to reduce the impacts.	Refer to Chapter 8 and Appendix H
	An Avifaunal Assessment must be conducted to determine the impacts that the proposed activity may have on avifauna. Mitigation measures must be proposed and included in the EIAr and EMPr.	Refer to Chapter 7 and Appendix L
f)	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided.	Refer Chapter 2. Agreement with the local municipalities have not been confirmed.
	The EIAr must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites.	Refer to Chapter 2 Section 2.2.
g)	A copy of the final site layout map. All biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads	Refer to Appendix P
h)	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Appendix P
i)	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix P
j)	A shapefile of the preferred development layout footprint must be submitted to this Department.	N/A
k)	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following: i. All recommendations and mitigation measures recorded in	i. Refer to Appendix Q (EMPr) ii. Refer to Appendix Q

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	the EIAr and the specialist studies conducted. ii. The final site layout map. iii. Measures as dictated by the final site layout map and micro-siting, iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken. vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase. viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats. ix. An open space management plan to be implemented during the construction and operation of the facility x. A traffic management plan for the site access roads to ensure that no hazards would results from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment xii. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off xiii. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan	(EMPr) iii. Refer to Appendix Q (EMPr) iv. Refer to Appendix Q (EMPr) v. Refer to Appendix Q (EMPr) vi. Refer to Appendix P of the EMPr vii. Refer to Appendix E of (EMPr) viii. Refer to Appendix Q (EMPr) Section 5.3 Objective 8 ix. Refer to Appendix Q (EMPr) x. Refer to Appendix F of the EMPr xi. See point above xii. Development and implementation of an appropriate stormwater management plan is required (Section 4.2 & 5.3 of the EMPr) xiii. Refer to Appendix C of the EMPr xiv. Refer to Appendix Q (EMPr) – Section 5.3 – Objective 12 xv. Refer to Appendix Q (EMPr) – Section 5.3 – Objective 7

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	to prevent and reduce the risk of any potential erosion xiv. An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the sailor storm water systems xv. Measures to protect hydrological features such as streams, rivers, pans, wetlands, darns and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	
l)	The EIAr must include a cumulative impact assessment of the facility if there are other similar facilities in the region. The specialist studies e.g. biodiversity, visual, noise etc. must also assess the facility in terms of potential cumulative impacts.	Refer to Chapter 9 of this report for the assessment of cumulative impacts.

LEGAL REQUIREMENTS IN TERMS OF THE EIA REGULATIONS

Table 2 below details how the legal requirements of Section 31 of the EIA Regulations (EIA Report content) have been addressed within this report

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Section 1.4 and Appendix A
(b) a detailed description of the proposed activity	Chapter 2
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken	Chapter 2
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 6
(e) details of the public participation process conducted in terms of sub-regulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	i. The Plan of study for the EIA Phase was proposed to achieve the following: » Provide an overall assessment of the social and biophysical environment affected by the Castle Wind Energy Facility (Chapter 7 and specialist reports – Appendix F-O) » Assess potentially significant impacts (direct, indirect and cumulative, where required) – Chapter 8 & 9. » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts (Chapter 8, 9 & 10) » Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded (Chapter 6 and Appendix E).
(f) a description of the need and desirability of the proposed activity;	Section 2.2
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that	Section 2.4

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Section 4.2.5
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 2.4, Chapter 6
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Section 8.6
(k) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	Appendix D4
(l) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 6
(m) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapter 6 and 7
(n) a description of any assumptions, uncertainties and gaps in knowledge	Section 4.2.3 and specialist reports (Appendix E-K)
(o) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 8.5
(p) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Chapter 10 Section 10.4
(q) a draft environmental management programme containing the aspects contemplated in regulation 33	Appendix L
(r) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix F-O
(s) any specific information that may be required by the competent authority.	Refer to Table 1 of the EIR.

INVITATION TO COMMENT ON THE EIA REPORT

Members of the public, local communities and stakeholders were invited to comment on the Draft Environmental Impact Assessment Report which was made available for public review and comment for a 40-day period at the following locations from **01 December 2014 –28 January 2015:**

» De Aar Public Library – 21 Station Street, De Aar
» Phandulwazi Library – Nanzwakazi Location, Hlithani Street, De Aar
» Emthanjeni Local Municipality Offices – 45 Voortrekker Street, De Aar
» Frans Jooste Library – Bree Street, Philipstown
» Renosterberg Local Municipality – Green Street, Philipstown
» www.savannahSa.com

The release of a Final EIA Report provides stakeholders with an additional opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report has incorporated all issues and responses received during the process. As required in terms of Regulation 56(2) of the EIA Regulations, this report has been made available for public review prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project. Any changes made from the Draft EIA Report to this Final EIA Report **have been underlined throughout** this Final EIA Report for ease of reference.

Comments on this FEIR should be submitted to the DEA with a copy to Savannah Environmental. Relevant contact details are as follows:

National DEA: Muhammad Essop Tel: (012) 399 9406 **Email:** MEssop@environment.gov.za **Post:** Private Bag X 447 ,Pretoria,0001	**Savannah Environmental(Public Facilitator):** **Gabriele Wood** **Tel:** 011 656 3237 **Fax:** 086 684 0547 **Email:** gabriele@savannahsa.com **Post:** P O Box 148 Sunninghill 2157

EXECUTIVE SUMMARY

Background and Project Overview

Castle Wind Farm (Pty) Limited is proposing the establishment of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, which is ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the Castle Wind Energy Facility. This development is proposed to comprise a cluster of up to 31 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed within an area of approximately ~3257ha in extent.

The wind energy facility is proposed to be located on the following farm portions (refer to Figure 1):

- Portion 12 of Farm 165 (Vendussie Kuil);
- Portion 13 of Farm 165 (Vendussie Kuil); and
- The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The three farm portions collectively make up a broader study area of approximately 3257ha (i.e. 32.6 km^2) which is being considered for siting of the wind energy facility.

The facility will be comprised of up to 31 wind turbines with a generating capacity of up to 3.5MW each; with a hub height of up to 120m and a rotor diameter of up to 132m. The entire facility would have a capacity of up to 140 MW.

Infrastructure associated with the wind energy facility is proposed to include:

- **31 wind turbines**;
- Turbine foundation/footprint;
- 31 Crane hardstand areas
- **Cabling** between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation;
- Temporary laydown areas);
- Temporary batching plant
- **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m)
- **Internal access roads** (approximately 7m wide) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. Due to the dispersed distribution pattern of the wind turbines however, this will necessitate the construction of new access roads in some areas.
- Workshop area / office for control, maintenance and storage.

The primary access road to the site will be off the existing gravel road from the R389 to Philipstown and Hanover. Two reasonable and feasible alternatives are have been considered (refer to Figure 8.2):

Alternative access to site during construction and operation

» **Access Road Alternative 1 (referred to as the Northern Access Road):** The site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 19.5km from the R389 to the proposed site. Several homesteads are situated along this access roads.
» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 18.5km from the R389 to the proposed site.

Savannah Environmental was contracted by Castle Wind Farm (Pty) Limited as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. The manner in which a country sources its energy plays a big part in reducing the effects of climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing the Castle Wind Facility with a maximum contracted capacity of up to 140MW on a site located on Portion 12 of Farm 165 (Vendussie Kuil), Portion 13 of Farm 165 (Vendussie Kuil) and the Remaining Extent of Portion 0 of Farm 8 (Knapdaar) has been established by Castle Wind Farm (Pty) Limited. The positive implications of establishing a wind energy facility on the identified site within the Northern Cape include the following:

» The potential to harness and utilise wind energy resources within the Northern Cape Province
» The project will assist the South African government in reaching their set targets for renewable energy.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
» The National electricity grid in the Northern Cape Province will benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by the developer. **No environmental fatal flaws were identified** to be associated with the proposed wind energy facility. A number of impacts of medium to high significance were however identified which may require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMPr)** included within **Appendix Q**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to **protect and preserve** surrounding environment.

Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Castle Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level, provided that appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

The following conditions would be required to be included within an environmental authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within **Appendices F - O** must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained to carry out a restricted activity involving a specimen of a listed threatened or protected species.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» The final location of the wind turbines and associated infrastructure within identified sensitive areas must be informed by walk-through surveys to be undertaken by ecological, heritage and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
» Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bats.

» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
» Adequate stormwater management measures to be put in place as the soils on the site are prone to erosion.
» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
» Construction managers should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
» Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

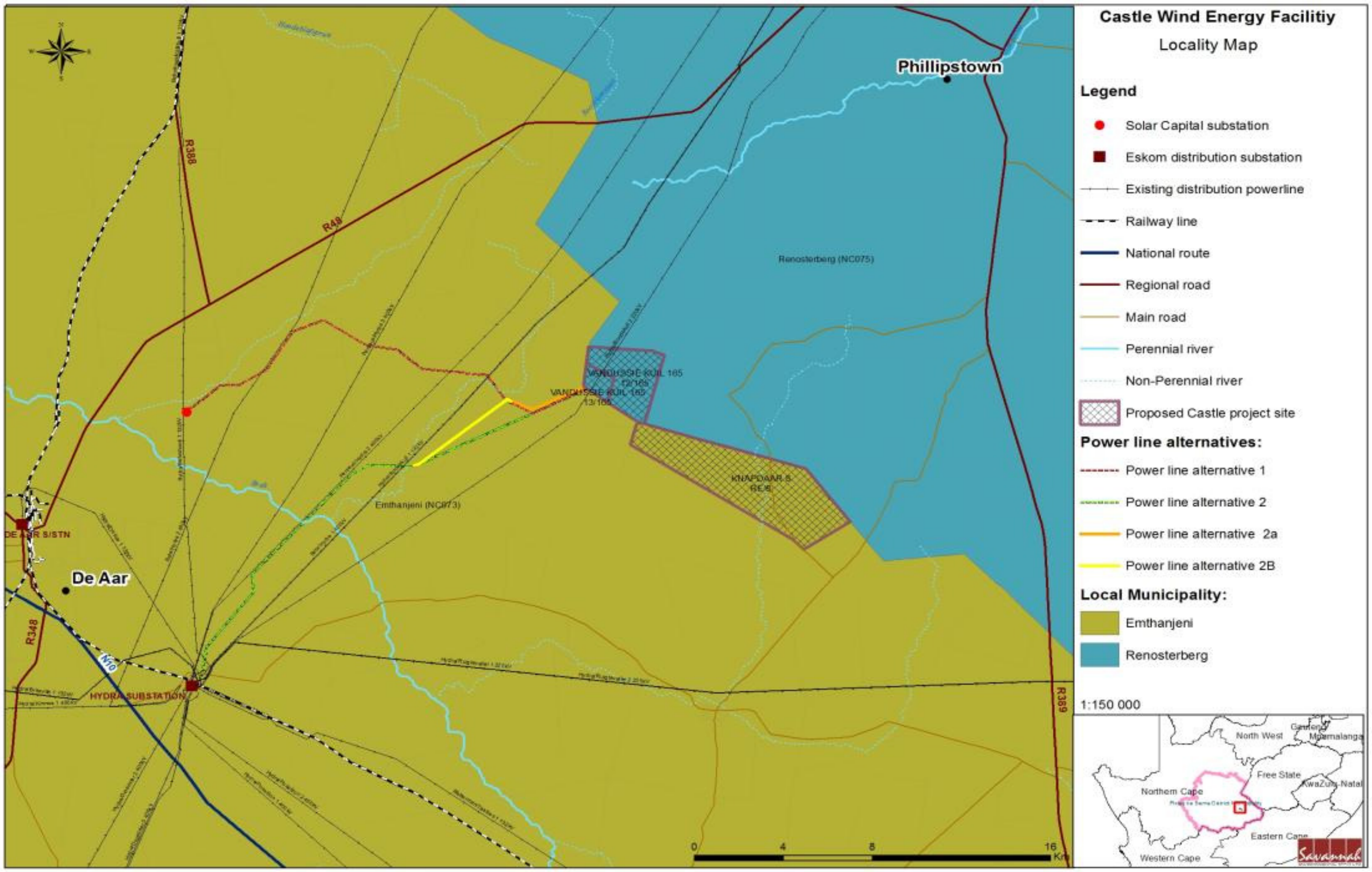

Figure 1: Locality map showing the study area for the establishment of the Castle Wind Energy (Northern Cape)

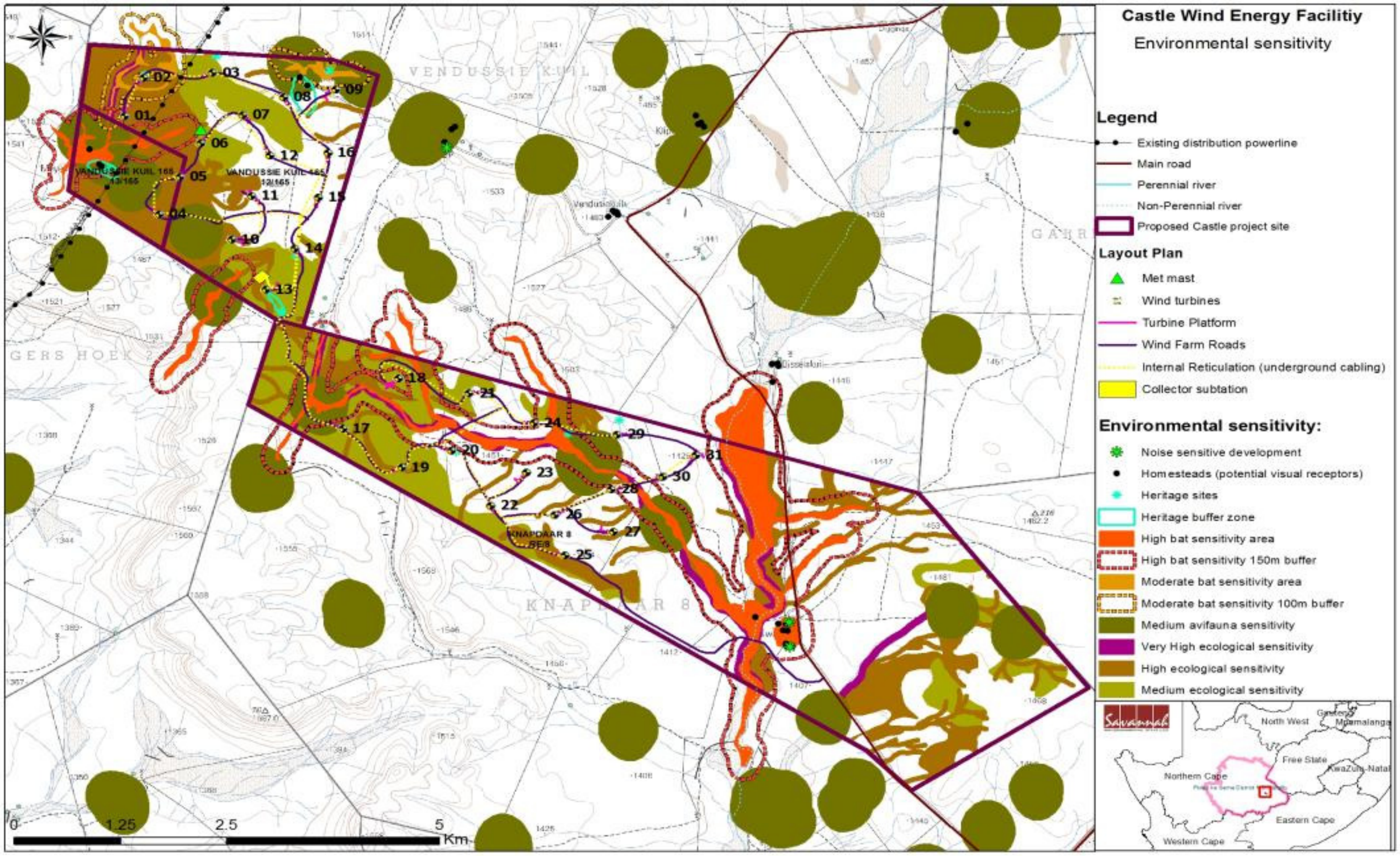

Figure 2: Environmental sensitivity map for the proposed Castle Wind Energy Facility in relation to the proposed Facility layout

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APPENDICES

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Betz Limit: The flow of air over the blades and through the rotor area allows a wind turbine to generate power. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as Betz Limit.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme/plan: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity.

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800.

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Regional Methodology: The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) have developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The methodology proposed within this guideline document is intended to be a regional level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development within the Western Cape Province (on the basis of planning, environmental, infrastructural and landscape parameters).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Tower: The tower, which supports the rotor, is constructed from tubular steel, concrete or a mixture of both. It is approximately 120 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 140 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Valley-bottom wetlands (Channelled or Unchannelled): These are flat valley-bottom wetland areas with or without a major channel/stream running through them. Water inputs are typically from an upstream channel, as the flow becomes dispersed, and from adjacent slopes (if present) or groundwater. Water generally moves through the wetland in the form of diffuse surface flow and/or interflow (with some temporary containment of water in depressional areas), but the outflow can be in the form of diffuse or concentrated surface flow. Infiltration and evaporation from unchannelled valley-bottom wetlands can be significant, particularly if there are a number of small depressions within the wetland area. Horizontal, unidirectional diffuse surface-flow tends to dominate in terms of the hydrodynamics.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

Wind speed: The rate at which air flows past a point above the earth's surface.

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DAFF	Department of Forestry and Fishery
DENC	Northern Cape Department of Environmental Affairs and Nature Conservation
DEA	National Department of Environmental Affairs
DME	Department of Minerals and Energy
DOT	Department of Transport
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited

INTRODUCTION CHAPTER 1

Castle Wind Farm (Pty) Limited is proposing the establishment of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the Castle Wind Energy Facility. This development is proposed to comprise a cluster of up to 31 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed within a larger area of approximately ~3257ha in extent.

The nature and extent of the proposed facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases of a facility of this nature is explored in more detail in this Environmental Impact Assessment Report. This Environmental Impact Assessment Report consists of eleven sections:

» **Chapter 1** provides a project overview and motivation for the proposed project and the environmental impact assessment
» **Chapter 2** provides the project description, need and desirability and identified project alternatives
» **Chapter 3** describes wind energy as a power generation option and provides insight to technologies for wind energy and the scope of the proposed Castle Wind Energy Facility
» **Chapter 4** provides a description of the processes followed in the determination of acceptable sites for the development of the proposed Castle Wind Energy Facility
» **Chapter 5** provides the strategic context for energy planning in South Africa
» **Chapter 6** outlines the process which was followed during the Scoping and EIA Phase of the project, including the stakeholder consultation programme that was undertaken
» **Chapter 7** describes the existing biophysical and socio-economic environment
» **Chapter 8** describes the assessment of environmental impacts and cumulative impacts associated with the proposed Castle Wind Energy Facility and recommended mitigation measures
» **Chapter 9** describes the assessment of cumulative impacts associated with the proposed Castle Wind Energy Facility and recommended mitigation measures
» **Chapter 10** presents the conclusions of the impact assessments, recommendations as well as an impact statement
» **Chapter 11** contains a list references for the Draft EIA report and specialist reports

1.1. Project Overview

The site for the proposed facility, was identified by Castle Wind Farm (Pty) Ltd through a Regional Site Assessment that was undertaken by Savannah Environmental, together with MetroGIS, on behalf of juwi Renewable Energies. The purpose was to determine acceptable areas considered suitable for development within the identified study area within the Northern Cape Province. The regional site identification process included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of a wind farm, including the wind resource, land availability, accessibility and existing grid infrastructure. The proposed site was confirmed by Castle Wind Farm (Pty) Limited as being potentially suitable for wind energy development. As a result, no feasible site alternatives have been identified for investigation for the proposed wind energy facility development, as the site has been screened as being potentially suitable for development of the project. This area was put forward for consideration within this EIA. The site selection process is discussed in further detail in Chapter 4 of this report.

The overarching objective for the planning process is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. As local level environmental and planning issues were not assessed in sufficient detail through the regional level site identification process, these issues must now be considered within site-specific studies and assessments through the EIA process. This process will delineate areas of sensitivity within the broader site and ultimately inform the placement of the wind turbines and associated infrastructure on a site.

The detailed project description and the scope of the proposed Castle Wind Energy Facility (for the construction, operation and decommissioning phases) is discussed in more detail in Chapter 2.

1.2. Requirement for an Environmental Impact Assessment Process

The proposed wind energy facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998). This section provides a brief overview of the EIA Regulations and their application to this project.

EIA Regulations overview: NEMA is the national legislation that provides for the authorisation of 'listed activities'. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority[1]and the Northern Cape Department of Environment and Nature Conservation (DENC) will act as the commenting authority. An application for authorisation has been accepted by DEA under application reference number 14/12/16/3/3/2/278.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. Castle Wind Farm (Pty) Ltd appointed Savannah Environmental (Pty) Ltd as the independent environmental assessment practitioner to conduct the EIA process for the proposed project.

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issues reported on in the Scoping and EIA Reports as well as dialogue with Interested and Affected Parties (I&APs). In terms of sections 24 and 24D of NEMA, as read with Government Notices R543, R544, R545 and R546, a Scoping and EIA process is required for the proposed project (GG No 33306 of 18 June 2010). A table of the listed activities for the proposed projects in terms of GN R545, R544 and R546 (as amended in December 2010) is provided below:

[1] In terms of the Energy Response Plan, the DEA is the competent authority for all energy related applications.

Table 1.1: Listed Activities applicable to the Castle Wind Energy Facility

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
GN544	10	The construction of facilities or infrastructure for the transmission and distribution of electricity – Outside urban areas or industrial complexes with a capacity of more than 33kV but less than 275kV	Construction of power line/s, outside an urban area, with a capacity of more than 33kV.
GN544	11	The construction of: (iii) bridges (vi) bulk storm water outlet structures (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	Bridges, storm water structures and buildings (such as the workshop) will occur within 32m of a watercourse.
GN544	13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres	Facilities for storage of diesel / oils that are up to 500m^3 are required for the wind energy facility.
GN544, 18 June 2010	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	The construction of the wind energy facility will include excavation of soil in a watercourse (drainage line) that may exceed 5 cubic metres.

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
~~GN544~~	~~22~~	~~The construction of a road, outside urban areas,~~ ~~(i) with a reserve wider than 13.5 metres or,~~ ~~(ii) where no road reserve exists where the road is wider than 8 metres, or~~ ~~(iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 of Government Notice 387 of 2006 or activity 18 of Notice 545 of 2010.~~	~~The wind energy facility will require access roads to be constructed.~~
~~GN544~~	~~26~~	~~Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).~~	~~Sensitive / conservation worthy vegetation species, protected under the NEM:BA to be removed for infrastructure including wind turbines, access roads and associated infrastructure.~~
GN544	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – (ii) where no reserve exists, where the existing road is wider than 8 metres – excluding widening or lengthening occurring inside urban areas.	Existing farm (gravel) access roads may be widened or lengthened. These roads have no road reserve and may be wider than 8 metres in some areas.
GN545	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	The wind energy facility will consist of wind turbines for electricity generation of more than 20MW.
GN545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; Except where such physical	The development footprint for the proposed wind energy facility will cover an area greater than 20 hectares.

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
		alteration takes place for: *(i)* Linear development activities. *(ii)* Agriculture or afforestation where activity 16 in this schedule will apply	
GN 546, 18 June 2010	4 (a) (ii) (bb)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas.	New roads wider than 4 m to be constructed in a rural part of the Northern Cape within a National Protected Area Expansion Strategy Focus area.
GN 546, 18 June 2010	10(a) (ii) (bb)	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas.	Fuel required during construction will be stored on-site. The site occurs in a rural part of the Northern Cape and a portion of the site falls within a National Protected Area Expansion Strategy Focus area.
GN 546, 18 June 2010	13 (b) & (c) ii (bb)	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (b) National Protected Area Expansion Strategy Focus areas. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus	An area of 1 ha or more of indigenous vegetation cover need to be cleared in a rural part of the Northern Cape, within a National Protected Area Expansion Strategy Focus area.

Relevant Notice	Activity No.	Description of listed activity	Applicability to the project
		areas.	
GN 546, 18 June 2010	14 (a) i	The clearance of an area of 5 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) In the Northern Cape (i) All areas outside urban areas	An area of 5 ha or more of indigenous vegetation cover may need to be cleared in a rural area within the Northern Cape.
GN 546, 18 June 2010	16 (iii) & (iv) (a) ii (bb)	The construction of (iii) buildings with a footprint exceeding 10 square metres in size or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. (a) In the Northern Cape *(iii)* Outside urban areas (bb) National Protected Area Expansion Strategy Focus areas.	Buildings and infrastructure larger than 10 m^2 to be constructed within 32 m of a watercourse which fall within National Protected Area Expansion Strategy Focus areas.
GN 546, 18 June 2010	19	The widening of a road by more than 4metres, or the lengthening of a road by more than 1 kilometre. (a) In the Northern Cape (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas.	Existing farm (gravel) access roads to be widened in a rural part of the Northern Cape, within a National Protected Area Expansion Strategy Focus area.

This report documents the evaluation of the potential environmental impacts of the proposed construction and operation of the proposed Castle Wind Farm project. This Environmental Impact Assessment Report forms part of the EIA process and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.3. Objectives of the EIA Process

The Scoping Report dated November 2013 was received by the DEA on the 03 December 2013, and accepted by the DEA on the 30 January 2014. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase (i.e. the current phase) assessed identified environmental impacts (direct, indirect, and cumulative) associated with the different project development phases (i.e. design, construction, operation, and decommissioning). The EIA Phase also recommends appropriate mitigation measures for potentially significant environmental impacts. The release of a draft EIA Report provides stakeholders with an opportunity to review the information included in the Draft EIAR and to raise their concerns through the EIA Process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review phase prior to submission to DEA.

1.4. Details of Environmental Assessment Practitioner and specialist team

Savannah Environmental was appointed by Castle Wind Farm (Pty) Ltd as an independent consultant to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any of the specialist sub-consultants on this project are subsidiaries of or affiliated to Castle Wind Farm (Pty) Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

The EAPs from Savannah Environmental who are responsible for this project are:

» *Tebogo Mapinga* - is a Senior Environmental Consultant. She holds a Bsc degree with over 7 years of experience in the environmental field in both public and private sectors. Her competencies lie in environmental impact assessments, compliance monitoring and public participation for small and large scale projects. She is currently in the process of completing her honours degree in Environmental Management.
» *Karen Jodas* - the principle Environmental Assessment Practitioner (EAP) for this project, is a registered Professional Natural Scientist and holds a Master of Science degree. She has 17 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.
» *Gabriele Wood*: the public participation consultant for this project, hold an Honours Bachelor degree in Anthropology and has 7 years of experience in Public Participation and Social consulting, including professional execution of public participation processes for a variety of projects as well as managing and co-ordinating public participation processes for Environmental Impact Assessments (EIA).

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA Processes. Savannah Environmental has developed a valuable understanding of impacts associated with the construction and operation of renewable energy facilities.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

Specialist	Area of Expertise
Simon Todd of Simon Todd Consulting	Ecology
Jon Smallie of WildSkies Ecological Services	Avifauna
Werner Marias of Animalia	Bats
Lourens du Plessis of MetroGIS	Visual impacts and GIS mapping
Jaco van der Walt of Heritage Contracts	Heritage
Tony Barbour Environmental Consulting and Research	Social
Johan van Tol- of HydroPedological Solutions	Soils, erosion and agricultural potential
Morne de Jager of Enviro Acoustics Research	Noise
Toni Belcher & Dana Grobler of Blue Science	Freshwater Assessment
Barry Millsteed	Palaeontology

Curricula vitae for the Savannah Environmental project team and its specialist sub-consultants are included in Appendix A.

PROJECT DESCRIPTION, NEED AND DESIRABILITY AND ALTERNATIVES CHAPTER 2

This chapter provides details regarding the project description, scope of the proposed Castle Wind Energy Facility, including all required project components of the project and necessary steps for the project to be developed and the description of alternatives. The scope of the project includes construction, operation and decommissioning activities. This chapter also describes alternative options with regards to the proposed wind energy facility development, including the "do nothing" alternative.

2.1 Project and Site Description

Castle Wind Farm (Pty) Ltd is proposing the construction of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project will be referred to as the Castle Wind Energy Facility.

The wind energy facility is proposed to be located on the following farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The three farm portions collectively make up a broader study area of approximately 3257ha (i.e. 32.6 km^2) which is being considered for the siting of the wind energy facility (refer to Figure 2.1).

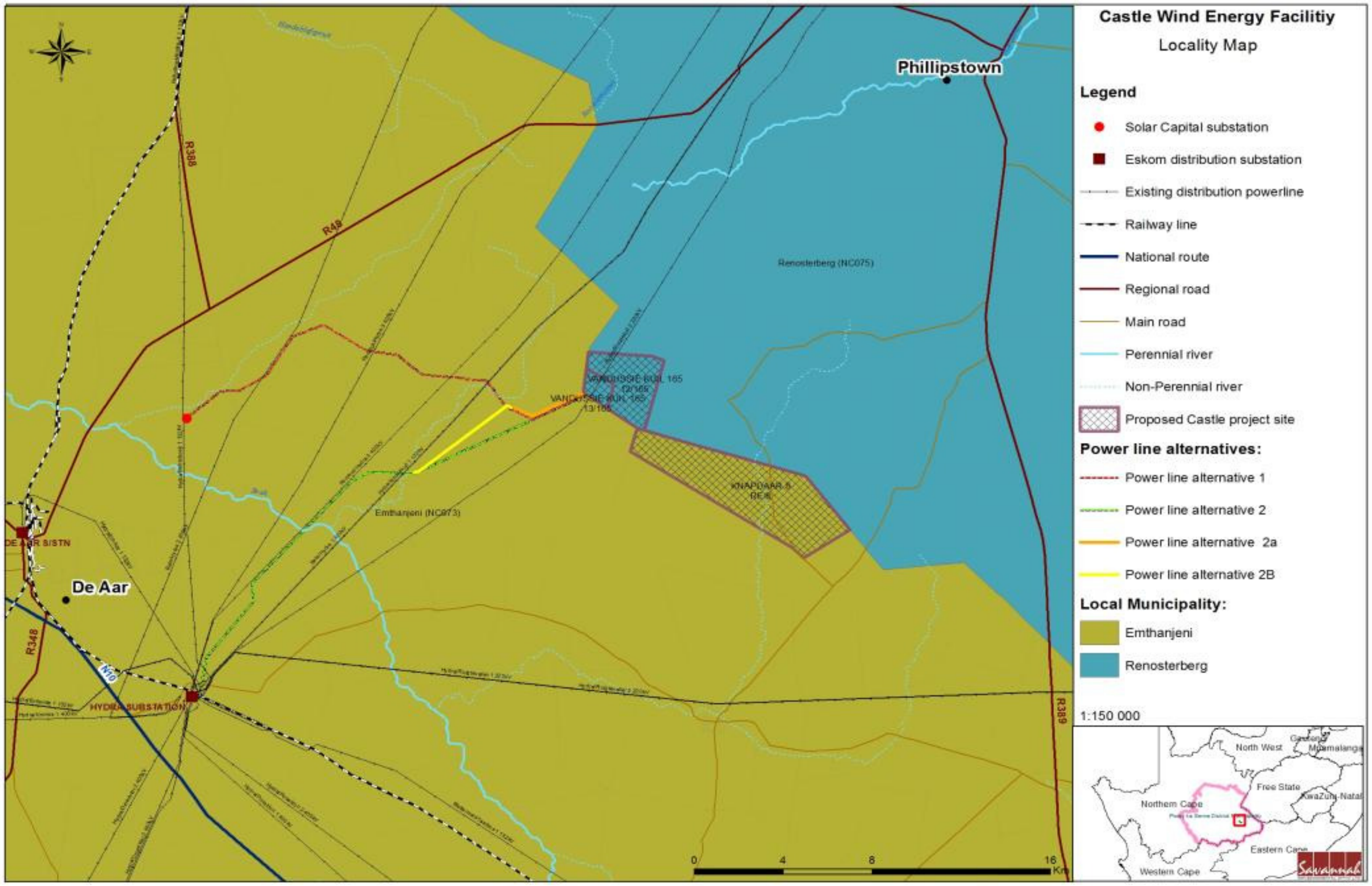


Figure 2.1: Locality map showing the study area and municipal demarcations for the establishment of the Castle Wind Energy Facility in the Northern Cape Province (refer to Appendix O for A 3 Map)

2.2 Need and Desirability

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area. It must also reflect the sustainable development vision, goals and objectives formulated, and the desired spatial form and pattern of land use reflected in the area's IDP and SDF.

2.2.1 Northern Cape Provincial Spatial Development Framework (SDF)

The Northern Cape Provincial Spatial Development Framework (2012) Section C8.2.3, Energy Objectives, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. The objectives are listed below:

- Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts.
- Enhance the efficiency of Eskom's power station at the Ilanga Lethemba Substation or the Hydra Substation.
- There is a national electricity supply shortage and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority.
- Develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government, as well as the private sector.
- Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003). This target relates to the delivery of 10 000 GWh of energy from renewable energy sources (mainly biomass, wind, solar, and small-scale hydro) by 2013.

Therefore the development of the proposed wind facility is in line with the above mentioned objectives outlined in the Northern Cape SDF.

2.2.1 District Renewable Energy Hub (Draft Concept Document)

The Local Economic Development (LED) Division of the PKSDM has proposed the development of a Renewable Energy Hub along the N10 corridor and around the town of De Aar. The proposal is set out in a District Renewable Energy Hub Draft Conceptual Document (26 February 2010).

The concept document outlines the proposed strategy which is in line with both the National and Provincial policy with respect to renewable energy generation. A number of renewable energy sources have been identified for the proposed District-wide Hub including:

» Solar;
» Wind;
» Biomass (bio diesel and associated by-products); and
» Hydro-electric.

The draft concept document indicates that the district is well positioned for renewable energy development due to the ample availability of suitable land, the existence of adequate existing infrastructure (particularly with respect to the existing railway hub) to facilitate the growth of the industrial and manufacturing sectors, the exposure to high insolation rates and steady winds, as well as access to both surface and groundwater resources.

The Renewable Energy Hub is seen as a critical component to the revitalization of the both the broader District and the town of De Aar. In this regard it is envisaged that the Hub would attract both local and foreign investors and research institutions, which, in turn, would help to alleviate the increasing demand on electricity nationally as well as South Africa's dependence on fossil fuel. In addition the Hub would create employment and downstream business opportunities for local entrepreneurs.

As part of the broader development of De Aar and the District, the PKSDM is in the process of drafting a development plan for an inland port and transport hub centered in and around De Aar and powered by renewable energy generated by the Renewable Energy Hub.

2.2.2 Local Level Integrated Development Plans (IDPs)

The majority of the site falls within the Emthanjeni Local Municipality. A small section of the site falls within the Renosterberg Local Municipality. The Emthanjeni Local Municipality's IDP (2012) identified a number of key performance areas (KPAs). These KPAs aim to utilise existing economic strengths and opportunities by transferring these into workable programmes and projects. These programmes and projects tend to reduce the current threats, and strengthen the weaknesses in the local economic environment. The

Renosterberg Local Municipality and the Emthanjeni Local Municipality's IDP KPAs that are relevant to the proposed energy facility include:

» Basic Service Delivery: Energy is highlighted as one of the priority issues for the Emthanjeni Local Municipality and Renosterberg Local Municipality with respect to basic services; and,
» Local Economic Development (LED): Micro and macro-economic development and land use management are highlighted as one of the priority issues for the municipality. Therefore the development of the wind energy facility is desirable by the local and district municipality and is aligned with the IDP's.

2.2.3 Financial Viability and Community Needs

In terms of the energy yield predicted for the facility calculated from more than 12 months of monitored wind data, the developer considers the Castle Wind Energy Facility to be financially viable. In the South African context, developmental needs (community needs) are often determined through the planning measures (IDP, SDF and EMF). The wind projects can contribute indirectly to the two Local Municipality's Integrated Development Plans (IDPs). In terms of the needs on the local community, the IDPs identified the need for Economic Development, Electricity Improvements, Youth Development, Infrastructure Development, Skills Development and SMME Development. The Castle Wind Energy Facility would contribute positively to these community needs. The project will create employment and business opportunities, as well as the opportunity for skills development for the local community. The project will result in benefits to the local community, in accordance with the localisation requirements of the REIPPP Programme. In addition, indirect benefits and spend in the local area will benefit the local community.

The development of the project would benefit the local/regional/national community through the development of a renewable energy project. Surrounding communities would also benefit from the development through job creation and downstream spin-offs. In addition, according to Department of Energy (DoE) bidding requirements the developer must plan for a percentage of the profit per annum from the wind energy facility to go back into the community by means of a social beneficiation scheme. Therefore, there is a potential for creation of employment and business opportunities and the opportunity for skills development for the local community.

2.2.4 The Need for the Wind Energy Facility

The purpose of the proposed wind energy facility is to sell the electricity generated to Eskom under the Renewable Energy Independent Power Producers Procurement (REIPPP)

Programme. The REIPPP Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities by IPPs in South Africa.

The need for harnessing renewable energy resources (such as wind energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns of increased greenhouse gas emmissions, the exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to a goal of ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Castle Wind Farm (Pty) Limited proposes the establishment of the Castle Wind Energy Facility to add new capacity to the national electricity grid. The proposed project was identified by the developer as a highly desirable site based on a pre-feasibility assessment that was conducted for a larger area within the Northern Cape. The proposed site displays the characteristics needed in order to develop a Wind Energy Facility and is considered as highly favourable.

2.2.5 The Desirability for the Wind Energy Facility

The use of wind power for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The site for the proposed facility was screened by Savannah Environmental, together with MetroGIS, on behalf of juwi Renewable Energies through a Regional Site Assessment that was undertaken to determine acceptable areas considered suitable for development within the identified study area in the Northern Cape Province. The proposed site was selected for the development of a wind energy facility based on its predicted wind regime (high wind speeds), environmental suitability, suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical perspective.
Castle Wind Farm (Pty) Limited considers this development site to be highly preferred for wind energy facility development. Wind monitoring has been undertaken using an 80m wind monitoring mast in order to confirm the wind resource on the site and ultimately inform the turbine layout of the facility as well as to inform the turbine selection process.

Monitored wind speeds at the site and in the larger De Aar area indicate that this area within the Northern Cape shows great potential for the generation of wind power. The proposed project is located in an area of high wind speeds, averaging > 7m/s. In addition, the recent award of the adjacent Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities near De Aar by the DoE under the REIPPP program demonstrates suitability and economic viability of the development of wind farm projects in this area (refer to Figure 2.2).

Receptiveness of the site to Wind Farm Development:

Castle Wind Farm (Pty) Limited considers this area, and specifically the demarcated site on Portion 12 and 13 of Farm 165 (Vendussie Kuil) and Remaining Extent of Portion 0 of Farm 8 (Knapdaar), to be highly preferred for the development of a wind energy facility. The reasons include:

» Extent of site: Availability of level land of sufficient area can be a restraining factor. The proposed site is approximately 3257ha in extent which is sufficient for the construction of the facility allowing for avoidance of site sensitivities.
» Power transmission considerations: The Castle Wind Energy Facility could be connected to a) the newly constructed Ilanga Lethemba Substation (Solar Capital Substation), near De Aar or b) the Hydra Substation.
» Site access: the site can be readily accessed via the existing northern or southern gravel access road from the R389 to Philipstown and Hanover.
» Loss of current land use: There is no cultivated agricultural land in the study area or directly adjacent to it which could be impacted upon by the proposed development.
» Location of the site: The proposed site will be located in the middle of the two preferred bidder round 3 projects (Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities) and therefor the proposed wind energy facility can be considered as an ‘infill’ development (refer to Figure 2.2).
» Climatic conditions: Climatic conditions determine the economic viability of a wind energy facility as it is directly dependent on the wind resources in the area. The De Aar area has been identified as a hub for Renewable Energy Developments for the reasons stated prior.
» Topographic conditions: The site conditions are optimum for a development of this nature with the project area being of a suitable gradient for a wind project.

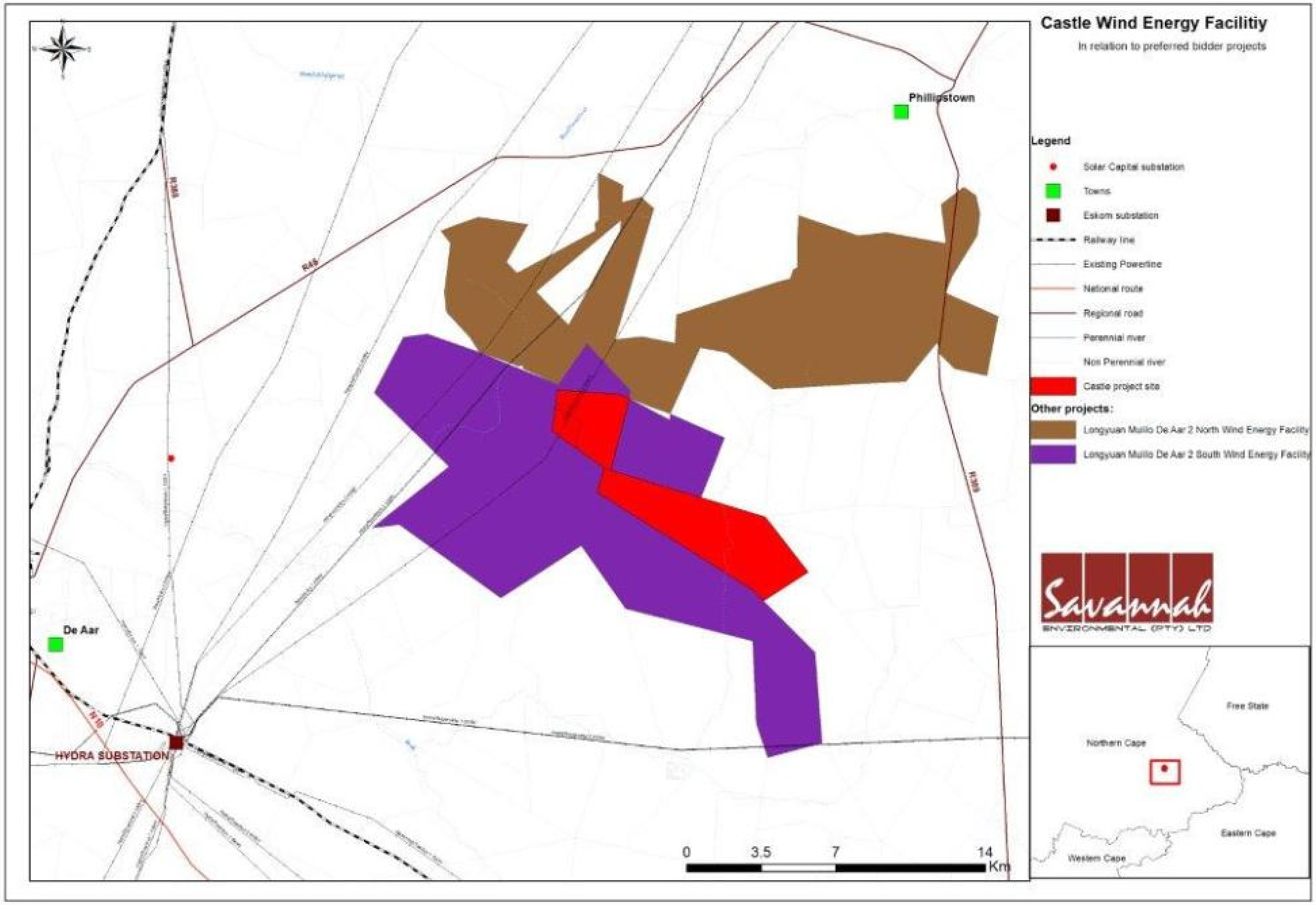


Figure 2.2: Layout indicating the location of the Castle Wind Energy Facility in relation to two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities (Preferred bidder round 3)

2.2.6 How the principles of environmental management as set out in section 2 of NEMA have been taken into account in the planning for the proposed project

The principles of NEMA have been considered in this assessment through the compliance with the requirements of the relevant legislation in the undertaking of the assessment of potential impacts, as well as through the implementation of the principle of sustainable development. Where appropriate, mitigation measures have been recommended for impacts which cannot be avoided. In addition to this, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of the minimisation of pollution and environmental degradation.

The EIA process has been undertaken in a transparent manner with all effort made to involve interested and affected parties, stakeholders and relevant Organs of State, such that an informed decision regarding the project can be made by the Regulating Authority.

The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage components. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management.

2.3 Components / Infrastructure associated with the Wind Energy Facility

The wind energy facility will comprise of up to 31 wind turbines with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 132m. The entire facility would have a generating capacity of up to 140 MW (refer to Figure 2.4). The infrastructure associated with the wind energy facility is proposed to include:

» Wind turbines;
» 31 crane hardstand areas
» Turbine foundation/footprint: $26m^{2.}$
» Cabling between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation.

Text Box 1

Please note that a separate application form has been submitted to the DEA for the proposed construction of a 132 kV overhead power line connecting the proposed Castle Wind Energy Facility to the Ilanga Lethemba (Solar Capital) Substation or the Hydra Substation. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructure associated with the project, such that a holistic picture of the project is provided.

   » Temporary Laydown areas
   » Temporary Batching plant
   » On-site substation (with an approximate compound size of 100 m x 100 m).
» A 132 kV overhead power line to connect into the newly constructed Ilanga Lethemba Substation (Solar Capital Substation), near De Aar or the Hydra Substation. The power line will have a 36m servitude and will be approximately 20-25 kilometres in length.
» Internal access roads up to 7m wide.
» Workshop area / office for control, maintenance and storage.

During the Scoping phase, the proposed development of a wind energy facility consisted of up to 38 wind turbines The entire facility would have a generation capacity of up to 140MW.

A 28 turbine layout was later developed to ensure maximum wind farm efficiency during the Final Scoping Phase, with the use of an initial road layout and the use of the sensitivities which had been identified during this phase. Subsequent to submitting the layout however, the landowner requested a larger buffer around his homestead, new sensitivities were identified and further discussion with the Project's civil engineering consultants necessitated an amendment to the layout. The final layout was amended to 31 turbines after it was concluded that the construction challenges will be significantly less than previously expected, primarily due to the improved road design, and that the previous turbine spacing had been unnecessarily large.

All specialists have been made aware of the changes to the layout and have commented on the 31 turbine layout in terms of the sensititivities identified during each study. .

Temporary infrastructure required during the construction phase includes:
» Construction camps;
» Construction yard and offices;
» Laydown area and storage areas; and
» Temporary access roads.
» Batching plant (in the event the project does not make use of 'ready mix' material)

Services required on site:
» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor to be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required.
» Sanitation – during construction, all sewage waste will be collected by a contractor to be disposed of at a licensed waste disposal site. This service will be arranged with the municipality when required during the operational phase.

» Water and electricity – water will be obtained from the municipality or a licence will be obtained from DWS for abstracting water from local boreholes. Electricity will be generated from generators for any electrical work on site.

2.4 Project Alternatives

2.4.1 Site Alternatives

The proposed site for the Castle Wind Energy Facility was identified as having potential for the installation of wind turbine generators on the basis of various technical criteria, including the wind resource, accessibility of the site, accessibility to the Eskom grid, and local site topography. The regional site assessment (described in detail in Chapter 4) involved testing the site against environmental and planning criteria, and the approach served as a site risk assessment tool from an environmental acceptability perspective – that is, a process to highlight or red-flag potential issues of concern prior to initiating a full EIA process for a proposed site. This site identification process was considered acceptable and therefore no location or site alternatives were considered any further.

2.4.2 Activity Alternatives

No activity/technology alternatives were assessed since the site has been identified by Castle Wind Farm (Pty) Limited as being highly desirable for the establishment of a wind energy generating facility due to the highly favourable wind resource associated with the proposed site. Therefore no other development or renewable technologies, such as photovoltaic solar (PV) or concentrated solar power (CSP), were considered. In addition, Castle Wind Farm (Pty) Limited as a wind farm developer, has technical expertise to develop wind farms and is not considering other renewable technologies.

A wind energy facility is therefore considered by Castle Wind Farm (Pty) Limited to be the only feasible and reasonable activity for consideration on the proposed site.

2.4.3 Site-specific or Layout Design Alternatives

During the Scoping phase, the proposed development of a wind energy facility consisted of up to 38 wind turbines. This layout was considered to be a 80% accurate layout, and would allow for some adjustment to avoid site-specific environmental constraints identified through the EIA phase, where necessary. The overall aim of the layout is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. This micro-siting information has informed the specialist impact assessments in this EIA phase. The planning process also included the positioning of other ancillary infrastructure, including, the power line and internal substation site/s.

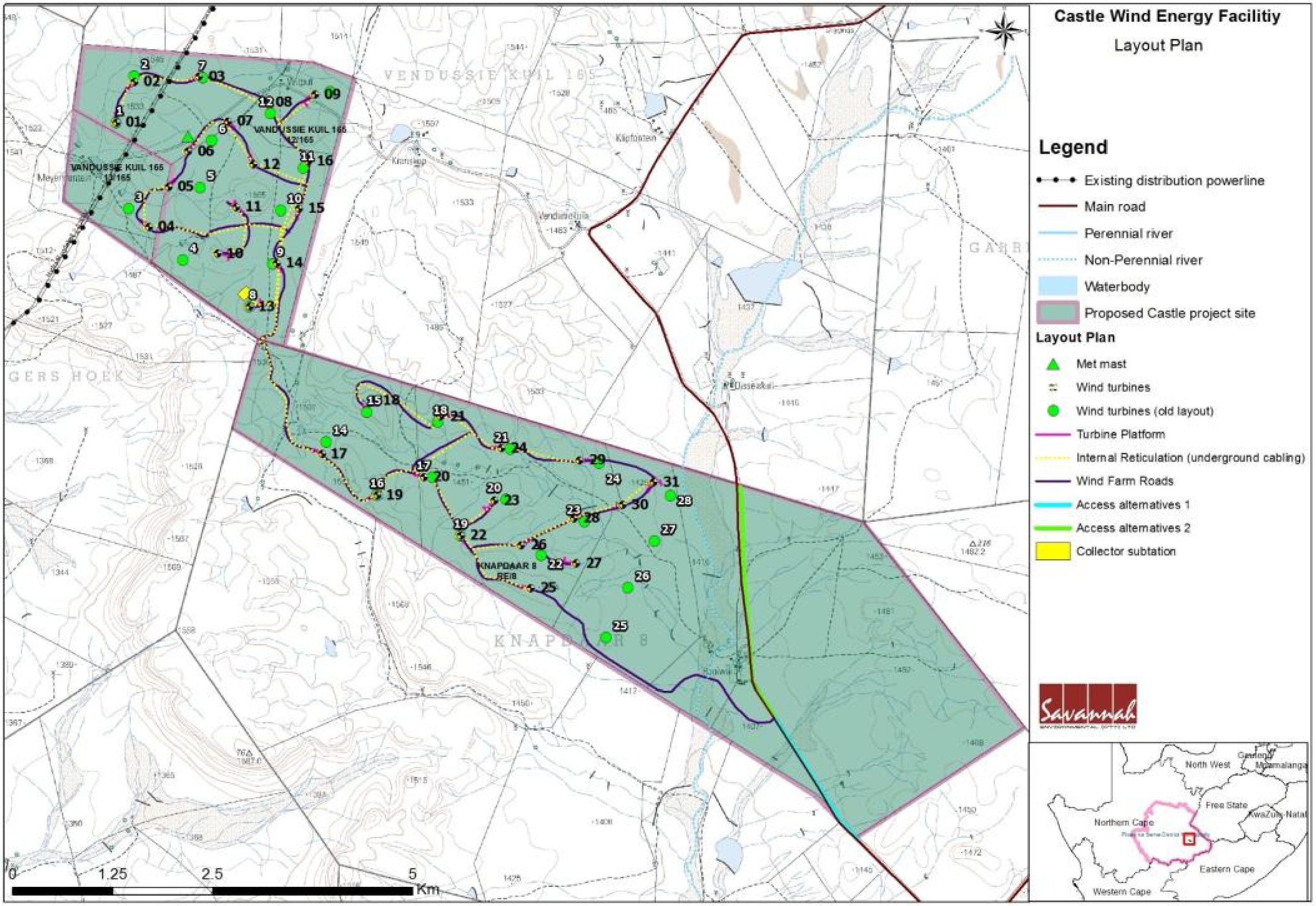


Figure 2.*3* Turbine layout consisting of both old 28 turbine layout & revised 31 turbine layout for the proposed Castle Wind Energy Facility in the Northern Cape Province

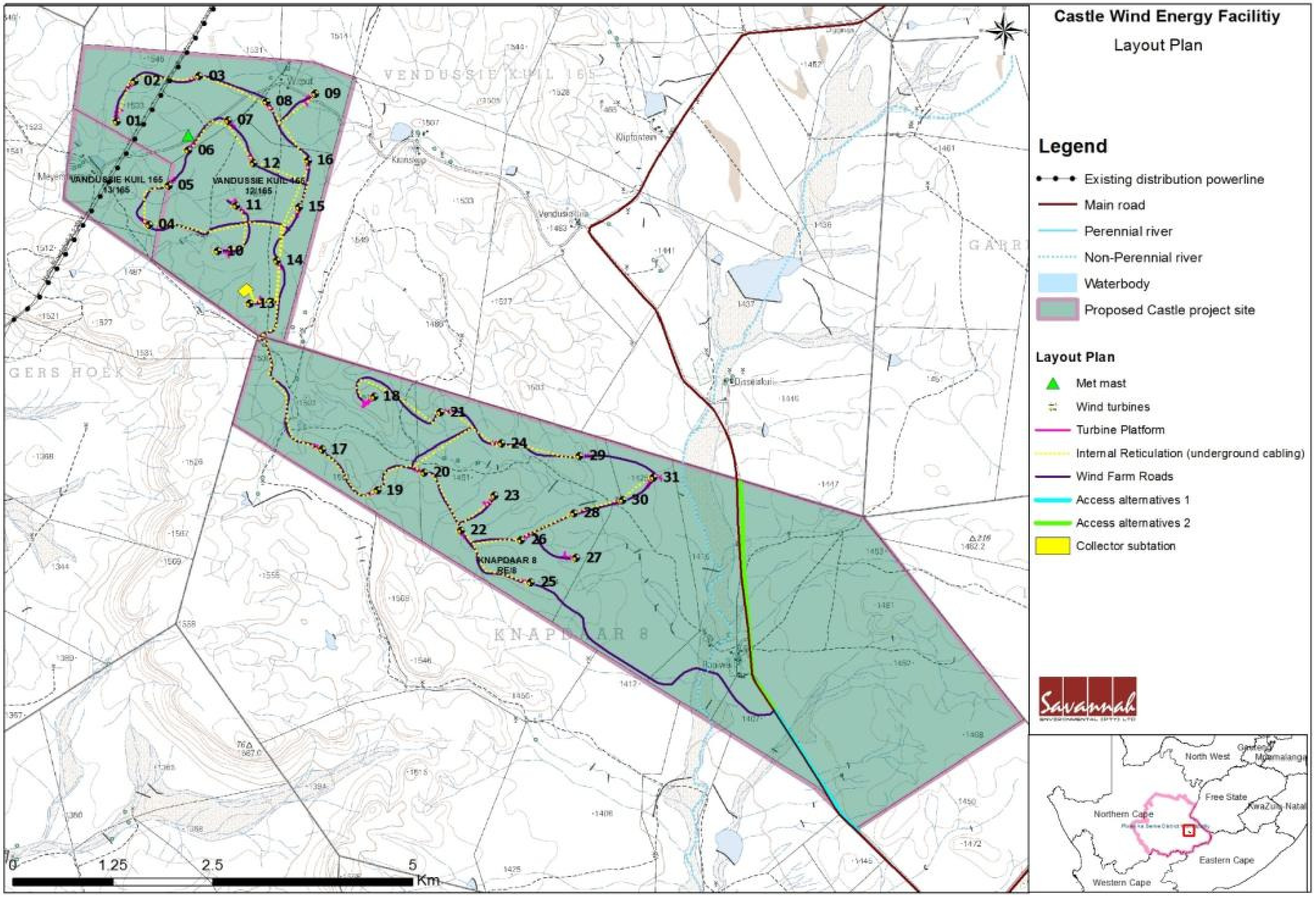


Figure 2.4 Preferred layout consisting of 31 turbines for the proposed Castle Wind Energy Facility in the Northern Cape Province

2.4.2 Access Road Alternatives

The following proposed access roads are proposed (refer to Figure 2.5):

» **Access Road Alternative 1 (referred to as the Northern Access Road):** the site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. There are several homesteads situated along the southern access road and these homesteads will most likely be negatively impacted by traffic, generated noise and dust in the area particularly during the construction phase.

» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. There are no homesteads situated along the southern access road hence it has been identified as a preferred alternative.

2.4.4 Technology alternatives

This refers to alternative technologies for use in the establishment of the wind energy facility. There is a limited range of alternative technologies (turbines) for commercial-scale wind energy facilities. In addition, the technology is constantly evolving. Table 2.1 summarises the types of variables associated with existing wind turbine technologies. There are no significant differences from an environmental perspective between technologies. The technology provider has not yet been confirmed and will be decided after further wind analysis and a tender process. The developer would utilise the same make and model (and size) of turbine across the whole site.

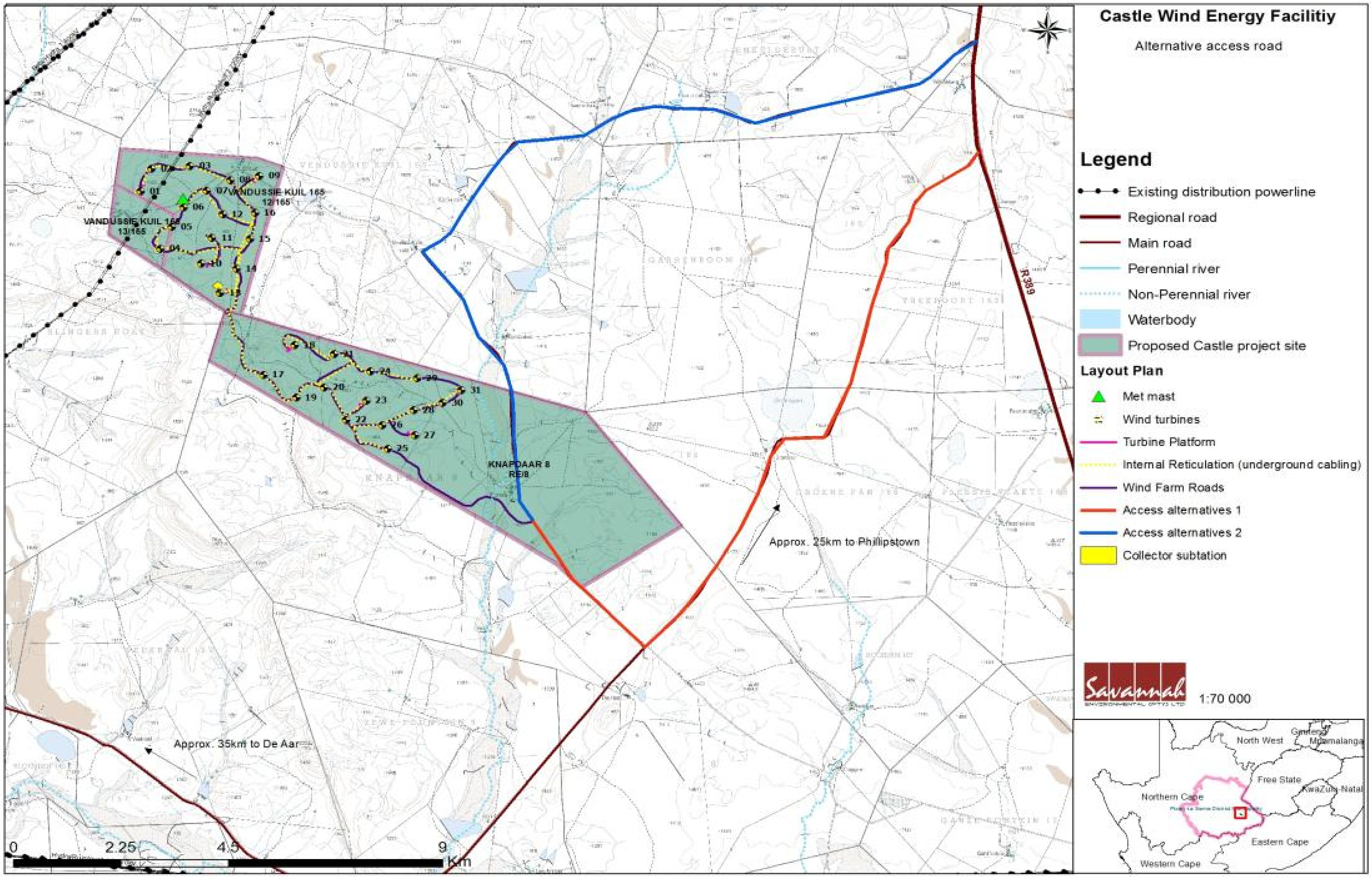


Figure 2.*4* Layout of alternative access roads to the proposed Castle Wind Energy Facility in the Northern Cape Province

Table 2.1: Variables associated with existing wind turbine technologies

Variables	Description
Type	The horizontal axis wind turbine completely dominates the commercial scale wind turbine market.
Size	Typical land-based utility scale wind turbines are currently in the 600 kW to 3.5MW range.
Foundation	The foundation is usually poured re-inforced concrete. Its size and shape is dictated by the size of the wind turbine and local geotechnical considerations.
Tower	Towers are typically constructed from steel and/or concrete. The height of towers generally varies between 80 m and 140 m.
Rotor	3- Bladed rotor is standard.
Rotor Speed Control	Fixed or variable speed rotors.
Gears	Geared and Gearless.
Generator	Standard high speed generator (geared) or custom low-speed ring generator (gearless).
Other variables	Yaw gears, brakes, control systems, lubrication systems and all other turbine components are similar on modern wind turbines.

2.4.5 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the wind energy facility on the proposed site. Two main reasons why the do-nothing alternative is not preferred in relation to this wind energy facility project are discussed below, namely:

» The current land-use regime of the site; and
» The need to diversify the energy mix is South Africa.

The overall agricultural potential of the site is very low, largely restricted by aridic climate conditions and shallow soils. The Cv/Hu soil associations are the only areas of the site suitable for crop production should adequate irrigation water be available.
Land capability is limited by the mountainous, rocky terrain, the shallow soils and the aridity of the region. The site is used for sheep farming. The natural grazing capacity is low and varies between 18 - 30 hectares per large stock unit across the site. There is a very small area of cultivated, irrigated land surrounding the farm house (Rooi Kraal) which is located on the Farm Knapdaar. Therefore, the "do nothing" alternative would leave current land-use and livestock grazing, with losing out the opportunity to generate renewable energy from the wind and at the same time continue current livestock grazing on areas that are outside of the proposed wind energy facility infrastructure. Therefore, from a land-use perspective, the do nothing alternative is not preferred.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. As a consequence of this there is therefore a need for additional electricity generation options to be developed throughout the country. The decision to expand South Africa's electricity generation capacity and the mix of generation technologies is based on **national policy.** This is informed by on-going strategic planning undertaken by the national Department of Energy (DoE), the National Energy Regulator of South Africa (NERSA) and Eskom Holdings Limited (as the primary electricity supplier in South Africa). The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least-cost energy service in many cases - and more so when social and environmental costs are taken into account.

The generation of electricity from renewable energy resources in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored further by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue saving of R26.6 million. As an already water stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.
» **Exploitation of our significant renewable energy resource:** At present, valuable renewable resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» **Pollution reduction:** The releases of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.
» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated

to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.

» **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
» **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities has significant potential for job creation in South Africa.
» **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
» **Support to a new industry sector:** The development of renewable energy offers an opportunity to establish a new industry within the South African economy.
» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date.

Within a policy framework, the development of renewable energy in South Africa is supported by the White Paper on Renewable Energy (November 2003), which has set a target of 10 000 GWh renewable energy contributions to final energy consumption. Furthermore the IRP 2010 states that 42% share of all new power generation should be derived from renewable energy forms, as targeted by the Department of Energy (DoE) (Integrated Resource Plan 2010 – 2030). The target is to be achieved primarily through the development of wind, biomass, solar and small-scale hydro. DME's macroeconomic study on renewable energy, developed under the now completed Capacity Building in Energy Efficiency and Renewable Energy (CaBEERE) project, has established that the achievement of this target would provide a number of economic benefits, including increased government revenue amounting to R299 million, increased GDP of up to R1 billion per year and the creation of an estimated 20 500 new jobs. In addition, the development of renewable energy beyond the 10 000 GWh target holds further employment benefits and would maximise the number of jobs created per TWh (NERSA, March 2009).

Through research, the viability of a wind energy facility near De Aar has been established. The Castle Wind Farm (Pty) Ltd proposes that up to 31 turbines for the entire facility, depending on the turbine capacity, be established as part of the facility. The purpose of the wind energy facility is to add new capacity for the generation of renewable energy to the national electricity supply which is short of generation capacity. This would meet current and expected demand and would aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). The 'do nothing' alternative will not assist the South African government in meeting increasing power supply demand or in reaching the set targets for renewable energy. In addition, the Northern Cape's power supply will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Provinces' grids.

The 'do nothing' alternative is not a preferred alternative as the following positive impacts will not be realised should the wind energy facility (all three phases) not be developed:

» Job creation from the construction and operational phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Utilisation of clean, renewable energy in an area where it is optimally available.

SUITABILITY OF THE SITE FOR THE DEVELOPMENT OF A WIND ENERGY FACILITY IN THE NORTHERN CAPE CHAPTER 4

Savannah Environmental, together with MetroGIS, undertook a regional site assessment on behalf of the developer to determine acceptable areas considered suitable for wind energy development within a broader area in the Northern Cape Province (Savannah Environmental, 2011). The study area consisted of an area of approximately 36 0000 km^2 (225km x 160km). Within this study area, an area near De Aar in the Northern Cape where the Castle Wind Energy Facility site is located, was considered as a possible site for development of a wind energy facility. A summary of the methodology and process applied in the evaluation of the developer's identified sites and the findings of the study are given in the sections below.

4.1. Identification of the Northern Cape Area for further Investigation

The potential to establish new wind energy facility developments on five sites near De Aar and Copperton in the Northern Cape Province was identified by juwi Renewable Energies (Pty) Ltd. The sites were identified as having potential for wind energy facility development and included Portion 12 & 13 of the Farm 165, (Vendussie Kuil) and the remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The sites were identified as having potential for the installation of wind turbine generators on the basis of various technical criteria, including the wind resource, accessibility of the site, accessibility to the Eskom grid, and local site topography. As part of a pre-feasibility assessment which included site selection, a high level Regional Site Assessment was undertaken for a larger study area in the Northern Cape covering an area of approximately 36 0000 km^2 (225km x 160km) in order to inform the developer of the environmental suitability of the identified sites for the development of a wind energy facility. The five identified site development footprints were then tested against the results.

This study was undertaken in accordance with the guidelines outlined in the *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006), as well as the Strategic Assessment mapping for the entire Western Cape Province (DEA&DP). The purpose of this Regional Site Assessment was to determine areas considered suitable for development *from an environmental perspective* within the broader study area, and then to test the suitability of the five identified sites against these results. The Regional Site Assessment approach therefore served as a site risk assessment tool from an environmental acceptability perspective – that is, a process to highlight or red-flag potential issues of concern prior to initiating a full EIA process for a proposed site.

This chapter provides the outcomes of the regional assessment and technical considerations specific to the Castle Wind Energy Facility study area, and provides results which indicate the suitability of specific area for wind energy siting and development.

4.2. Criteria for testing the environmental suitability of the site

The methodology utilised is a regional level planning tool to guide project development planners (and ultimately decision-makers) with regards to the appropriate areas for development and/or the environmental suitability of identified development sites. Local level issues are not assessed in sufficient detail at this regional level, and the intention is that identified suitable or preferred areas/sites be further considered within site-specific studies and assessments (that is, through an Environmental Impact Assessment).

The objectives for the Regional Site Assessment study were therefore to:

» Provide support to a robust, technically sound and defendable site selection process.
» Confirm the areas of suitability within the larger study area for wind energy development from an environmental perspective.
» Confirm the appropriateness of the sites identified for the establishment of a wind energy facility/ies (ensuring that technical and environmental constraints are minimised as far as possible).
» Define and understand any constraints associated with the identified sites for development (in terms of the outcome of the Regional Assessment study).
» Provide support to an application for authorisation to DEA for the preferred site/s, using the findings as a motivation for the site/s for which application is made.

The regional site assessment involved testing the proposed development site against the environmental and planning criteria as listed in the wind regional environmental assessment of the Western Cape Province, to determine the potential environmental suitability of the site, as well as highlight any red flags.

The aim of the Regional Assessment study was to undertake both a Criteria Based analysis[2] and a Landscape Based analysis[3] and to merge the results of the two studies in order to

[2] The Criteria Based assessment forms the foundation of the Regional Methodology (Elements of Method 1 from DEA&DP guideline document).
[3] Landscape Assessment as a vital component, incorporating character analysis, sensitivity, value and capacity considerations (Elements of Method 2 from DEA&DP guideline document).

identify Preferred, Negotiable and Restricted Zones for wind energy development. Detailed planning, including the use of criteria and thresholds, was used to designate areas of suitability for the development of wind energy facilities specifically. The input categories for the Criteria Based Method included, but were not limited to:

- » Environmental criteria that could be negatively affected by the construction and operation of a wind energy facility (e.g. national parks, nature reserves, rivers, wetlands, etc.)
- » Topographical information
- » Urban and industrial planning criteria
- » Infrastructure criteria that could negatively affect the placement of a wind energy facility (e.g. airports, military installations, etc.)
- » Vertically disturbed landscape corridors (major transmission lines, railway lines, etc.)

The input categories for the Landscape Based Method included aspects such as:

- » Major scenic drives, routes of tourism importance
- » Local scenic drives or "cultural" routes
- » Defined historical or heritage sites
- » Scenic areas, areas of natural beauty
- » Viewshed analysis/visual exposure
- » Landform/land cover analysis

The combined results of the two methods were merged to highlight the site's environmental suitability for a wind energy development.

4.3. Data Sources for the Regional Assessment

Data was compiled in accordance with the data layers utilised in the Western Cape Provincial Government document: *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape*.

4.4. Results of the Regional Site Assessment

The input components resulted in various layers of information that were merged using GIS to form a combined dataset (various combinations of positive and negative criteria) which have defined **preferred areas/zones for development** based on environmental and planning criteria. The table below indicates the possible combinations (based on the DEA&DP study) that resulted in the preferred areas for development index that is displayed in the map legend.

No.	Description	Preference
1	Areas with more than 1 negative criteria	Highly restricted/constrained
2	Areas with one negative criteria	Restricted/constrained
3	Neutral areas (no positive or negative criteria)	Negotiable
4	Areas with one positive criteria (and no negative criteria)	Preferred
5	Areas with more than one positive criteria (and no negative criteria)	Highly preferred

The rating system utilised within the updated DEA&DP SEA takes a more 'risk adverse approach' than that put forward by the initial DEA&DP guideline. The rating system assumes that a criteria rated as negative would always override a criteria rated as positive. Definitions of the terms used to define the level of preference are as follows:

» ***Highly Preferred / Preferred:*** Low landscape value with a high to low capacity for change. Wind energy facility development may be possible, subject to site level assessment.
» ***Negotiable:*** Low to high landscape values, but with a high capacity to absorb change. Wind energy development in these areas may be possible, subject to site level assessment.
» ***Restricted / High Restricted:*** High value landscapes combined with low capacity of landscape to adapt to change. These areas should ideally be restricted from wind energy facility development.

From the results of the desk-top mapping the majority of the full extent of the study area was indicated as being preferred for development from a planning and environmental perspective. The study areas falls virtually entirely within areas that are not restricted (as per the methodology followed). Limited areas, within the larger study area, are indicated as being highly restricted/constrained and where these areas exist, it would be possible to avoid them. This result for the larger study area is predominantly as a result of the topography (open plains), the existing impact from vertically disturbed landscapes (including power lines and substations) and the general lack of nature reserves, biospheres and conservancies in the broader area. The larger study area can be largely considered to have high suitability for development from an environmental perspective. Small areas were indicated as being restricted/constrained and highly restricted/constrained. These restrictions/constraints are largely due to:

» Localised areas of elevated relief and high-lying topography. This relates to impacts on steep slopes, as well as increased potential for visual exposure.
» The presence of rivers, drainage lines and pans
» The proximity to the De Aar Military installation

The presence of an Important Bird Area in a large portion of the study area was flagged as an important factor to consider, however this was not mapped as a constraining factor as the influence would be site specific and based on the results of long-term bird monitoring.

The broader De Aar study area was therefore largely considered to have high suitability for development from an environmental perspective.

A Composite Map was generated to show the most favourable areas for development of a wind energy facility within the study area (indicated in dark green and pale green) from an environmental perspective (refer to Figure 4.1).

4.5 Identification of a Site for Investigation in the EIA Process

The results from the testing of the proposed development site indicated that Castle Wind Energy Facility is a site of potential development based on the following conclusions from the regional assessment:

» The portions of the site associated with elevated relief are considered to be constrained to development.
» This site falls within a vegetation type known as Northern Upper Karoo and Besemkaree Koppies Shrubland Both vegetation types.These vegetation types are classified as Least Threatened and have been impacted little by transformation, with more than 95% remaining intact (Driver et al. 2005; Mucina et al., 2006). The condition of the vegetation will be confirmed through a botanical survey/assessment.
» Positive (inclusionary) criteria (including disturbed vertical landscapes) which overlap with this development site include the Hydra-Roodekuil 220kV power line which traverses the site.
» The entire site falls within the 35km buffer area of the De Aar military installation/aerodrome area, which is considered as a negotiable area with the South African Airforce (SAAF). The topography between the site and the military installation is considered highly important, as elevated topography could pose a barrier to shield the effects of wind turbines on radar at the SAAF facility.
» Part of the site (Portion 12 & 13 of Farm 165 (Vendussie Kuil)) occurs within an area identified as part of the National Protected Area Expansion Strategy.
» The site falls within the Important Bird Area (IBA) SA037 - Platberg-Karoo Conservancy. This is considered a negotiable area, but the species and frequency of occurrence of birds on the site will be confirmed through on-site monitoring.

Following the regional site assessment, it was juwi Renewable Energies' intention to proceed with an EIA process for the proposed Castle Wind Energy Facility under the project development company Castle Wind Farm (Pty) Ltd. As this Regional Site Assessment has guided juwi to site their proposed facility within an area/zone of preference (as per the regional methodology followed), no alternative locations or sites are to be considered through the EIA process. The demarcated area was an indicative area considered to be favourable/ viable for the development of a large-scale wind energy facility.

The Castle Wind Energy Facility site was considered to be the preferred location for a wind energy facility development above the three other sites which were identified and investigated through the regional assessment process, due to the proximity to the Mulilo Wind Farms near De Aar and photovoltaic (solar) energy plant on Du Plessis Dam Farm near De Aar, projects, which were awarded preferred bidder status in the REIPPP programme (Round 3). The Castle project is located directly adjacent to these facilities, and effectively acts as an infill development. Proximity to and accessibility to the grid were other factors also considered by the developer when planning the location of the Castle project.

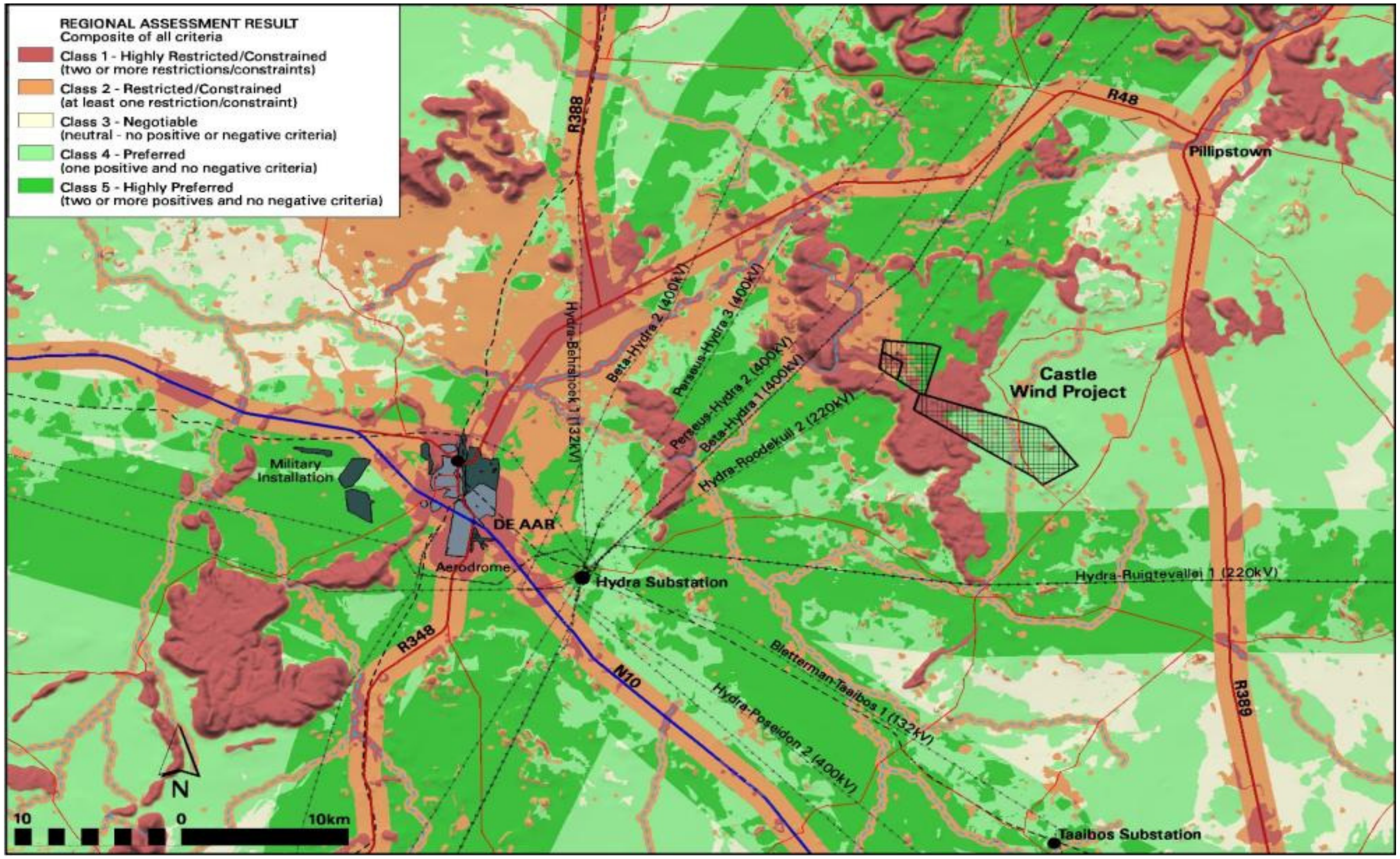


Figure 4.1: Composite map of all criteria of the Regional Assessment indicating the location of the proposed development site indicated as the Castle Wind Project

STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 5

5.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as wind energy facilities is illustrated in Figure 5.1. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed wind energy facility.

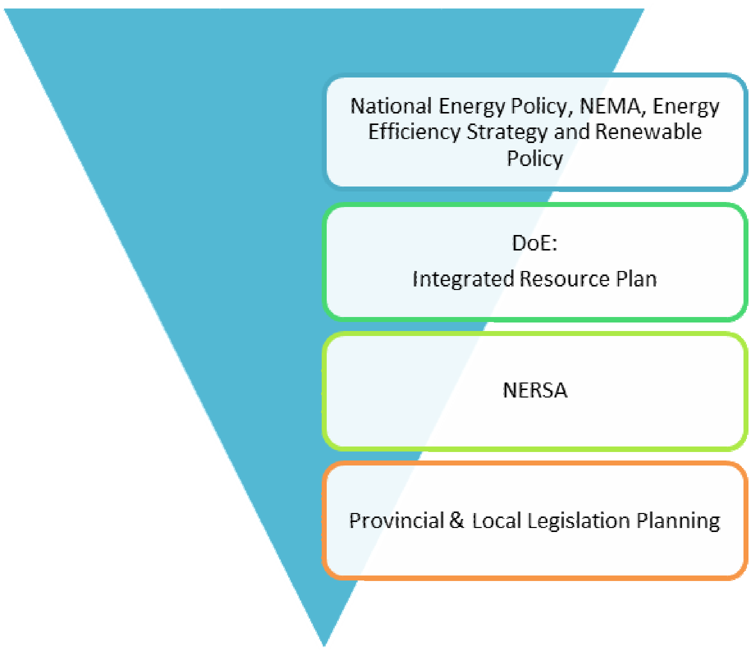


Figure 5.1: Hierarchy of electricity policy and planning documents

5.1.1 The Kyoto Protocol, 1997

South Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO_2 (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce its greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed wind energy facility) is therefore in line with South Africa's international obligations in terms of the Kyoto Protocol.

5.1.2 White Paper on the Energy Policy of the Republic of South Africa, 1998

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by DME in 1998. This White Paper identifies five key objectives for energy supply within South Africa, i.e.:

» increasing access to affordable energy services;
» improving energy sector governance;
» stimulating economic development;
» managing energy-related environmental impacts; and
» securing supply through diversity.

Furthermore, the National Energy Policy identifies the need to undertake an Integrated Energy Planning (IEP) process and the adoption of a National Integrated Resource Planning (NIRP) approach. Through these processes, the most likely future electricity demand based on long-term southern African economic scenarios can be forecasted, and provide the framework for South Africa to investigate a whole range of supply and demand side options.

5.1.3 White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)

Internationally there is increasing development of the use of renewable technologies for the generation of electricity, primarily due to concerns related to climate change, reduction in greenhouse gas emmisions and exploitation of fossil fuel resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with addressing the following challenges:

» Ensuring that economically feasible technologies and applications are implemented;
» Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
» Addressing constraints on the development of the renewable industry.

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

5.1.4 Final Integrated Resource Plan 2010 - 2030

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions

The document outlines the proposed generation new-build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new-build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW.

The DoE has released a draft Integrated Energy Planning Report (June 2013) for public comment. The Draft Integrated Energy Planning Report gives insight on the possible implications of pursuing alternative energy policy options in South Africa. Once the implications of all the alternative options have been explored and evaluated against each of the eight (8) key objectives, final recommendations will be made in the form of the Final IEP Report.

5.15 Department of Energy Process for Independent Power Producers (IPP)

In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Castle Wind Farm (Pty) Ltd proposes the establishment of the Castle Wind Energy Facility to add new capacity to the national electricity grid. Castle Wind Farm (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (i.e. typically for a period of 20 - 25 years) in order to build and operate the proposed wind energy facility. As part of the agreement, Castle Wind Farm would be remunerated per kWh by Eskom or subsequent authority/market operator. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned, or the power purchase agreement renegotiated and extended.

The IPP will undergo a bidding process in which the Department of Energy will determine preferred bidders. A Preferred Bidder will be held to comply with the price and economic development proposals in its bid, with regular reporting to demonstrate compliance during the life span of the project.

The DoE REIPPP Programme is currently underway, with the preferred bidders having been awarded a total of 3 916MW across 7 of the 9 Provinces. Construction on many of these has already commenced. The government signed contracts for 47 IPP projects (in 2012 and 2013 from the Round 1 and Round 2 projects), and have awarded a further 17 projects in Round 3. Castle Wind Farm (Pty) Ltd intend bidding the project to the DoE for the bid submission in 2015.

5.2 Provincial and Local Level Developmental Policy

5.2.1 Northern Cape Growth and Development Strategy (2004-2014)

The Provincial Growth and Development Strategy (PGDS) notes that the most significant challenge that the government and its partners in growth and development are confronted with is the reduction of poverty. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The PGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

- Agriculture and agro-processing;
- Fishing and mariculture;
- Mining and mineral processing;
- Transport;
- Manufacturing; and
- Tourism.

However, the PGDS also notes that economic development in these sectors also requires:

- Creating opportunities for lifelong learning;
- Improving the skills of the labour force to increase productivity;
- Increasing accessibility to knowledge and information.

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

- Developing requisite levels of human and social capital;
- Improving the efficiency and effectiveness of governance and other development institutions;
- Enhancing infrastructure for economic growth and social development.

Of specific relevance to this project, the PGDS make reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape, the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the Province's natural resource endowments must be encouraged. In this regard the PGDS notes "the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc, could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The PGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The PGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the Province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed wind energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape.

The PGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the Province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. It is noted that attention should be paid to ensuring that the development of large renewable energy projects, such as the proposed wind energy facility, do not negatively affect the region's natural environment or the tourism potential of the Province.

5.2.2 Local & District Level Integrated Development Plans

The majority of the site falls within the Emthanjeni Local Municipality. A small section of the site falls within the Renosterberg Local Municipality. For relevance, the Emthanjeni Local Municipality's IDP and the greater Pixley ka Seme District Municipality's IDP are discussed here. The Emthanjeni Local Municipality's IDP (2012) identified a number of key performance areas (KPAs). These KPAs address the outcome of an analysis of the status quo across numerous sectors within the ELM and include the following:

» Basic Service Delivery;
» Local Economic Development;
» Environmental Management;

» Social Development;
» Good Governance and Public Participation;
» Safety and Security;
» Cross-Cutting Issues;
» Municipal Financial Viability and Management; and
» Municipal Institutional Transformation.

These KPAs aim to utilise existing economic strengths and opportunities by transferring these into workable programmes and projects. These programmes and projects tend to reduce the current threats, and strengthen the weaknesses in the local economic environment. The IDP KPAs that are relevant to the proposed energy facility include:

» Basic Service Delivery: Energy is highlighted as one of the priority issues for the ELM with respect to basic services; and,
» Local Economic Development (LED): Micro and macro-economic development and land use management are highlighted as one of the priority issues for the municipality.

The Municipality identified a number of industrial and manufacturing projects that form part of their strategy for the economic development within the area. These include amongst others:

» The development of N10 Corridor;
» Revitalisation of the rail infrastructure;
» Development of industrial sites (Hanover / Britstown);
» Urban Renewal Programme (Renewal of Townships);
» A Logistics hub (De Aar); and
» A Renewable Energy hub (De Aar).

The proposed wind energy facility therefore is in line with the development of a Renewable Energy hub in the region around De Aar, as highlighted in the Emthanjeni Local Municipality's IDP (2012-2013) and the Pixley ka Seme District's IDP (2009-2012).

5.3 Project Planning and the site-specific Environmental Impact Assessment

In terms of the EIA Regulations under NEMA, a Scoping and EIA report (including an environmental management programme (EMPr)) are required to be compiled for this proposed project. The EIA is considered as an effective planning and decision-making tool in the planning process of a new power generation facility. It allows potential environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed through project design and implementation. The level of detail at a site-specific level is refined through the process, and allows for resolution of potential issue(s) through dialogue with affected parties.

The relationship between project development and the environmental assessment and management process is depicted in the figure below.

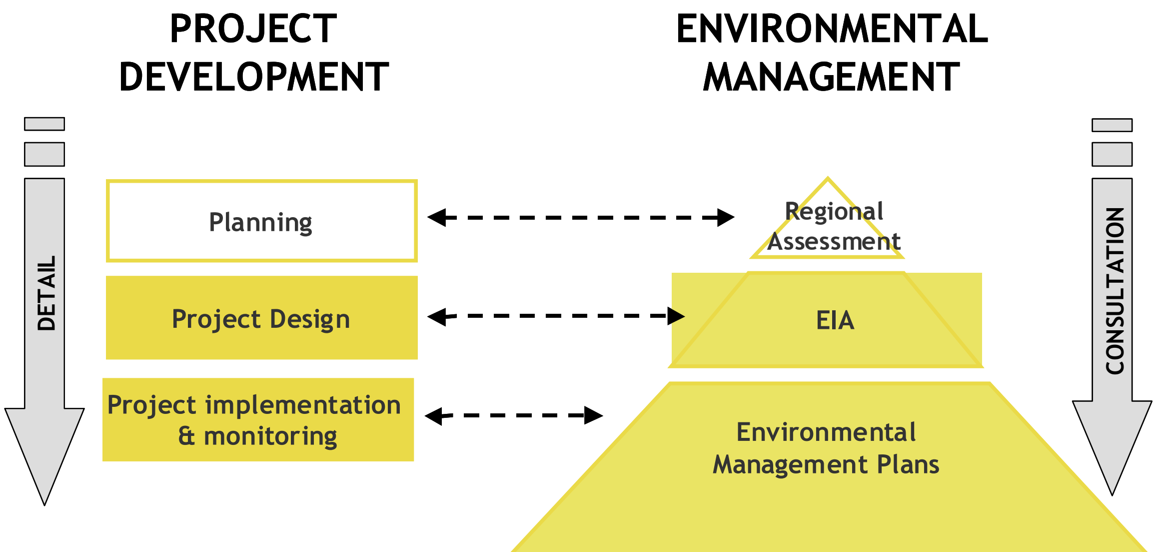


Figure 5.2: Diagram depicting the relationship between project development and environmental management

The project planning phase for the Castle Wind Energy Facility included a detailed site selection process, as well as the environmental suitability of the site being confirmed through an environmental screening process undertaken by Savannah Environmental. This site screening process is detailed further in Chapter 4 of this Draft Environmental Impact Assessment Report.

The environmental screening process considered a high-level region for possible development. Within this region, the developer proposed a site. This entire extent of the site has been considered in this Draft Environmental Impact Assessment Report to determine any environmental sensitivity and/or fatal flaws and to inform the layout of the wind energy facility.

APROACH TO UNDERTAKING THE EIA PROCESS CHAPTER 6

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: i.e. **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an Environmental Management Programme (EMPr)) to the competent authority for decision-making. The EIA process is illustrated below:

Figure 6.1: Phases within the EIA Process

The EIA Phase for the proposed Castle Wind Energy Facility and associated infrastructure has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of 18 June 2010, as amended in December 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations. This chapter serves to outline the EIA process that was followed.

6.1. Phase 1: Scoping Study

The Scoping Study, which was concluded in January 2014 with the acceptance of the Scoping Report by DEA, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed Castle Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

The draft Scoping Report compiled was made available at the following public venues for I&AP review and comment from 26 October 2013 to 04 November 2013:

» De Aar Public Library – 21 Station Street, De Aar
» Phandulwazi Library – Nanzwakazi Location, Hlithani Street, De Aar
» Emthanjeni Local Municipality Offices – 45 Voortrekker Street, De Aar
» Frans Jooste Library – Bree Street, Philipstown
» Renosterberg Local Municipality – Green Street, Philipstown
» The report was also available for download from www.savannahSA.com

All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report and Plan of Study for EIA. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) on 03 December 2013. The Final Scoping Report was accepted by the DEA in 30 January 2014 (refer to Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project in line with the Plan of Study for EIA as stated in the Scoping Report. In addition, it is required that comments from the relevant organs of state are submitted with the Final Environmental Impact Assessment Report (EIAR), and that the EIAR is to contain a construction and operational phase Environmental Management Programme (EMPr).

6.2. Phase 2: Environmental Impact Assessment Phase

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess identified feasible alternatives put forward as part of the project.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits associated with all phases of the project including design, construction, operation, and decommissioning, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

6.3. Overview of the EIA Phase

The EIA Phase was undertaken in accordance with the EIA Regulations published in GN 33306 of 18 June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed in detail below.

6.3.1. Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and EIA report. Consultation with the regulating authorities (i.e. DEA and NC DENC) has continued throughout the EIA process. On-going consultation included the following:

» Submission of a Final Scoping Report (December 2013) following a public review period (and consideration of stakeholder comments received).
» Correspondence with DEA and NC DENC in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

The following was undertaken as part of this EIA process:

» Submission of a Draft Environmental Impact Assessment (EIA) Report for a 40 day public review period.

» Provision of an opportunity for DEA and NC DENC representatives to visit and inspect the proposed site once the Final EIA Report has been submitted to the DEA for review.
» Consultation with Organs of State that may have jurisdiction over the project:
  * National Department of Environmental Affairs
  * National Energy Regulator of South Africa (NERSA)
  * Department of Energy
  * Department of Water and sanitation
  * Department of Agriculture, Forestry and Fisheries
  * Department of Mineral Resources
  * Department of Science and Technology
  * Northern Cape Department of Environment and Nature Conservation (NC DENC)
  * Department of Transport and Public Works and various District Roads Departments
  * Department of Land Affairs
  * <u>Department of Communications</u>
  * <u>Northern Cape Department of Agriculture, Land Reform and Rural Development</u>
  * Civil Aviation Authority (SACAA)
  * Emthanjeni Local Municipality
  * Renosterberg Local Municipality
  * Pixley Ka Seme District Municipality
  * The South African Airforce (SAAF)
  * South African Heritage Resources Agency (SAHRA)
  * Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
  * South African National Roads Agency Limited (SANRAL)
  * SANParks
  * Eskom
  * Telkom SA Ltd
  * Sentech
  * Square Kilometer Array (SKA)

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within this Final EIAR. A record of the authority consultation in the EIA process is included within **Appendix E**.

6.3.2. Public Involvement and Consultation: EIA Phase

The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.

» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to **Appendix C** for a listing of recorded parties). Adjacent landowners were identified and informed of the project (refer to landowner map in **Appendix P**). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA process and the project database has been updated on an on-going basis.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by Savannah Environmental through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders and parastatals (refer to Table 6.1).

Table 6.1: Key stakeholder groups identified during the EIA Phase

Organs of State
National Government Departments
Department of Agriculture, Forestry and Fisheries
Department of Communications
Department of Energy
Department of Mineral Resources
Department of Public Works
Department of Rural Development and Land Reform
Department of Science and Technology
Department of Water and Sanitation
South African Airforce (SAAF)
South African National Parks (SANParks)
Government Bodies and Institutions
Eskom SOC Ltd
National Energy Regulator of South Africa (NERSA)

Sentech
South African Civil Aviation Authority (SACAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
Square Kilometre Array: Southern Africa
Telkom SA Ltd
Provincial Government Departments
Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
Northern Cape Department of Agriculture, Land Reform and Rural Development
Northern Cape Department of Environment and Nature Conservation (DENC)
Northern Cape Department of Roads and Public Works
Local Government Departments
Emthanjeni Local Municipality
Renosterberg Local Municipality
Pixley Ka Seme District Municipality
Conservation Authorities
BirdLife South Africa
Wildlife and Environment Society of South Africa (WESSA)
Landowners
Affected landowners and tenants
Neighbouring landowners and tenants

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA Phase were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA Process and the project database has been updated on an on-going basis.

» **Newspaper Advertisements**

As part of the EIA phase a newspaper advert was placed in the De Aar Echo and Die Volksbald to:

- notify and inform the public of the proposed project and invite members of the public to register as I&APs
- inform the public of the review period for the Draft EIA Report

The adverts were placed as follows:

- Afrikaans advert in **Die Volksbad** on the **02 December 2014.**
- English advert in the **De Aar Echo** on the **05 December 2014**

» **Stakeholder Engagement**
In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA phase, including:

- **Focus group meetings** (stakeholders invited to attend- 14-15 January 2014)
- **Public feedback meeting** (public invited to attend- 14 January 2014)
- One-on-one **consultation meetings** where required (for example with directly affected or surrounding landowners)
- **Telephonic consultation** sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants)
- Written, faxed or e-mail **correspondence.**

Record of all consultation undertaken during the EIA phase is included within Appendix E.

6.3.3 Notification of the EIA Process

In order to notify and inform the public of the proposed project and invite members of the public to register as interested and affected parties (I&APs), the project and EIA process was advertised in the De Aar Echo and Die Volksblad on 23 August 2013.

In addition, site notices were placed on site and in public places on 21 August 2013 (farm entrance gates, the public library in De Aar and municipal office in De Aar) in accordance with the requirements of the EIA Regulations

In addition to the above advertisements and notices, key stakeholders and identified I&APs were notified in writing of the commencement of the EIA process. These parties included, inter alia:

» Relevant parties from municipalities potentially affected by the proposed project.
» The affected landowners and neighbouring landowners
» Organs of State having jurisdiction in respect of any aspect of the activity, including:
  * National Department of Environmental Affairs
  * National Energy Regulator of South Africa (NERSA)
  * Department of Energy
  * Department of Water and sanitation
  * Department of Agriculture, Forestry and Fisheries

* Department of Mineral Resources
* Department of Science and Technology
* Northern Cape Department of Environment and Nature Conservation (NC DENC)
* Department of Transport and Public Works and various District Roads Departments
* Department of Land Affairs
* Department of Communications
* Northern Cape Department of Agriculture, Land Reform and Rural Development
* Civil Aviation Authority (SACAA)
* Emthanjeni Local Municipality
* Renosterberg Local Municipality
* Pixley Ka Seme District Municipality
* The South African Airforce (SAAF)
* South African Heritage Resources Agency (SAHRA)
* Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
* South African National Roads Agency Limited (SANRAL)
* SANParks
* Eskom
* Telkom SA Ltd
* Sentech
* Square Kilometer Array (SKA)

Copies of all the advertisements placed and notices distributed are contained in Appendix E of this report. Copies of these letters distributed to the above mentioned organs of state/ key stakeholders are included in Appendix E of this report.

6.3.4. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Report (refer to Appendix E for the Comments and Response Reports compiled through the EIA Process to date).

The Comments and Response Report includes responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

6.3.5. Public Review of Draft Environmental Impact Assessment Report

The Draft EIA Report was made available for a 40 day public review period from **01 December 2014 –28 January 2015** at the following locations:

» De Aar Public Library – 21 Station Street, De Aar
» Phandulwazi Library – Nanzwakazi Location, Hlithani Street, De Aar
» Emthanjeni Local Municipality Offices – 45 Voortrekker Street, De Aar
» Frans Jooste Library – Bree Street, Philipstown
» Renosterberg Local Municipality – Green Street, Philipstown
» The report is also available for download from www.savannahSA.com

In order to facilitate comments on the Draft Environmental Impact Assessment Report, all registered I&APs were notified of the availability of the report by letter. An advert was placed in the De Aar Echo and Die Volksbad, to inform the public and I&APs of the availability of the Draft EIAR for review. The public meeting was held on the 14 January 2014 at the De Aar East Community Hall at 18h00. A Land owner focus group meeting was held on the 15 January 2014 at Mr Andries van der Merwe's Farm (Vandussie Kuil) at 12h30.

6.3.6. Final Environmental Impact Assessment (EIA) Report

The final stage in the EIA Phase entailed capturing of responses from I&APs on the Draft EIA Report in order to refine this report. This Final EIA report is submitted to the decision-making Authorities, and it is this Final report upon which a decision is made regarding the proposed project.

Table 6.2: Summary of Public Involvement Process undertaken to date

	Activity	**Date**
Scoping Phase	Placement of newspaper advert in local newspapers notifying the public and interested parties of the project.	23 August 2013
	Placement of site notices on-site & in public places	21 August 2013
	Distribution of a stakeholder letter, background information document to authorities, ward councillors, landowners within the study area, neighbouring landowners and stakeholder groups	August 2013 – September 2013
	Placement of newspaper advert in local newspapers informing interested and affected parties of the availability of the Draft Scoping Report and Public Meeting date.	27 – 28 September 2013

	Activity	Date
	40-day public review period for the Draft Scoping Report for public comment.	26 September 2013 to 04 November 2013
	Public Meeting	26 September 2013
	Focus group meetings	26-27 September 2013
	Notification to registered I&APs of submission of Final Scoping Report to DEA	November 2013
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting	02 & 05 December 2015
	40-day public review period for the Draft Environmental Impact Assessment Report for public comment	01 December 2014 to 28 January 2015

6.4. Assessment of Issues Identified through the EIA Process

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in the table below.

Table 6.3: Specialists involved in the assessment of impacts

Specialist	Area of Expertise	Refer Appendix
Simon Todd of Simon Todd Consulting	Ecology	Appendix F
Toni Belcher and Dana Grobler	Freshwater Assessment	Appendix G
Jon Smallie of WildSkies Ecological Services	Avifauna (including long-term monitoring)	Appendix H
Werner Marais of Animalia	Bats (including long-term monitoring)	Appendix I
Johan van Tol of HydroPedological Solutions	Soil, erosion and agricultural potential	Appendix J
Morne de Jager of Enviro Acoustic Research	Noise	Appendix K
Lourens du Plessis of MetroGIS	Visual	Appendix L
Tony Barbour (Environmental Consultant and Researcher)	Social	Appendix M

Jaco van der Walt of Heritage Contracts and Archaeological Consulting cc	Archaeology and Heritage	Appendix N
Barry Millsteed	Palaeontology	Appendix P

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the wind energy facility. Issues were 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.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);
  * Assigned a score of 4 is highly probable (most likely); and
  * Assigned a score of 5 is 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.
- 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)P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area);
- **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated); and
- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As the project developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An Environmental Management Programme has been included as **Appendix Q**.

6.5. Regulatory and Legal Context

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and local levels. As a renewable energy development is a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for the renewable energy facility project and the related statutory environmental assessment process.

6.5.1. Regulatory Hierarchy

At **National Level**, the main regulatory agencies are:

» *Department of Energy*: This department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provide legislative protection for listed or proclaimed heritage sites.
» *Department of Transport – South African Civil Aviation Authority (SACAA):* This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *South African National Roads Agency Limited (SANRAL):* This department is responsible for all National road routes.
» *Department of Water and Sanitation (DWS):* The DWA is mandated to manage South Africa's water resources by ensuring the security and quality thereof. This Department is responsible for evaluating and issuing licenses pertaining to water use.
» *The Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. This Department has published a guideline for the development of wind farms on agricultural land. Deals with sub-division or registration of a long term lease on agricultural land. Consent from this Department is required for the development and reckoning of the land to be utilised by the wind energy facility.
» *Department of Mineral Resources*: A Section 53 Application is required in terms to this Department. DMR consent required.

At **Provincial Level**, the main regulatory agencies are:

» *Provincial Government of the Northern Cape – Department of Environment and Nature Conservation (Northern Cape DENC).* This department is the commenting authority for this project.

» *Department of Transport and Public Works - Northern Cape.* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Northern Cape Department of Agriculture and Rural Development* – This is the provincial authority responsible for matters affecting agricultural land.
» *Northern Cape Heritage*: provides legislative protection for listed or proclaimed heritage sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, the local and district municipalities (Emthanjeni Local Municipality, Renosterberg Local Municipality and Pixley Ka Seme District Municipality) play a role. In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

There are also numerous non-statutory bodies such as wind energy associations and environmental lobby groups that play a role in various aspects of planning and the environment that will influence wind energy development.

6.5.2 Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Scoping Report:

» National Environmental Management Act (Act No. 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA)
» Municipal Integrated Development Plans;
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in the scoping report, and to be addressed in the EIA. A listing of relevant legislation identified at this stage of the process is provided in Table 6.4.

Table 6.4: Initial review of relevant policies, legislation, guidelines and standards applicable to the proposed Castle Wind Energy Facility EIA

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No. 107 of 1998)	» NEMA requires, inter alia, that: ∗ Development must be socially, environmentally, and economically sustainable. ∗ Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. ∗ A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions. » EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. » In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority charged by NEMA	» National Department of Environmental Affairs (DEA) » Northern Cape Department of Environment and Nature Conservation (NC DENC)	» The Final EIA Report is to be submitted to the DEA for review and decision making. » The NC DENC is the commenting authority.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	with granting of the relevant environmental authorisation. » In terms of GNR 543 of 18 June 2010, a Scoping EIA Process is required to be undertaken for the proposed project.		
National Environmental Management Act (Act No. 107 of 1998)	» A project proponent is required to consider a project holistically and to consider the cumulative effect of potential impacts. » In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with a project is avoided, stopped or minimised.	» DEA	» While no permitting or licensing requirements arise directly, the holistic consideration of the potential impacts of the proposed project has found application in the EIA process. » The implementation of mitigation measures are included as part of the Draft EMPr and will continue to apply throughout the life cycle of the project.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	» In terms of the Biodiversity Act, the developer has a responsibility for: * The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). * The application of appropriate environmental management tools	» DEA	An Ecological Impact Assessment has been undertaken as part of the EIA process. » A permit may be required should any listed plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	to ensure integrated environmental management of activities. * Limit further loss of biodiversity and conserve endangered ecosystems. » In terms of S57, a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 4. In this regard the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. » In terms of S75, (1) The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs. (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	damage to the environment. (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating, or re-establishing itself in any manner. » In terms of GNR 152 of 23 February 2007: regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements. » In terms of GNR 1002 on 9th December 2011: National List of Threatened Ecosystems published under S52(1)(a) of the Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	(2004). » GNR1187 Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List published under S56(1)of the Act.		
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	» The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. » In terms of the regulations published in terms of this Act (GN 921, 29 November 2013), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that (a) The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste; (b) Adequate measures are taken to prevent accidental spillage or leaking; (c) The waste cannot be blown away; (d) Nuisances such as odour, visual impacts and breeding of vectors do not arise; and (e) Pollution of the environment and	» DEA » NC DENC	» As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. » Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act. This is detailed in the EMPr for the project. » The volumes of waste to be generated and stored on the site during construction and operation of the power line will not require a waste license (provided these remain below the prescribed thresholds).

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	harm to health are prevented.		
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	» S18, S19 and S20 of the Act allow certain areas to be declared and managed as "priority areas" » Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. » Dust control regulations promulgated in November 2013 may require the implementation of a dust management plan.	» DEA » NC DENC	» While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction phase of the project. » The Air Emissions Authority (AEL) may require the compilation of a dust management plan.
National Water Act (Act No. 36 of 1998)	» Under S21 of the act, water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation. » In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» National Department of Water Affairs » Northern Cape Department of Water Affairs	» A water use license is required to be applied for or obtained if infrastructure (such as access roads or cabling) impacts on a wetland or watercourse (Section 21c and i). » If ground or surface water is planned to be abstracted for use at the facility

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			(either during construction or operation), this may also require a water use licence (Section 21a).
Environment Conservation Act (Act No. 73 of 1989)	» National Noise Control Regulations (GN R154 dated 10 January 1992)	» DEA » Local Authorities	» There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328. This must be completed as part of the EIA process for the project.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (i.e. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. » S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of	» Department of Minerals and Energy	» If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained. » Approval in terms of S53 will be required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.		
National Heritage Resources Act (Act No. 25 of 1999)	» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent » The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Standalone HIAs are not required	» South African Heritage Resources Agency	» A Phase 1 heritage impact assessment has been undertaken as part of the EIA process. » A permit may be required should identified cultural or heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Forests Act (Act No. 84 of 1998)	» In terms of S5(1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated”. » GN 1042 provides a list of protected tree species.	» Department of Agriculture, Forestry and Fisheries	» A permit would need to be obtained for any protected trees that are affected by the proposed project.
National Veld and Forest Fire Act (Act 101 of 1998)	» Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 places a duty on landowners to prepare and maintain firebreaks, and Chapter 5 places a duty on all landowners to acquire equipment and have available personnel to fight fires. » In terms of S12 the applicant would be obliged to burn firebreaks to	» Department of Agriculture, Forestry and Fisheries	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project in terms of fire prevention and management.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	ensure that should a veldfire occur on the property, that it does not spread to adjoining land. » In terms of S12 the firebreak would need to be wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. » In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.		
Hazardous Substances Act (Act No. 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising, or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by	» Department of Health	» It is necessary to identify and list all the It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. » The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.	» Provincial Department of Transport (provincial roads) » South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		power station components may not meet specified dimensional limitations (height and width).
Conservation of Agricultural Resources Act (CARA) (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5). » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	Department of Agriculture, Forestry and Fisheries	This Act will find application during the EIA and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.
Development Facilitation	Provides for the overall framework and	Emthanjeni Local Minicipality	The applicant must submit a

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Act (Act No 67 of 1995)	administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for land development and conflict resolution.	and Renosterberg Local Municipality	land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
Provincial Legislation			
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	Provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require. **Manipulation of boundary fences** 19. No Person may – (a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape	Northern Cape Department of Environment and Nature Conservation	A permit is required for any activities which involve species listed under schedule 1 or 2. The DENC permit office provides an integrated permit which can be used for all provincial and Threatened or Protected Species (TOPS)-related permit requirements.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	therefrom; The Act also lists protected fauna and flora under 3 schedules ranging from Specially protected (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1.		
Aviation Act (No. 74 of 1962)	In terms of Section 22(1) of the Aviation Act (Act No 74 of 1962) (13th amendment of the Civil Aviation Regulations (CARs) 1997) the Minister promulgated amendments pertaining to obstacle limitation and markings outside aerodromes or heliports. In terms of this act no buildings or objects higher than 45 metres above the mean level of the landing area, or, in the case of a water aerodrome or heliport, the normal level of the water, shall without the approval of the Commissioner be erected within a distance of 8 kilometres measured from the nearest point of the boundary of an aerodrome or heliport. No building, structure or other object which will project above the approach, transitional or horizontal surfaces of an aerodrome or heliport shall, without the prior approval of the Commissioner, be erected or allowed to come into existence. Structures lower than	South African Civil Aviation Authority	In terms of the proposed wind energy facility, Castle Wind Facility may need to obtain the necessary approvals from the Civil Aviation Authority (CAA) for erection of the proposed wind turbines.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	45 m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and, in addition, their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircrafts Section 14 relates specifically to wind energy facilities and it is stated that due to the potential of wind turbine generators to interfere with radio navigation equipment, no wind farm should be built closer than 35 km from an aerodrome. In addition, several other conditions relating specifically to wind turbines are included in Section 14.		

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 7

This section of the EIA Report provides a description of the environment that may be affected by the proposed Castle Wind Energy Facility near De Aar, in the Northern Cape Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development and associated infrastructure, such as the power line, have been described. This information has been sourced from both existing information available for the area as well as through site investigations. It also aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices F - O**.

7.1. Regional Setting and the Study Area

The proposed Castle Wind Energy Facility site is located in the sparsely populated region of the Karoo in the Northern Cape Province. The proposed site falls within the Emthanjeni Local Municipality and the Renosterberg Local Municipality, within the Pixley ka Seme District Municipality. The administrative center of the Emthanjeni Local Municipality is De Aar, which lies approximately 300 km south east of the provincial capital of Kimberley. The site lies ~28 km north-east of De Aar and ~22 km south-west of Philipstown. The wind energy facility is proposed to be located on the following farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The three farm portions collectively make up a broader study area of approximately 3257ha (i.e. 32.6 km^2) which is being considered for the wind energy facility and in this report. The N10 (De Aar-Hanover), R48 (De Aar-Philipstown) and R389 (Hanover-Philipstown) are the nearest tarred road links to the study area. Gravel roads off these tarred connections provide access to the study area farms. Access to the site is constrained by the local topography.

Portions 12 and 13 of the Farm 165 (Vendussie Kuil) are traversed by the Hydra to Roodekuil 2 -220kV power line. A host of other power lines traverse further northwest of the site, which congregate at the Hydra substation. These are: Hydra to Roodekuil 1- 220kV, Beta to Hydra 1 & 2 - 400kV and Perseus to Hydra 2 & 3 - 400kV. Another set of power lines traverses south of the proposed development site. The closest of these are the Hydra to Ruigtevallei 1 & 2 - 22kV lines, located just less than 7km at the closest. The Eskom Hydra Substation is located southeast of De Aar, approximately 23km from the proposed Castle Wind Energy Facility site, and the newly constructed Ilanga Lethemba Substation (Solar Capital Substation) which is located near De Aar.

Homesteads or farm residences surrounding / in proximity to the proposed wind energy facility site include: Meyersfontein, Witput, Die Dam, Leeufontein, Slingershoek, Matjiesfontein, Pienaarskloof, Kranskop, Klipfontein, Garrenboom, Vendussiekraal, Disselskuil, Groenpan, Plessisvlakte, Rooidam, Knapdaar, etc. The average population density of the District Municipality is estimated at approximately 10 people per km^2, primarily concentrated within the towns of De Aar and Philipstown.

7.2. Land Cover/ Land-Use

The vegetation of eastern side of the study area consists of Northern Upper Karoo and that of the western side was classified as Besemkaree Koppies Shrubland (Mucina & Rutherford, 2006) (refer to Figure 7.1). The current land-use is restricted to low intensity grazing. The natural grazing capacity of the site is approximately 25 hectares per large stock unit. The low rainfall, high potential evaporation, high maximum and low minimum temperatures, coupled with shallow soils covering most of the site, limits any additional land-use activities. A small area of 7.5 ha near the Rooiwal homestead in the south-eastern part of the study area, is cultivated and irrigated using borehole/groundwater. A number of non-perennial streams are present, but the dominant source of water for agricultural purposes is groundwater.

7.3 Climatic Conditions

The study area receives an average of less than 300mm rainfall per annum and is representative of the dry semi-desert climate associated with the Great Karoo. Rainfall for the site is low and is ~290 mm per annum according to the South African Rain Atlas (Water Research Commission, undated). In terms of the relationship between rainfall and evaporation the lower lying parts of the site fall into the classification of arid while the higher lying parts fall into the classification of semi-arid. The aridity is a significant limitation to agriculture in the region.

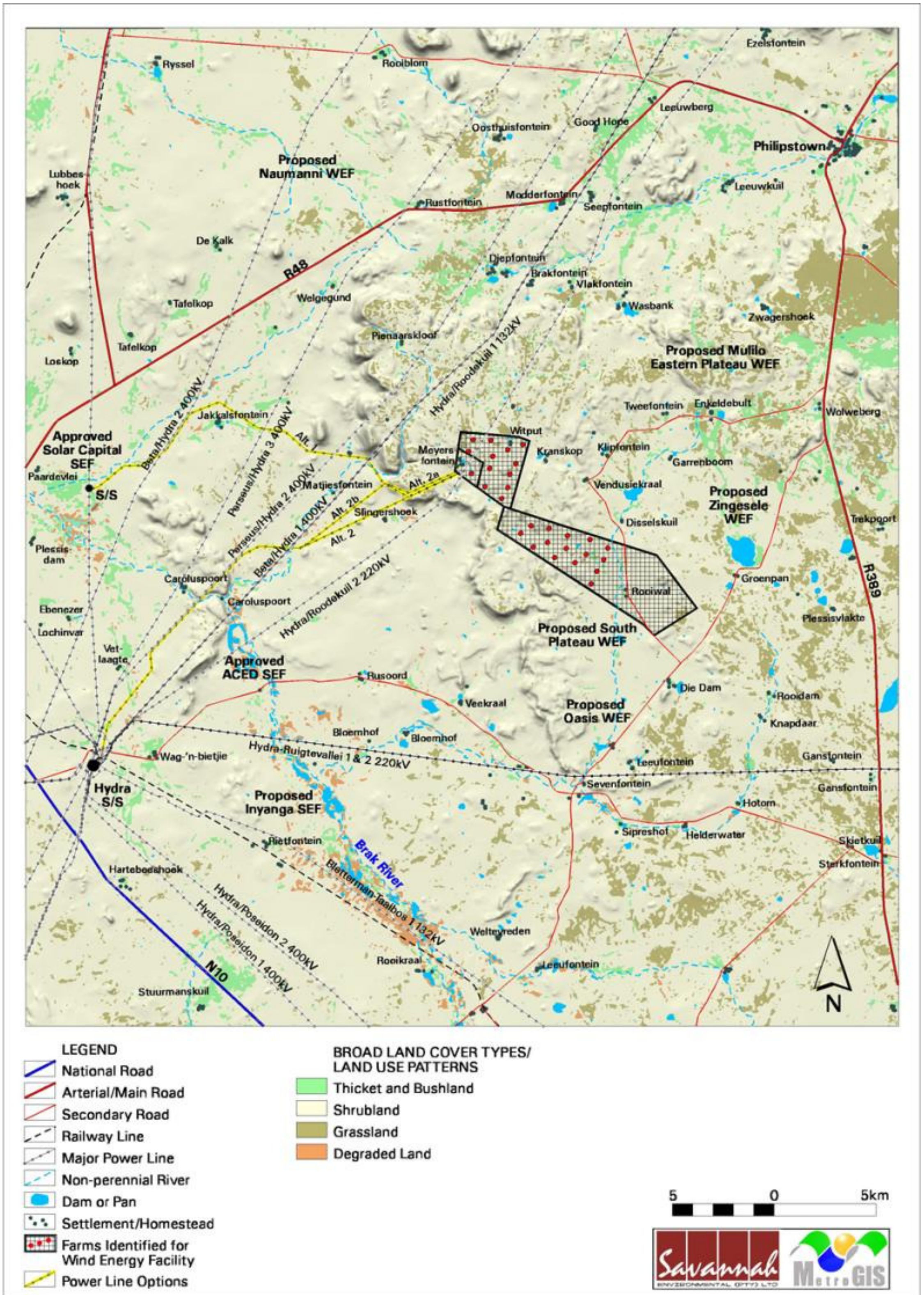


Figure 7.1: Land cover/land use map for the Castle Wind Energy Facility, as well as the broader study area

7.4. Biophysical Characteristics of the Study Site and immediate surrounds

This section of the report describes the development footprint and its immediate surroundings of the proposed Castle Wind Energy Facility.

7.4.1. Topography

The topography or terrain morphology of the region is broadly described as Lowlands with Hills of the Interior Plain. The elevation above sea level ranges from 1687m at the top of the northern section of the escarpment (near Pienaarskloof), to 1238m along the Brak River floodplain (where it leaves the study area in the west). The site itself has an undulating slope elevation with some low hills or ridges occurring in places. A shaded relief map is shown in Figure 7.2. The proposed wind energy facility site is predominantly on an elevated, mountainous plateau within the Karoo. There is a drainage valley that runs through the eastern part of the site. Elevation ranges between 1400 m in the valley to 1550 m on the highest parts of the plateau. Average slope across the site is around 3%, however the terrain is broken and also contains short slopes that are much steeper (up to 25%).

7.4.2. Hydrology

The non-perennial Brak River is the only major hydrological feature traversing the study area. The Brak River flows in a north westerly direction to the south west of the study area with a number of its tributaries crossing the site as they flow in a south-westerly direction. The main tributary of the Brak River flows southwards through the southern portion of the site. This tributary is seasonally flowing and contains an associated valley bottom wetland area consisting of low growing sedges and grasses. Most of the smaller tributaries within the study area are ephemeral and are discernible only as slightly shallow depressions with no clear associated vegetation and slightly clayey soils. Small, shallow instream dams and erosion control structures that have been constructed within many of these drainage channels. Associated with many of the streams and the small dams are small wetland areas and endorheic pans. The significant pans within the area are located outside of the site.

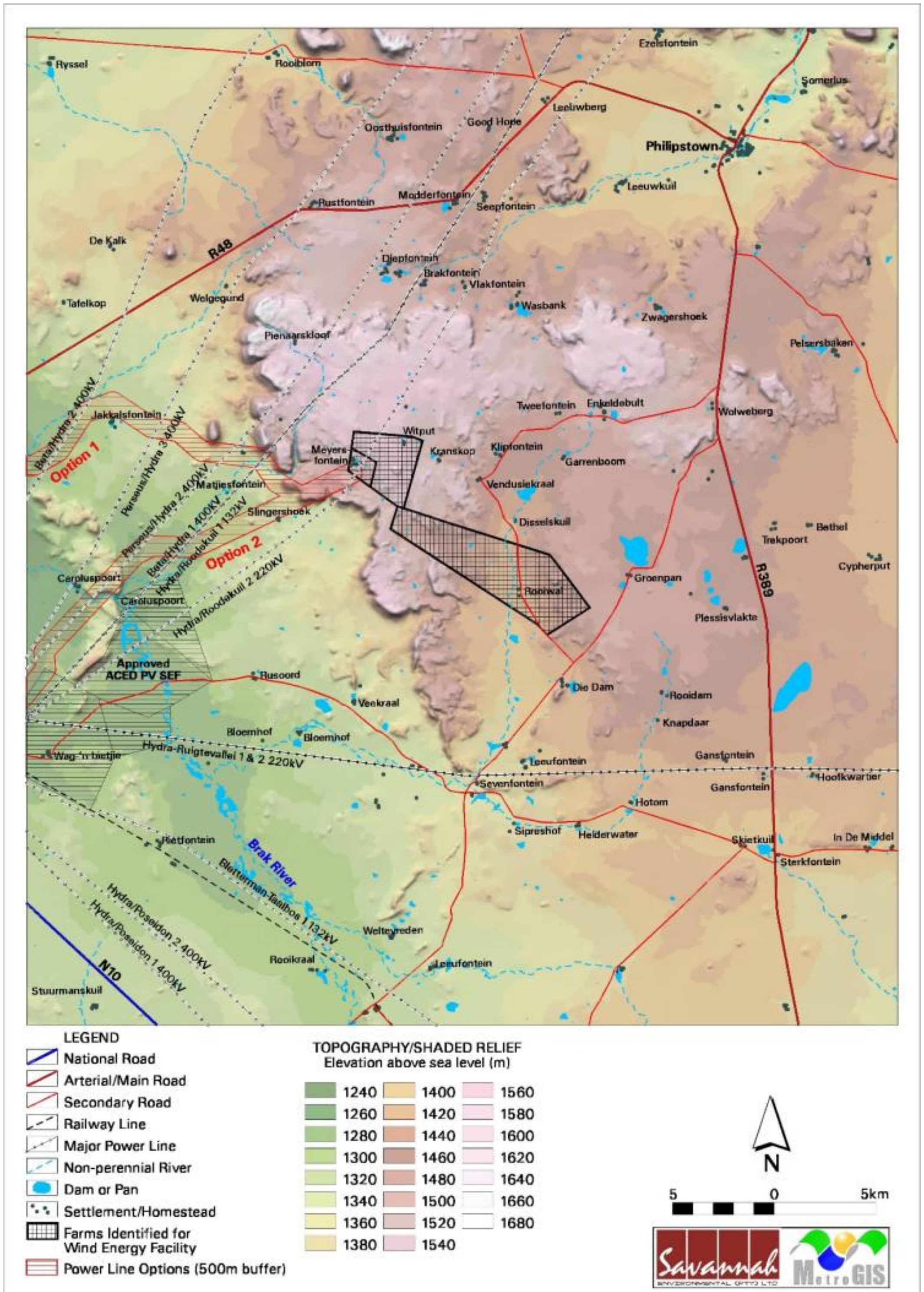


Figure 7.2: Shaded relief map indicating the location of the proposed facility and the topography and elevation above sea level

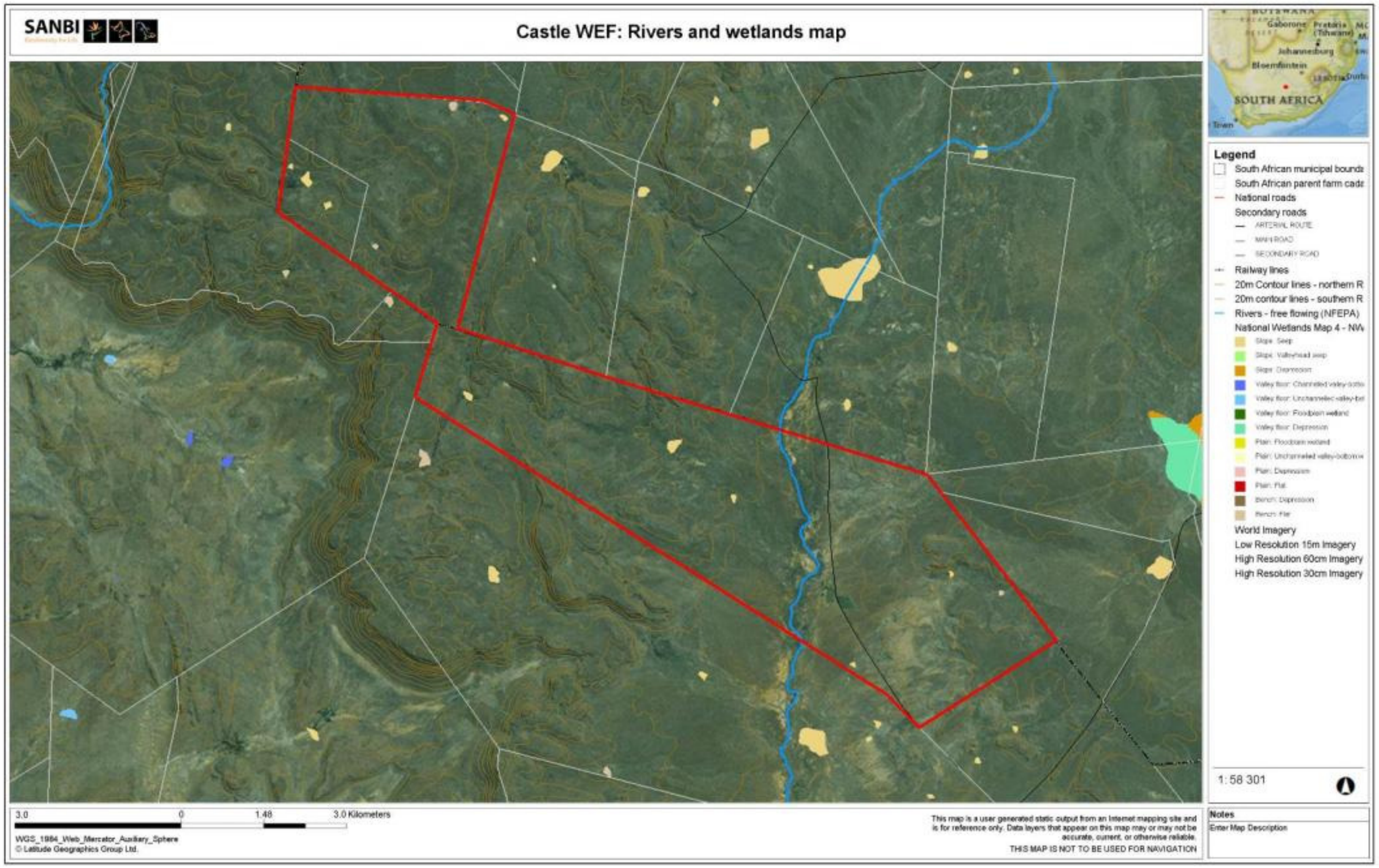


Figure 7.3: Water features within the study area

7.4.3. Geology, Soils and Agricultural Potential

The underlying geology of the site are shales, mudstones and sandstones of the Beaufort Formation, Karoo Sequence. Windblown deposits are however dominant in lower midslope and footslope positions in the south-eastern corner of the study area.

Three land types dominate the study area, namely Fb72, Fb73 and Ae142 (refer to Figure 7.3) described as follows:

» *Land type Ae142* - Ae land types (Ae142 in Figure 7.4) refers to an area where more than 40% of the soils are red, high base status soils that are deeper than 300 mm. The agricultural potential of the land covered by Ae142 is low and land-use restricted to low intensity grazing due to the climatic constraints. The potential of large parts of the land type can however be dramatically increased, should adequate irrigation water be available.

» *Land type Fb72 and Fb73* - in Fb land types (Fb72 and Fb73 in Figure 7.4), lime accumulations occur frequently in one or more of the valley bottom soils. The agricultural potential of the land covered by Fb72 and Fb73 is low due to the soil and climatic constraints.

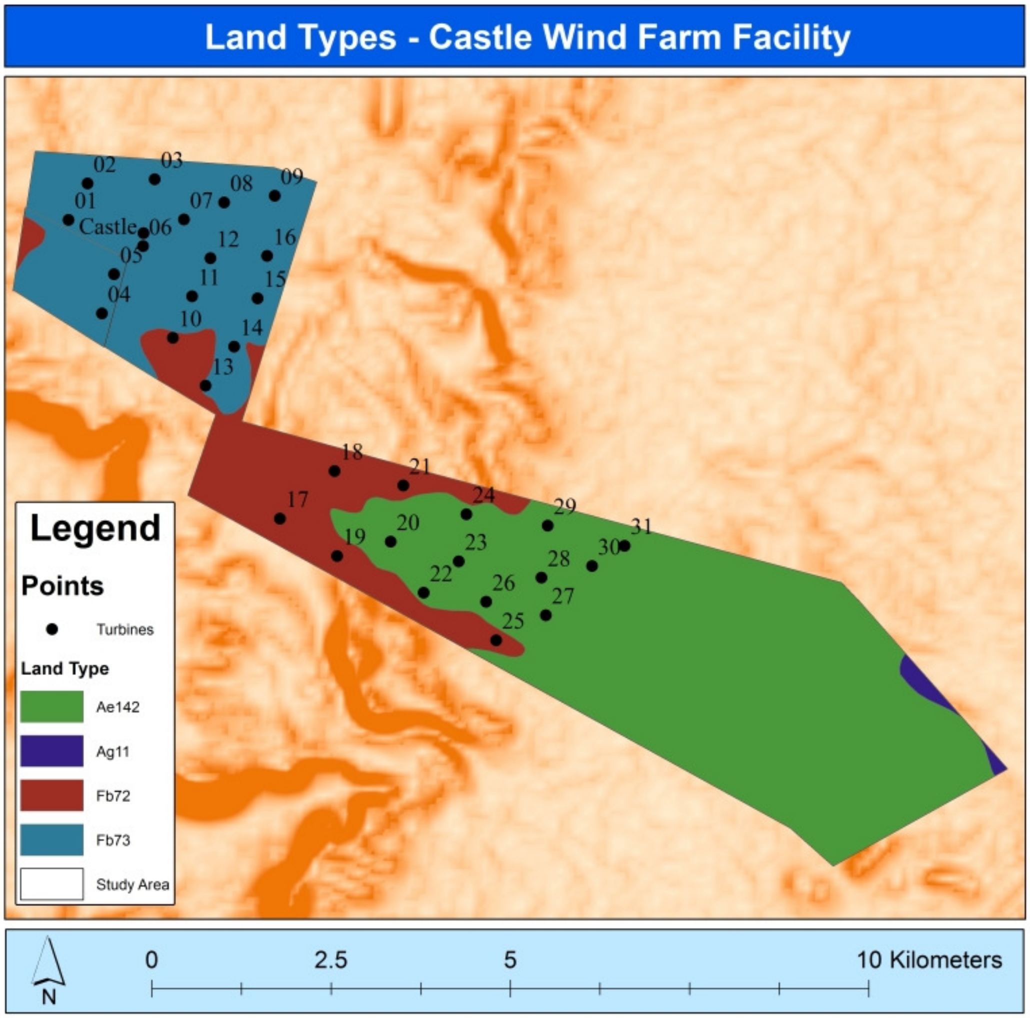


Figure 7.4: The distribution of the different land types within the Castle Wind Energy Facility site

The following six different soil associations are found on the site (refer to Figure 7.5):

- **Cv/Hu**: These are deep (>1 000 mm) well drained soils of the Hutton and Clovely soil form. These soils are derived from aeolian deposits and are restricted to the south-western corner of the study area. The clay content of these soils is low and their morphology indicates that both internal and external drainage is good. They are not sensitive to erosion.
- **Du/Sw**: These soils of the Dundee and Swartland forms occur in valley bottom positions of the site. The Du formed to alluvial depositions and alluvial stratifications are still visible. The majority of trees and large shrubs are found on these Du soils, suggesting that they can support plant growth by supplying nutrients and water even in this harsh climate. The

occurrence of Du soils are however restricted to a narrow band around the stream channels (Figure 7.4); a landscape position prone to erosion. Swartland soils show a marked increase of clay with depth and a moderate to strong structure in the B-horizon (pedocutanic). Due to the duplex nature of the Swartland soils as well as high Na^+ contents in the B-horizon, these soils are susceptible to erosion.

» **Hu/Gs**: This soil association occur on relatively flat areas of the Fb land types. The Hutton soils in this association differ dramatically from that in the Cv/Hu association. These Hutton soils are shallow (<500 mm) with abundant doleritic rocks in the profile. Glenrosa soils are shallow orthic A horizons on weathering rock (lithocutanic B horizons). The small storage capacity of these soils makes them sensitive to erosion with limited agricultural potential.

» **Ms/Gs**: This soil association is dominated by shallow (<250 mm) soils of the Mispah and Glenrosa forms. They dominate convex positions of areas with slopes >2%. The limited storage capacity of the soils limits the agricultural potential to natural grazing and makes these soils susceptible to erosion.

» **R/Ms**: This association is dominated by rock outcrops on steep slopes 5 – 55%. Limited or no storage capacity will result in overland flow due to infiltration excess and this soil association is susceptible to erosion.

» **Sw**: Swartland soils occur on relatively flat areas (slope <2%) of especially Fb land types. As discussed above, luviation of clays resulted in the duplex character of these soils. Although this particular association were found on gentle slopes, these soils can be dispersive and susceptible to erosion. The strong structure of the pedocutanic B horizon will limit root penetration and water infiltration.

Table 7.1. Summary of the soil potential of the study site.

Soil Association	Soil Forms	Current Potential	Limitations	Inherent potential for irrigation	Erosion sensitivity
Cv/Hu	Clovely & Hutton	Very low	Arid climate	Very high	Low
Du/Sw	Dundee & Swartland	Very low	Arid climate	Low	High
Hu/Gs	Hutton & Glenrosa	Very low	Arid climate and limited soil depth	Very low	Moderate
Ms/Gs	Mispah & Glenrosa	Very low	Arid climate and limited soil depth	Very low	High
R/Ms	Rocks & Mispah	Very low	Arid climate and limited soil depth	Very low	High
Sw	Swartland	Very low	Arid climate and strong structure of pedocutanic B horizon	Low	Moderate

The overall agricultural potential of the site is very low, largely restricted by aridic climate conditions and shallow soils. The Cv/Hu (refer to Figure 7.5) soil associations are the only areas of the site suitable for crop production should adequate irrigation water be available.

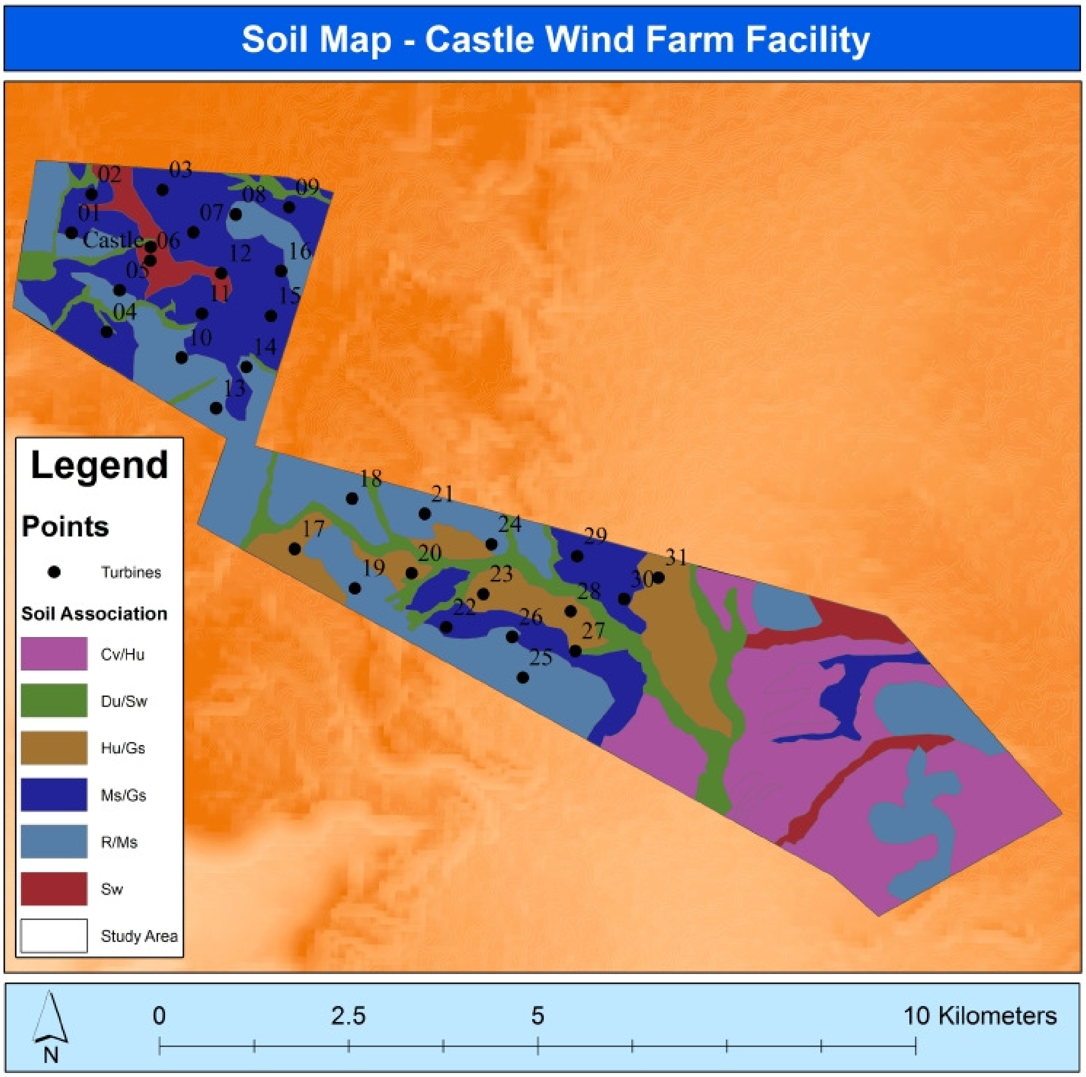


Figure 7.5. Soil association map of the study site with proposed turbine positions.

Land capability is the combination of soil suitability and climate factors. The entire site has a land capability classification, on the 8 Category scale, of Class 7 (i.e. non-arable, low potential grazing land). Land capability is limited by the mountainous, rocky terrain, the shallow soils and the aridity of the region. The site is used for sheep farming. The natural grazing capacity is low and varies between 18 - 30 hectares per large stock unit across the site. There is a very small area of cultivated, irrigated land surrounding the farm house (Rooi Kraal) which is located on the Farm Knapdaar which will not be impacted upon by the development.

7.4.4. Critical Biodiversity Areas and Conservation Planning Areas

No fine-scale conservation planning has been conducted in the area and no Critical Biodiversity Areas have been defined for the region. However, the western part of Portion 12 and 13 of the Farm 165 (Vendussie Kuil) lies within a National Protected Areas Expansion Strategy focus area (NPAES) (refer to Figure 7.6). NPAES focus areas are areas that are considered important for the expansion of the land-based protected area network as they contribute towards meeting biodiversity thresholds for terrestrial or freshwater ecosystems, maintaining ecological processes or climate change resilience. The affected NPAES focus area comprises 6400 ha and is a relatively small part of the broader 345 913ha Senqu Caledon focus area. Approximately 450ha of the NPAES focus area is actually within the site (i.e. the eastern boundary of the mapped NPAES focus area) and the loss of this area to the development would not be likely to compromise the ability to meet future conservation targets within this focus area.

The vegetation type in the area, particularly on the plains, consists of Northern Upper Karoo. This is one of the most extensive vegetation types in the country and has a low overall abundance of species of conservation concern.

7.4.5. Flora & Broad Scale Vegetation Patterns

According to the national vegetation map (Mucina & Rutherford 2006) (refer to Figure 7.6), two vegetation types (Northern Upper Karoo and Besemkaree Koppies Shrubland) occur within the site itself. The eastern part of the site consists of Northern Upper Karoo and the western part of the site consists of Besemkaree Koppies Shrubland. Both vegetation types are classified as Least Threatened and have not been significantly transformed. These vegetation types are described below and in more detail in the ecological report (Appendix F):

» *Northern Upper Karoo* is usually an open shrubland dominated by low karoo shrubs and grasses with larger elements such as *Acacia mellifera* more prominent in the north. Known endemic plant species found in this vegetation type include: *Lithops hookeriana, Stomatium pluridens, Atriplex spongiosa, Galenia exigua and Manulea deserticola*.
» *Besemkaree Koppies Shrubland* is associated with the slopes of koppies, butts, and tafelbergs within the dry grasslands of the southern and central Free State and the adjacent parts of the Northern and Eastern Cape. This vegetation type consists of an upper layer of tall shrubs, such as *Searsia erosa, S.burchellii, S.ciliata, Euclea crispa, Diospyros austro-africana* and *Olea europea subsp africana*, with an understorey of low shrubs and grasses. This vegetation type is associated with dolerite koppies and sills embedded within Karoo supergroup elements. Four vegetation-type endemics have been

recorded including *Euphorbia crassipes, Neohenrica sibettii, N.spicata* as well as an undescribed species of *Cussonia*.

Although these two vegetation are clearly differentiated on the SA Vegmap, in reality, they form a much more patchy mosaic at the site. In the west of the site, there are large tracts that have more affinity with Northern Upper Karoo than Besemkaree Koppies Shrubland. Even within this area, the flats between the rocky outcrops are consistent with Northern Upper Karoo and the north-west of the site consists of the large plain of this vegetation type.

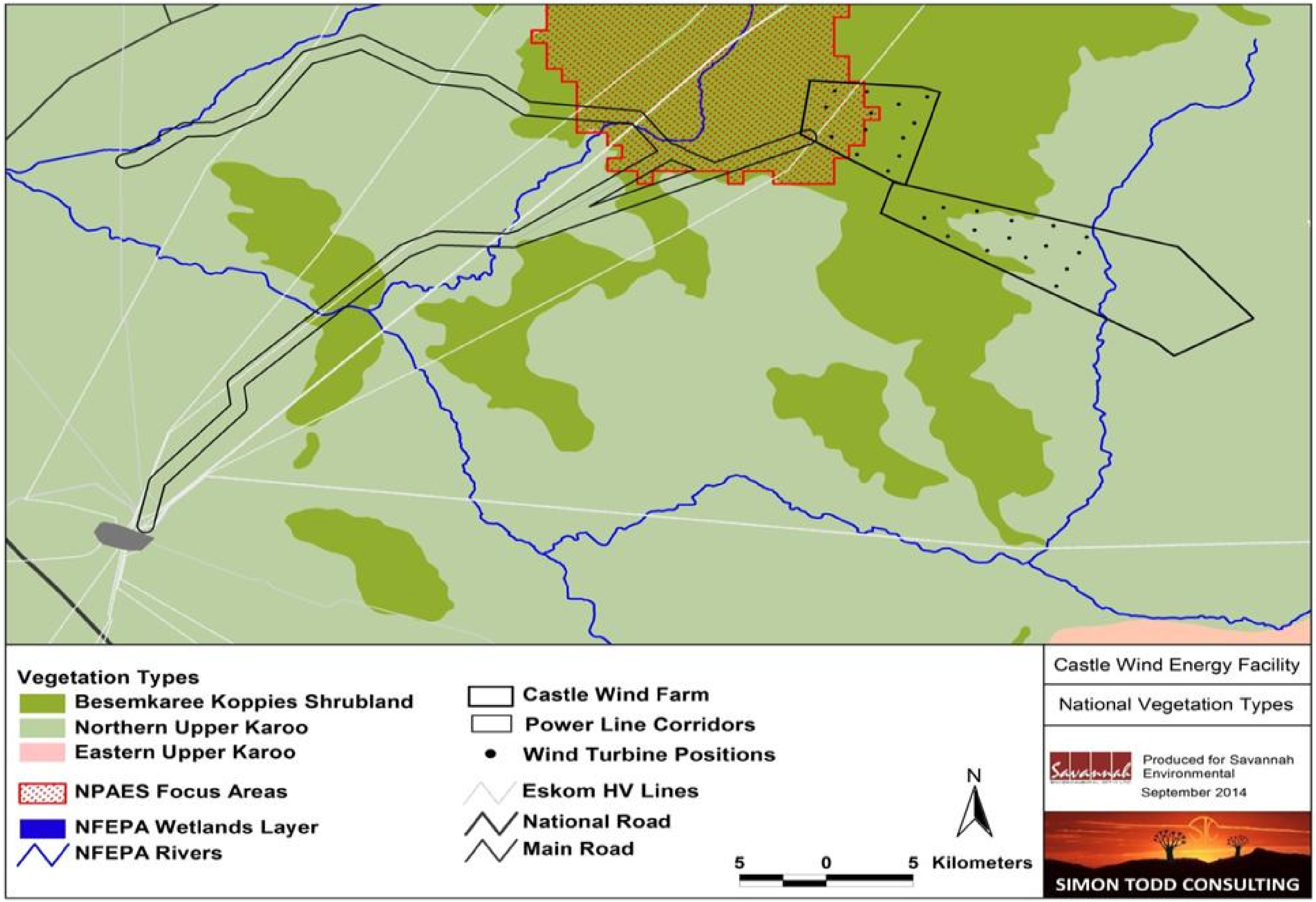


Figure 7.5: Broad-scale overview of the vegetation in and around the Castle Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011), as well as NPAES focus areas.

7.4.6 Listed and Protected Plant Species

According to the SANBI SIBIS database, 270 plant species have been recorded from the quarter degree squares 3024 CA, AD, CA, CB. This includes 3 species of low conservation concern, *Hermannia repetenda*, *Chasmatophyllum maninum* and *Hereroa concava*, all of which are classified as DDD. These species are poorly known species that have not been recently collected and their presence within the area is dubious and may result from database errors as they are not reported as occurring in the De Aar area. Other species of significance observed at the site include *Stomatium pluridens* and *Euphorbia crassipes*, which are regional endemics and provincially protected. Other protected species include *Aloe broomii* var. *broomii*, *Aloe variegata*, *Aloe claviflora*, *Pachypodium succulentum* and *Boscia albitrunca*. The density of these species was generally low, except for *Aloe broomii* which was abundant in the western section of the site.

7.4.7 Fauna

Mammals

The Castle Wind Energy Facility site lies within the range of 51 terrestrial mammals, including four listed mammal species. The four listed species are the Brown Hyaena *Hyaena brunnea* (NT), Black-footed cat *Felis nigripes* (VU) South African Hedgehog *Atelerix frontalis* (NT) and Honey Badger *Mellivora capensis* (SA RDB EN). While the Hedgehog, Black-footed Cat and Honey Badger are likely to occur at the site, the Brown Hyaena is less likely to be present. All of these species have relatively wide ranges across South Africa.

The south-facing slopes with dense vegetation, riparian areas and rocky outcrops are likely to provide habitat for mammalian species. Species observed at the site include Suricate, Yellow Mongoose, South African Ground Squirrel, Cape Porcupine, Springbok, Steenbok, Namaqua Rock Mouse, Baboon, Aardvark, Rock Hyrax, Hewitt's Red Rock Rabbit and African Mole Rat. All of these species have relatively wide ranges across South Africa and the development would not be likely to result in a significant overall decline in the available habitat for these species.

Reptiles

According to the distribution maps available in the literature, as many as 44 reptiles could occur in the study area. However, according to the records within the SARCA database, only 32 have been recorded in the region, which is a more representative estimate of the species richness likely to be encountered at the site. Species observed include Karoo Girdled Lizard *Karusasaurus polyzonus*, Spotted Sand Lizard *Pedioplanis lineoocellata lineoocellata*, Western Three-striped Skink *Trachylepis occidentalis* and Leopard Tortoise *Stigmochelys pardalis*.

The site represents a relatively rich habitat for reptiles as it contains various types of rocky outcrops, koppies, cliffs and steep slopes as well as more densely vegetated riparian areas, and flats of varying texture. Despite the likely high reptile richness at the site, no listed species are known from the area.

Amphibians

Eleven frog species are known from the broad area around the site, including the Giant Bullfrog (*Pyxicephalus adpersus)* which is listed as Near Threatened. The majority of species known from the area are toads and sand frogs which are relatively independent of water except for breeding purposes, which reflects the aridity of the area.

7.4.8 Bats

In terms of habitat, the table below described the potential of the vegetation units of the site to serve as suitable roosting and foraging spaces for bats.

Table 7.2: Potential of vegetation units suitable for roosting

Vegetation Unit	Roosting Potential	Foraging Potential	Comments
Besemkaree Koppies Shrubland	Moderate - High	Low - Moderate	The koppies and tafelbergs found within the unit can provide roosting areas for bats while the vegetation can attract insects which in turn attract insectivorous bats.
Northern Upper Karoo	Moderate	Moderate - Low	The pans, dwarf shrubs and grasses may attract insects which in turn will attract foraging bats. The low trees may prove useful for roosting purposes.

The ecology of three common South African insectivorous bat species are described below. These three species could occur on the site (refer to Table 7.3):

» ***Miniopterusnatalensis:*** *Miniopterusnatalens*is, commonly called the Natal - clinging bat, occurs widely across the country but mostly within the southern and eastern regions. It is listed as a Near Threatened conservation category. It is a cave-dependent species, such that the presence of suitable roosting sites in an area may be more important in predicting its presence than the vegetation. This species assembles in large numbers to roost within caves. It utilises separate caves for winter hibernating activities and summer maternity behaviour. Winter hibernacula generally occur in more temperate areas of the country and at higher altitudes, while summer maternity roosts are warmer and lower altitudes (Monadjemet al., 2010). No locations of any caves are known within the area of the site. If a suitable roosting cave is located near to the site, it would most likely be used as a summer maternity roost. *Miniopterusnatalensis* are known to undertake short migratory journeys between hibernacula and maternity roosts.

- ***Neoromicia capensis:*** Commonly called the Cape Serotine, *Neoromiciacapensis* has a Least Concern conservation category as it is widespread over much of sub-Saharan Africa in high numbers. It roosts individually or in small groups of two or three bats in a variety of shelters, such as under the bark of trees, at the base of aloe leaves, and under the roofs of houses. They will utilise most man-made structures as day roosts (Monadjemet al., 2010). These types of roosting sites on the farms must be considered as sensitive. They do not undertake migrations and therefore considered residents of the site. They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; inferring that they may occupy several habitat types across the site, and are adaptable towards habitat changes. They are thought to have a Medium – High likelihood of risk of fatality due to wind turbines (Sowler and Stoffberg, 2012).
- ***Tadarida aegyptiaca:*** The Egyptian Free-tailed Bat, *Tadaridaaegyptiaca*, is a Least Concern species as it has a wide distribution and high abundance throughout South Africa. This species is protected by national legislation in South Africa (ACR, 2010). They roost communally in small (dozens) to medium-sized (hundreds) groups in caves, rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. *Tadaridaaegyptiaca* has also adapted to roosting in buildings, in particular roofs of houses. Therfore man-made structures and large trees on the site would be important roosts for this species. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey. The Egyptian Free-tailed bat is considered to have a high likelihood of risk of fatality due to wind turbines (Sowler and Stoffberg, 2012).

Table 7.3: Table of species that may be roosting or foraging on the study area, the possible site specific roosts, and their probability of occurrence based on literature (Monadjem et al. 2010).

Species name	Common name	Probability of Occurrence (%)	Conservation Status	Possible roosting sites occupied on or near site	Foraging habits (indicative of possible foraging areas on or near site)
Eptesicus hottentotus	Long tailed Serotine	90-100	Least Concern	Dwells in crevices and buildings which can be found within the site, specifically the dolerite koppies and tafelbergs found in the Eastern Upper Karoo unit.	A clutter edge forager that feeds mainly on species of Coleoptera.
Miniopterus natalensis	Natal long-fingered bat	90-100	Near Threatened	Cave and hollow dependent, but have been personally observed to roost in small groups or individually in culverts.	Clutter-edge forager. Feeds on a variety of aerial prey including Diptera, Hemiptera, Coleoptera, Lepidoptera and Isoptera. May forage in open grassland during suitable weather.
Myotis tricolor	Temmink's myotis	40-50	Least Concern	It roosts socially in caves and moves between its winter hibernacula and summer maternity caves. It has a close association with mountainous areas. On the edge of distribution.	A clutter-edge forager that is restricted to aerial prey such as Coleoptera, Hemiptera, Diptera, Neuroptera and Hymenoptera
Neoromicia capensis	Cape Serotine	90-100	Least Concern	Roosts under the bark of trees, at the base of aloe leaves, under roofs and within crevices.	Clutter-edge forager feeding mainly on Coleoptera, Hemiptera, Lepidoptera and Neuroptera.May forage over open grassland in suitable weather.
Nycteris thebaica	Egyptian slit-faced bat	10-20	Least Concern	Roosts during the day in burrows, culverts and trunks of large trees. Preferring cluttered habitats more. On	A clutter forager with a diet that varies according to season between Orthoptera, Coleoptera

				edge of distribution.	and Lepidoptera as well as a number of other insects and arachnids.
Rhinolophus clivosus	Geoffroy's horseshoe bat	40-50	Least concern	Roosts socially in caves and mine adits and can also make use of cavities in rock formations. There are no known caves within the study area.	Known to establish feeding stations during the night under trees or the verandas of houses. Clutter forager with a diet comprised mainly of Lepidoptera and Coleoptera. More probable in cluttered valley areas. Unlikely to forage over open grassland.
Rhinolophus darlingi	Darling's Horseshoe bat	10-20	Least Threatened	Roosts in caves, mine adits and other suitable hollows. On edge of distribution.	A clutter edge forager that feeds mainly on species of Lepidoptera and Coleoptera.
Tadarida aegyptiaca	Egyptian free-tailed bat	90-100	Least concern	Roosts in caves, crevices, hollow trees, buildings, and any other suitable crevices. May be roosting in any crevice found on site, including buildings and trees.	Open-air forager with a diet consisting mainly of Diptera, Hemiptera, Coleoptera and to some extent Lepidoptera. Strong flier that will forage over the open grasslands.

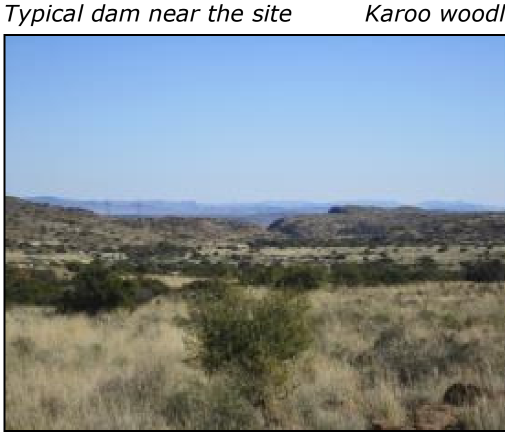
7.4.9 Avifauna

The Castle Wind Energy Facility site is situated within the Platberg Karoo Conservancy Important Bird Area (IBA – Barnes 1998) as the area supports populations of two Globally Threatened species, namely the Lesser Kestrel and the Blue Crane. The Important Bird Areas (IBA) Programme is one of BirdLife International's conservation initiatives. The site also falls within a high sensitivity area as classified in the "Avian Wind Farm Sensitivity Map for South Africa" (Retief *et al*, 2011).

Bird Micro Habitats

The habitats available to birds at a small spatial scale are known as micro-habitats, which are determined largely by vegetation structure rather than vegetation composition. These micro- habitats are formed by a combination of factors such as vegetation, land use, anthropogenic factors, topography and others. The micro -habitats identified on the site include: Karoo flats; drainage lines; dams; rocky kopjes and arable lands.


Typical dam near the site *Karoo woodland on site*




Karoo woodland on edge of escarpment *Shrubby Karoo on site*

Grassy Karoo in east of site *Small arable land on site*

Karoo flats or 'vlakte'

Figure 7.7: Examples of bird micro- habitats available on the Castle Wind Energy Facility site.

Target Species

A list of '26 target species' has been compiled for the Castle Wind Facility site. Target species are those species for which there is most conservation concern, and therefore the focus of this study (refer to Table 7.4). Data on bird activity collected thorough the pre-construction bird monitoring programme is available in the Avifaunal Impact Assessment Report (refer to Appendix **H**).

Table 7.4: Target bird species for the Castle Wind Energy Facility

Common name	Taxonomic name	Ecological group	SABAP 1	SABAP 2	Taylor 2014	IUCN 2013	Preferred micro habitat
Tawny Eagle	*Aquila rapax*	Raptor	X		EN	LC	Karoo – throughout study area
Martial Eagle	*Polemaetus bellicosus*	Raptor	X		EN	VU	Karoo – throughout study area
African Marsh-Harrier	*Circus ranivorus*	Raptor	X		EN	LC	Karoo – particularly flats
Ludwig's Bustard	*Neotis ludwigii*	Large terrestrial	X		EN	EN	Karoo – particularly on flats
Yellow-billed Stork	*Mycteria ibis*	Large terrestrial	X		EN	LC	Riverine
Black Harrier	*Circus maurus*	Raptor	X		EN	VU	Karoo – particularly flats
Black Stork	*Ciconia nigra*	Large terrestrial	X		VU	LC	Riverine, cliffs
Verreaux's Eagle	*Aquila verreauxii*	Raptor	X		VU	LC	Rocky mountainous areas, cliffs
Secretarybird	*Sagittarius serpentarius*	Large terrestrial	X		VU	VU	Karoo - throughout study area
Lanner Falcon	*Falco biarmicus*	Raptor	X		VU	LC	Karoo - throughout study area
Blue Crane	*Anthropoides paradiseus*	Large terrestrial	X		NT	VU	Karoo, particularly flats and dams
Kori Bustard	*Ardeotis kori*	Large terrestrial	X		NT	NT	Karoo – throughout study area
Lesser Flamingo	*Phoenicopterus minor*	Water bird	X		NT	NT	Dams, pans
Abdim's Stork	*Ciconia abdimii*	Large terrestrial	X		NT	LC	Karoo – particularly on flats
Karoo Korhaan	*Eupodotis vigorsii*	Large terrestrial	X		NT	LC	Karoo – throughout study area
Greater Flamingo	*Phoenicopterus ruber*	Water bird	X		NT	LC	Dams, pans

Lesser Kestrel	*Falco naumanni*	Raptor	X	-	LC	Karoo – throughout study area
Blue Korhaan	*Eupodotis caerulescens*	Raptor	X	-	NT	Karoo – particularly on flats
White Stork	*Ciconia ciconia*	Large terrestrial	X		BONN	Karoo – particularly on flats
Hamerkop	*Scopus umbretta*	Water bird	X	-	LC	Riverine
Jackal Buzzard	*Buteo rufofuscus*	Raptor	X	-	LC	Karoo – throughout study area
Egyptian Goose	*Alopochen aegyptiacus*	Water bird	X	-	LC	Dams, pans and arable lands
Southern Pale Chanting Goshawk	*Melierax canorus*	Raptor	X	-	-	Karoo – throughout study area
Northern Black Korhaan	*Afrotis afraoides*	Large terrestrial	X	-	-	Karoo – throughout study area
South African Shelduck	*Tadorna cana*	Water bird	X	-	LC	Dams, pans
Black-headed Heron	*Ardea melanocephala*	Large terrestrial	X	-	LC	Dams, pans

EN = Endangered; VU = Vulnerable, NT = Near-threatened, Bonn = Protected Internationally under the Bonn Convention on Migratory Species, LC = Least Concern. NOTE: Stork species are classified as large terrestrial for the purposes of analysis later in this report, as their behaviour is in most respects similar to that of large terrestrials.

7.5. Social Characteristics

The proposed site occurs within the Emthanjeni Local Municipality and the Renosterberg Local Municipality, which both fall within the greater Pixley ke Seme District Municipality. The social and economic characteristics of the region are described below.

7.5.1 Economy (Provincial level)

The Northern Cape economy has shown significant recovery since 2000/2001 when it had a negative economic growth rate of -1.5% (LED Strategy). The provincial economy reached a peak of 3.7% in 2003/2004 and remained the lowest of all provinces. The Northern Cape is the smallest contributing province to South Africa's economy (only 2% to South Africa GDP per region in 2007).

The mining sector is the largest contributor to the provincial GDP, contributing 28.9% to the GDP in 2002 and 27.6% in 2008. Agriculture and agri-processing sector is also a key economic sector. The agricultural sector contributed 5.8% to the Northern Cape GDP per region in 2007 which was approximately R1.3 billion, and it employs approximately 19.5% of the total formally employed individuals (NCSDF, 2012).

Economic development in the Northern Cape is hampered by the vastness of the area and the remoteness of its communities in rural areas. Development is also hampered by the low education and skills levels in the Province. As a result unemployment in the Northern Cape presents a major challenge.

7.5.2. Employment

The official unemployment rate in both the Pixley ka Seme District Municipality and Emthanjeni Local Municipality decreased for the ten year period between 2001 and 2011. In the Pixley ka Seme District Municipality, the rate fell from 36.4% to 28.2%, a decrease of 8.2%. In the Emthanjeni Local Municipality the unemployment rate decreased from 40.7% to 28.0%, a decrease of 12.7%. Youth unemployment in both the Pixley ka Seme District Municipality and Emthanjeni Local Municipality also dropped over the same period. Youth unemployment in the Emthanjeni Local Municipality is still high however at 37.2% in 2011.
The unemployment rate of the Renosterberg Local Municipality has decreased from 48% in 2001 to 26.8% in 2014 and the youth unemployment rate has also decrease from 55.8% in 2001 to 29.8% in 2011.

7.5.3. Population

The population of the Pixley ka Seme District Municipality increased by from 166 547 in 2001 to 186 351 in 2011, which represents an increase of ~ 12%. The population of the Emthanjeni Local Municipality increased from 35 785 in 2001 to 42 356 in 2011 (~ 18%) over the same period. The Renosterberg Local Municipality increased from 9070 in 2001 to 10 978 in 2011. The increase in the population in the Pixley ka Seme District Municipality was linked to an increase in the 15-64 and 65 and older age groups. The number of households in the Pixley ka Seme District Municipality, Emthanjeni Local Municipality and Renosterberg Local Municipality increased between 2001 and 2011. The size of the household sizes in both areas essentially remained the same, namely in the region of 3.7-3.9.

7.5.4. Education

The education levels at both the district and local municipal level have improved from 2001, with the percentage of the population over 20 years of age with no schooling in the Pixley ka Seme District Municipality decreasing from 27.1% to 14.6% in 2011. For the Emthanjeni Local Municipality the percentage has decreased from 23.7% to 11.0%. For the Renosterberg Local Municipality the percentage has decreased from 26% to 16%. The percentage of the population over the age of 20 with matric also increased in the Pixley ka Seme District Municipality, Emthanjeni Local Municipality and the Renosterberg Local Municipality. This was from 12.9% to 20.5% in the Pixley ka Seme District Municipality, from 17.1% to 24.7% in the Emthanjeni Local Municipality and from 6.1% to 6.6% in the Renosterberg Local Municipality.

7.6. Heritage and Palaeontological Profile

The town of De Aar was founded in 1881 on the farm by the same name. The farm originally belonged to Jan Vermeulen who sold it for the purpose of the development of the town. With the development of railway the town became an important station with one of the largest marshaling yards in the country.

Occupation by early humans would probably date to at least the Middle Stone Age (Earlier Stone Age sites are known in the wider region) and would consist of open sites near stream beds or hills and outcrops. Raw material sources would have been amongst the foci for Stone Age activity. Population density might have increased during the Later Stone Age and people would have occupied rock shelters where available, as well as open sites.

During this later period they also produced rock engravings, of which some are known to occur on the farm Tafelkop north of the study area, as well as rock paintings, some of which occur on the farm Veekraal east of the study area and others on Jakkalsfontein north of the study area.

The following heritage sites, features, and objects are known to occur in the larger region (Morris 2011):

» Stone Age sites located near the foot of hills and in rock shelters where these have developed;
» Sites with either rock engravings or rock paintings. Dolerite koppies in the region are known to have rock engravings (Fock & Fock 1989; Morris 1988; Parkington *et al*. 2008);
» Stock enclosures constructed of stone;
» Burial sites in the vicinity of the Brak River (power line servitudes);
» Houses and other structures older than 60 years;
» Farming infrastructure such as wind mills, etc; and
» Graves and cemeteries, both formal and informal.

A variety of heritage resources occur in this larger region and there is thus a likelihood that similar resources will be located in the study area. Sites can be expected especially in the areas where hills and outcrops occur, as well as along the banks of the Brak River.

The Castle Wind Energy Facility to the northeast of De Aar, Northern Cape, is underlain by Late Permian sedimentary rocks of the Adelaide Subgroup, Jurassic dolerites of the Karoo Dolerite Suite and unconsolidated sands constituting a Cenozoic-age regolith. The rocks of the Adelaide Subgroup are known to be fossiliferous elsewhere in the Karoo Basin and contain famous and scientifically significant vertebrate faunas and plant macrofossil floras. Several fragmentary fossils were located within this unit and the density of their occurrence suggests that numerous other fossils may be present within the unit elsewhere in the reporting area. No fossils were located within the Cenozoic regolith, but similar deposits are known to be fossiliferous elsewhere in the Karoo and fossil materials may well be present within subsurface portions of the stratigraphic unit. The dolerites formed via intrusion of magma that crystallised deep in the earth's crust, and accordingly, are unfossiliferous.

ASSESSMENT OF IMPACTS CHAPTER 8

Environmental impacts associated with the proposed Castle Wind Energy Facility are expected to be associated with the construction, operation and decommissioning of the facility. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site.

The construction for a wind energy facility include land clearing for site preparation and access/haul roads; transportation of supply materials and fuels; construction of foundations involving excavations and cement pouring; compaction of laydown areas and roadways, manoeuvring and operating cranes for unloading and installation of equipment; laying cabling; and commissioning of new equipment. Decommissioning activities may include removal of the temporary project infrastructure and site rehabilitation. Environmental issues associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to wildlife through mortality, injury and disturbance; impacts to sites of heritage value; soil erosion; and nuisance noise from the movement of vehicles transporting equipment and materials during construction.

Environmental issues specific to the operation of a wind energy facility may include visual impacts; noise produced by the spinning of rotor blades; avian/bat mortality resulting from collisions with blades and barotrauma; and light and illumination issues.

These and other environmental issues were identified through the scoping evaluation. Potentially significant impacts identified have now been assessed within the EIA phase of the study. The EIA process has involved input from specialist consultants, the project proponent, as well as input from key stakeholders (including government authorities) and interested and affected parties engaged through the public consultation process. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts vary significantly from site to site.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed wind turbines and associated infrastructure (substation, access road/s to the site, internal access roads between turbines, underground and overhead electrical cabling between turbines and turbine foundations), and to make recommendations regarding preferred alternatives for consideration by DEA, as well as for the management of the impacts for inclusion in the draft Environmental Management Programme (refer to **Appendix Q** for the EMPr).

In order to assess the impacts associated with the proposed wind energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation, and associated access roads[4]. A wind energy facility is unlike other power generation facilities in that it does not result in whole-scale disturbance to a site. The study area for the Castle Wind Energy Facility (approximately ~3257ha in extent) is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by turbines and associated infrastructure is illustrated in Figures 8.1 and 8.2 below, and includes the area covered by the following three farm portions:

» Portion 12 of Farm 165 (Vendussie Kuil);
» Portion 13 of Farm 165 (Vendussie Kuil); and
» The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

The project will include the following infrastructure:
» 31 wind turbines;
» 31 crane hardstand area
» Turbine foundation/footprint
» Cabling between turbines to be laid underground (1m deep) along the road verge where practical to connect to an on-site substation.
» Temporary laydown area
» Temporary batching plant
» On-site substation (with an approximate compound size of 100 m x 100 m).
» Internal access roads up to 7m wide.
» Workshop area / office for control, maintenance and storage.

The assessment presented within this chapter of the report is on the basis of the Preliminary Layout of the Castle Wind Energy Facility, indicating the layout of 31 wind turbines (which took into consideration the outcome and specialist assessments of the site) provided by Castle Wind Farm (Pty) Ltd. The assessment of issues presented within this chapter (and within the specialist studies attached within **Appendices F – O**) considers the worst-case scenario in terms of potential impacts.

[4] The 132kV overhead line connecting the proposed Castle Wind Energy Facility to the National grid (at either Ilanga Lethemba Substation (Solar Capital Substation) or the Hydra Substation (Eskom Substation)) is being assessed under a separate Basic Assessment process (BAR).

8.1 Alternative access to site during construction and operation

The primary access road to the site would be off the existing gravel access road from the R389 to Philipstown and Hanover. Two reasonable and feasible alternatives are have been considered (refer to Figure 8.2):

» **Access Road Alternative 1 (referred to as the Northern Access Road):** The site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 19.5km from the R389 to the proposed site and several homesteads are situated along this access roads.
» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 18.5km from the R389 to the proposed site.

Potential impacts pertaining to access to the site are assessed in the sections below, and a comparative assessment of the two access alternatives have been provided.

8.2 Assessment of Potential Impacts on Ecology (Flora, Fauna and Ecosystems)

Wind energy facilities require relatively large areas of land for placement of infrastructure. The expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to Appendix F - Ecology Report for more details).

8.2.1 Specialist Findings

The site consists of two vegetation types, Northern Upper Karoo and Besemkaree Koppies Shrubland. At a broad level, the areas of Besemkaree Koppies Shrubland are considered more sensitive than the Northern Upper Karoo on account of the rocky habitat and greater abundance of species of conservation concern associated with the former. The national vegetation map is, however, drawn at a very coarse scale and the site visit revealed that the extent of Besemkaree Koppies Shrubland at the site is significantly less than that suggested by the map. Apart from the above vegetation types, there are several large drainage lines within the site which are considered to be of high sensitivity as they contain significant woody biomass and represent important faunal habitat in the area (refer to Figure 8.3). Although some protected species can be confirmed present and are likely to be impacted by the development, these are relatively widespread species of low conservation concern. The development is likely to have an impact on fauna, especially during the construction phase, but in the long-term, it is likely that most species will be able to continue to utilise the site and any impacts on fauna would be of local significance only.

No fine-scale conservation planning has been conducted in the area and thus no Critical Biodiversity Areas have been defined for the region to date. However, the western part of Vendussie Kuil lies within a National Protected Areas Expansion Strategy (NPAES) focus area (refer to Figure 8.4). NPAES focus areas are areas that are considered important for the expansion of the land-based protected area network as they contribute towards meeting biodiversity thresholds for terrestrial or freshwater ecosystems, maintaining ecological processes or climate change resilience. The affected NPAES focus area is a part of the Senqu Caledon focus area. Only approximatley 450ha of the focus area is actually within the Castle Wind Farm development area and the loss of this area to the development would not be likely to compromise the ability to meet future conservation targets within this focus area.

The major sensitive feature of the site are the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass which contrasts with the surrounding landscape. The steeper, south-facing slopes are also considered sensitive on account of their woody biomass and more mesic environment, while the less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. The remaining flats and gentle slopes are lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type. Although the majority of turbines are located within these lower sensitivity areas, there are a few turbines located within the moderately sensitive rocky areas. No turbines are however located on very steep slopes or within drainage lines.

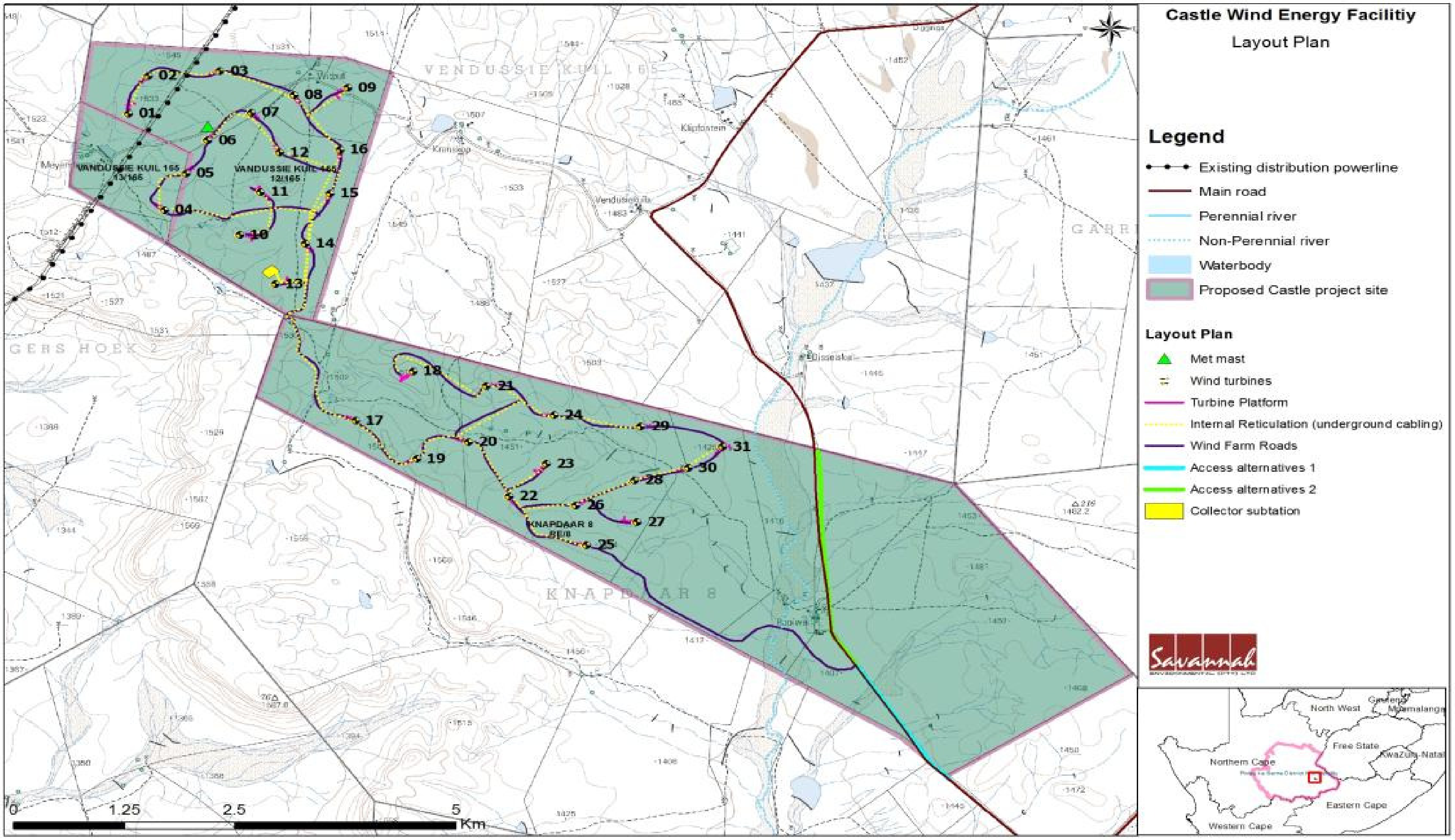


Figure 8.1 Preliminary Layout of the Castle Wind Energy Facility, indicating the cluster of 31 wind turbines (refer to Appendix P for an A3 map)

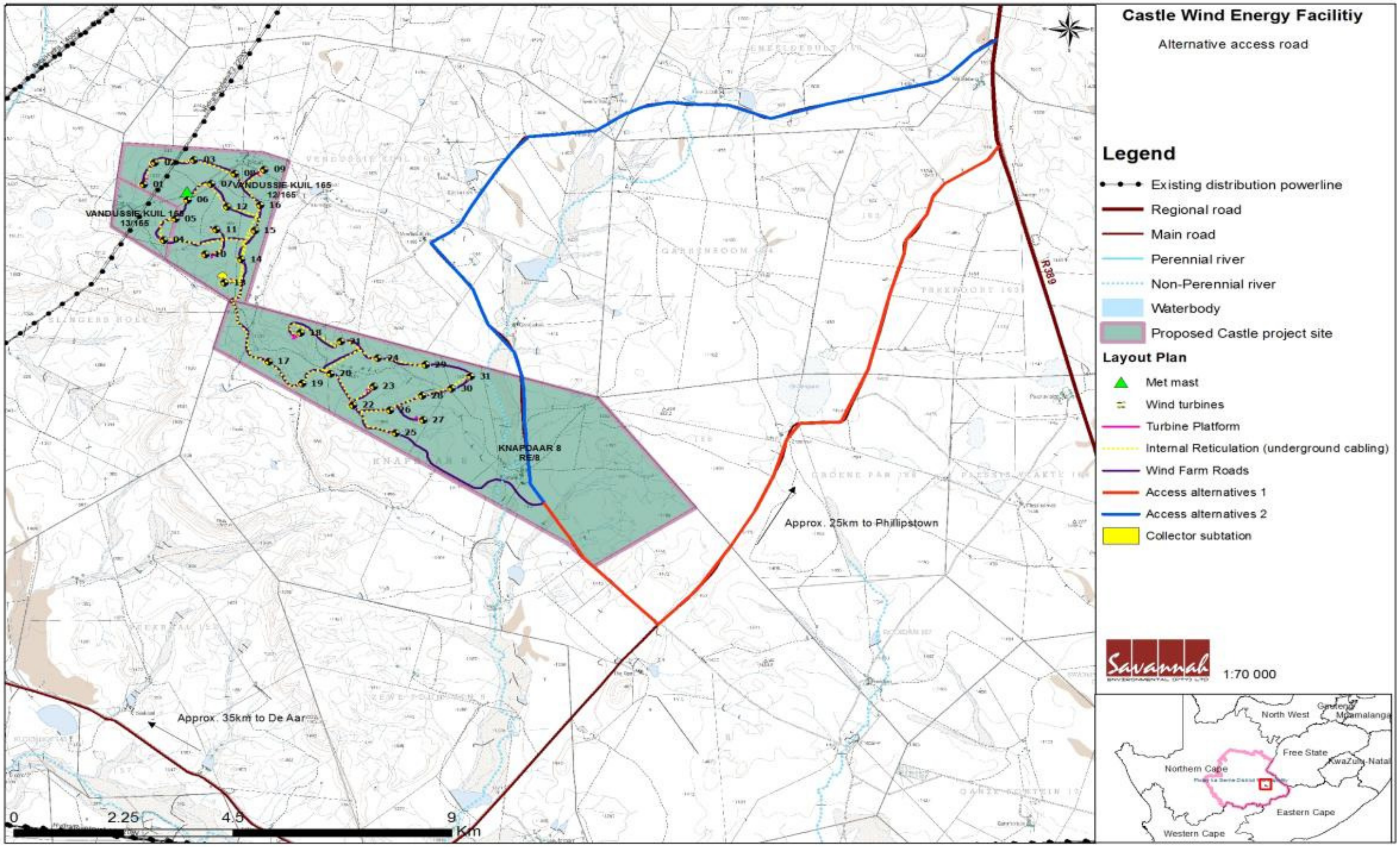


Figure 8.2 Layout map of the Castle Wind Energy Facility, indicating the 2 access road alternatives from the R389

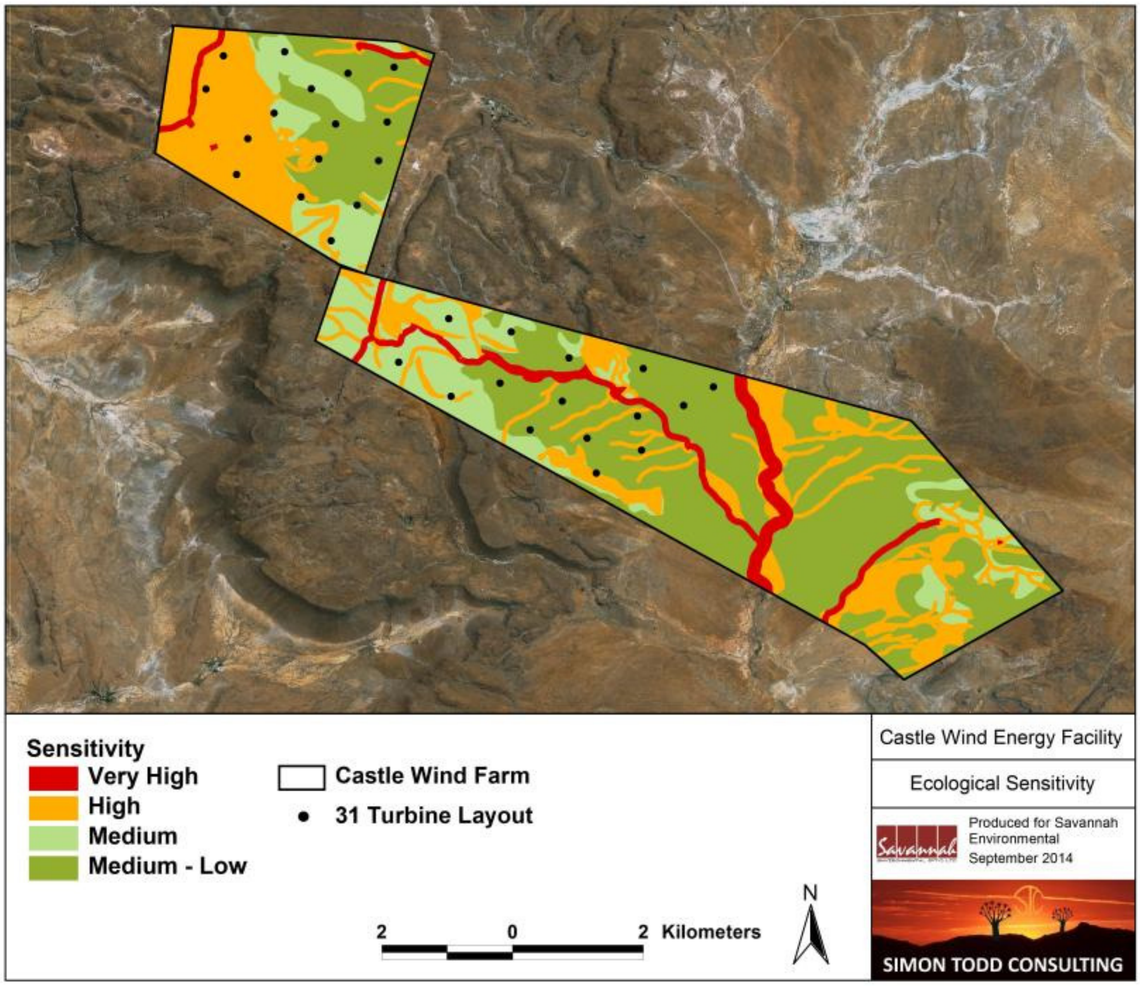


Figure 8.3: Ecological sensitivity map of the Castle Wind Energy Facility study area

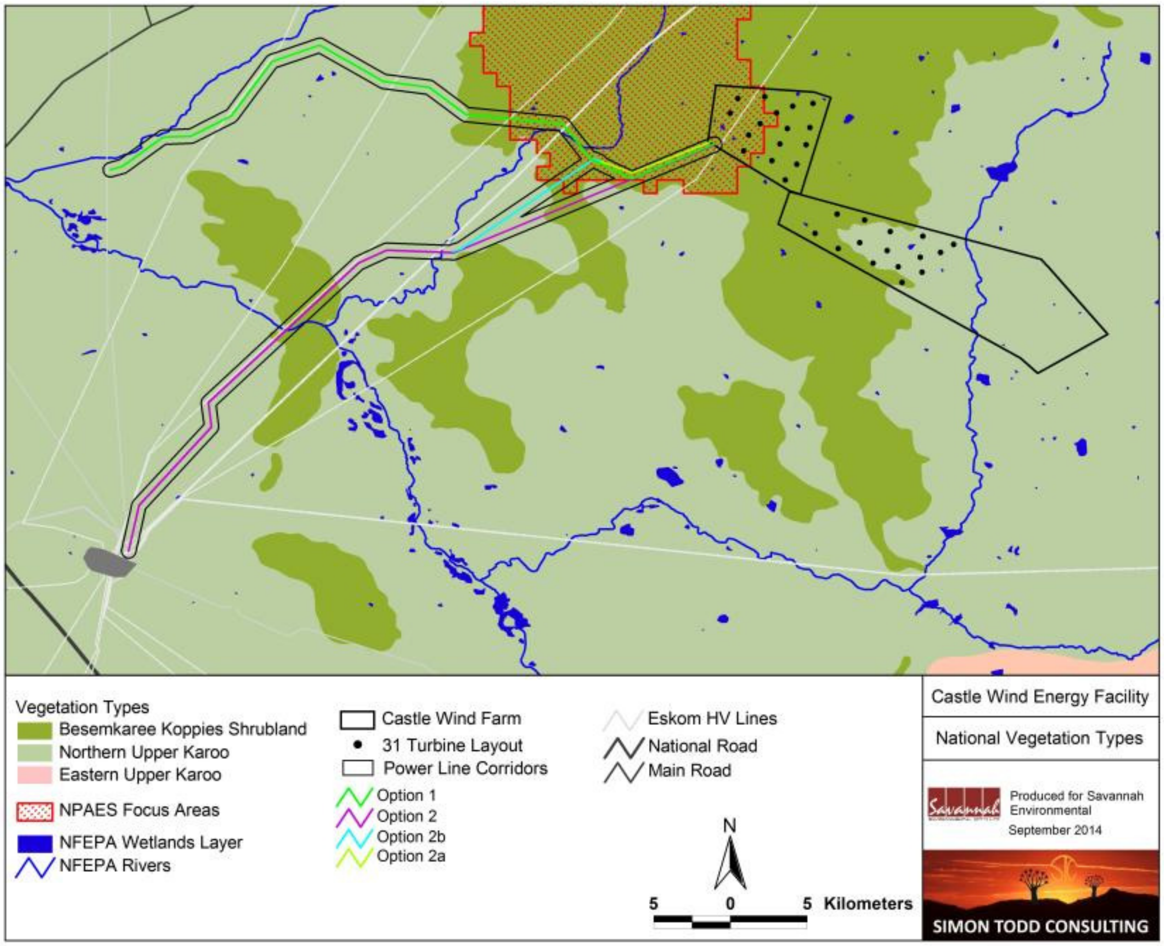


Figure 8.4: Broad-scale overview of the vegetation in and around the Castle Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011), as well as NPAES focus areas

8.2.3 Identified Impacts

The development will result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as roads, turbine foundations, operations buildings etc. The following impacts are identified as those most likely to be associated with the development of the facility.

Impacts on vegetation and protected plant species: Several endemic and protected plant species are confirmed present at the site and it is likely that some of these would be affected by the development. In addition, the construction of the facility would generate significant disturbance of intact vegetation. This impact would be restricted largely to the construction phase and would occur within the development footprint.

Soil erosion and associated ecosystem degradation: The large amount of disturbance created during construction will leave the site vulnerable to soil erosion. Erosion would result in changes in hydrology, water retention, productivity etc. resulting in a decline in ecosystem function and integrity. Although large parts of the site are quite flat with a relatively low erosion risk, there are also some steeper areas where the risk would be higher. Hardened infrastructure such as roads would also generate a large amount of runoff that would require specific management to reduce erosion risk. This impact would occur largely during the operational phase, within the facility development footprint.

Alien plant invasion: The disturbance created during construction is highly likely to encourage the invasion of the disturbed areas by alien species. Although the current levels of invasion are low, several alien species were present including *Prosopis glandulosa* and it is likely that these species will take advantage of the disturbance if given the opportunity.

Direct faunal impacts: Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would be likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals and reptiles, such as tortoises, would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. In the long term, the operational phase impacts are likely to be relatively low and would be related to noise generated by the turbines and human presence during operation and maintenance activities. This impact is likely to be restricted within the facility.

Impacts on landscape connectivity and Broad-Scale Ecological Processes: The development would disrupt the connectivity of the landscape for some species, which may avoid the area on account of the activity and turbine operation at the site. In itself this is not likely to be a highly significant impact given the relatively low extent of the development in relation to the overwhelmingly intact surrounding landscape. However, as there are a number of other planned renewable energy facilities in the area, cumulative impacts on broad-scale ecological processes may be more severe. This impact would be restricted to the facility itself as the power line would have a very low footprint and would not contribute significantly to this impact.

<table>
<tr><td colspan="3">Nature of impact: Impacts on vegetation and protected plant species will occur due to vegetation clearing and disturbance associated with the construction of the facility.</td></tr>
<tr><td colspan="3">Listed Activities:
» GN 544:10, 47(ii),
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Local (1)</td></tr>
<tr><td>Duration</td><td>Long-term (4)</td><td>Long-term (3)</td></tr>
<tr><td>Magnitude</td><td>Medium-High (7)</td><td>Medium (5)</td></tr>
<tr><td>Probability</td><td>Highly Probable (4)</td><td>Probable (3)</td></tr>
<tr><td>Significance</td><td>Medium (52)</td><td>Low (27)</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Low</td><td>Medium</td></tr>
<tr><td>Irreplaceable loss of resources</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Impacts on protected plant species can to some extent be mitigated through avoidance, but some impact on vegetation and protected species is inevitable and cannot be avoided.</td></tr>
<tr><td>Mitigation</td><td colspan="2">» Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DAFF permitting requirements.
» Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.
» Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
» ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas.
» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
» All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed.
» Temporary lay-down areas should be located within the development footprint or within areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.</td></tr>
<tr><td>Cumulative Impacts</td><td colspan="2">The potential for cumulative impacts is high as there are numerous other wind (with specific reference to the</td></tr>
</table>

	preferred bidder Round 3 projects- Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities) and PV facilities planned, approved or already constructed in the area. There are however no narrow endemics in the area that would be significantly impacted or by the development.
Residual Impacts	As the abundance of some protected species is high, it is unlikely that all of these can be avoided or translocated and some impact on protected species is an inevitable and unavoidable consequence of the development.

Nature of impact: Increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated by the turbine service areas and access roads.		
Listed Activities: » GN 544:10, 47(ii), » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (44)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation	» All roads and other hardened surfaces must have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. » Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. » A cover of indigenous species should be established in disturbed areas in order to bind the soil and prevent erosion.	
Cumulative Impacts	Cumulative impacts are likely to be very low after mitigation	
Residual Impacts	If erosion at the site is controlled, then there will be no residual impact	

Nature of impact: Alien plants are likely to invade the site as a result of the large amounts of disturbance created during construction		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Probable (4)	Improbable (3)
Significance	**Medium (40)**	**Low (21)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation	» Due to the disturbance at the site as well as the increased runoff generated at the site, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. » Rehabilitation of cleared areas with indigenous species after construction to reduce alien invasion potential. » Regular monitoring for alien plants within the development footprint. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible or used under strict guidance (Prosopis sp).	
Cumulative Impacts	Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impact from alien species would not be significant.	
Residual Impacts	If alien species at the site are controlled, then there will be very little residual impact.	

Nature of impact: Alien plants are likely to invade the site as a result of disturbance during decommissioning activities		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**

Extent	Local (2)	Local (2)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (44)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation	» Due to the disturbance at the site during decommissioning, alien plant species are likely to invade the site and a long-term control plan will need to be implemented for several years after decommissioning » Regular monitoring for alien plants within the development footprint for 2-3 years after decommissioning. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible or used under strict guidence. » Cleared and disturbed areas should be revegetated with a cover of indigenous grass or shrubs.	
Cumulative Impacts	Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impacts from alien species would not be significant.	
Residual Impacts	If alien species at the site are controlled, then there will be very little residual impact	

▪

Nature of impact: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction.		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (3)	Short-term (3)
Magnitude	Medium-High (7)	Medium-Low (5)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (30)**
Status	Negative	Negative

Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Noise and disturbance at the site during construction is largely unavoidable.	
Mitigation	» Site access should be controlled and no unauthorized persons should be allowed onto the site. » Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site. » Fires should not be allowed on site. » No firewood collection should be allowed on site. » No dogs should be allowed on site. » If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.	
Cumulative Impacts	During the construction phase, the activity would contribute to cumulative fauna disturbance and disruption in the area, but the impact would be of local extent and not of high significance.	
Residual Impacts	There will be some residual impact as the facility will persist past the construction phase.	

Nature of impact: The operation and presence of the facility may lead to disturbance or persecution of fauna.		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium-Low (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative

Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes.	
Mitigation	» No unauthorised persons should be allowed onto the site. » Undesirable and problem fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. » No fires should only be allowed at the site. » No fuelwood collection should be allowed on-site. » No dogs should be allowed on site. » If parts of the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All vehicles on the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises.	
Cumulative Impacts	The development would contribute towards habitat loss for fauna in the area. As the landscape in the vicinity of the facility site is currently overwhelmingly intact this would be a relatively low contribution under the current circumstances in terms of the number of developments that have been built to date.	
Residual Impacts	The facility will be operational for at least 20 years and impact sources such as noise will persist for the operational lifetime of the facility and cannot be mitigated although many fauna would become habituated to these disturbance sources.	

▪

Nature of impact: Disturbance or persecution of fauna during the decommissioning phase.		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (4)	Low (2)
Probability	Probable (3)	Improbable (3)

Significance	**Low (24)**	**Low (15)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes.	
Mitigation	» Site access to be controlled and no unauthorized persons should be allowed onto the site. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. » No fires to be allowed on site. » No firewood collection should be allowed on-site. » No dogs should be allowed on site. » Any accidental chemical, fuel and oil spills that occur at the site during decommissioning should be cleaned up in the appropriate manner as related to the nature of the spill. » No open excavations, holes or pits should be left at the site as fauna can fall in and become trapped. » All disturbed areas should be rehabilitated with a cover of indigenous grass.	
Cumulative Impacts	Cumulative impacts at the decommissioning phase are likely to be low.	
Residual Impacts	With avoidance measures there should be no residual impact on fauna.	

Impact Nature: Impacts on landscape connectivity and Broad-Scale Ecological Processes		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	Medium (30)	Low (27)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Only partly	
Mitigation	The facility should have an open-space management plan.	

Cumulative Impacts	The development is reasonably extensive and along with the other renewable energy facilities in the area, there would be some cumulative impact on landscape function. The surrounding landscape is however currently largely intact despite the large potential number of developments in the area.
Residual Impacts	There will be some residual impact as it is the presence of the facility that generates the impact and this cannot be mitigated.

8.2.3 Comparative Assessment of Access Road Alternatives

Both the northern and southern access routes are existing gravel routes. It might be required that certain sections of the existing gravel roads may need to be widened, which could result in the minimal removal of vegetation. Both alternatives may result in increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated. From an ecological perspective the road alternatives will have very low impact as they will not result in significant loss of habitat, disturbance of vegetation and the alternative access roads do not transverse any drainage lines. There is no significant difference in the potential impacts associated with the two access road alternatives. Therefore, there is **no preference** between the access alternatives.

8.3.4 Implications for Project Implementation

With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of ecological impacts of the wind energy facility can be significantly reduced or avoided.

» The development footprints will not impact on any botanical "no go" habitats or areas.
» The major sensitive feature of the site is the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass. The steeper, south-facing slopes are also considered sensitive on account of their woody biomass and more mesic environment. No turbines are located on very steep slopes or within drainage lines.
» The less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. .
» The remaining flats and gentle slopes are lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type. The majority of turbines are located within these lower sensitivity areas.
» Search and Rescue of certain translocatable flora occurring in permanent, hard surface development footprints (i.e. all buildings, new roads, and turbine

positions) should take place prior to construction within the entire development area.

- A preconstruction walk-through of the facility is required in order to locate species of conservation concern that can be translocated.
- Ensure compliance with the Northern Cape Nature Conservation Act and DAFF permitting requirements.
- Vegetation clearing to commence only after walk-through has been conducted and necessary permits obtained.
- All disturbed areas must be rehabilitated. Areas that can be re-vegetated must be determined during the construction phase.

8.3 Fresh Water Assessment

As there is usually flexibility relating to the location of the turbines within a large project site, it is usually easy to mitigation the impact of the turbines on the freshwater features within the site by locating them sufficiently far enough away from these features. Therefore, it is usually the associated infrastructure that potentially impacts on the freshwater features to a greater degree such as the roads and cables associated with the wind energy facility that usually need to traverse freshwater features. Such crossings and disturbances need to be minimised and mitigated as far as possible.

8.3.1 Specialist Findings

The Brak River, its tributaries and the associated wetland areas within the Castle Wind Energy Facility study area are considered to be in a largely natural to moderately modified ecological state. The Brak River system is deemed to have a moderate to low ecological importance and sensitivity. While there are a number of small depression wetlands, seeps and endorheic pans as well as valley bottom wetlands associated with the river systems, many of these systems have formed ideal features for the construction of small dams and are now highly modified.

The Brak River and its larger tributaries within the study area are considered to be of a moderate to low ecological importance and sensitivity. The ecological importance and sensitivity of the ephemeral tributaries are considered to be negligible. The ecological importance and sensitivity of the pans is very similar to that of the ephemeral streams and the impacts are considered marginal or negligible while the valley bottom wetlands are directly related to the Brak River and its larger tributaries and the impacts are considered to be moderate to low.

The expected impacts on the identified freshwater features are likely to mostly occur while construction activities are taking place. The primary negative impacts are the result of direct factors (including loss of natural vegetation adjacent to and within the freshwater features from the construction as well as longer term disturbance of these features by machinery) and indirect factors (including flow and water quality modification, erosion and invasive plant growth). All of these impacts can however be mitigated.

A water use authorisation application may need to be submitted to the Department of Water and Sanitation: Northern Cape Regional Office for approval of the water use aspects of the proposed activities. In all likelihood the proposed activities would be Generally Authorised for Section 21 (c) and (i) water use activities if the final layout plan for the facility is such that disturbance of the drainage lines is minimal and the recommended mitigation measures provided in this report are implemented.

8.3.2 Identified Impacts

Impact of proposed wind turbines or energy facilities and buildings associated with the wind energy facility (total combined impact for study area): Wind energy facilities require high intensity disturbance of a limited surface area at the site of the wind turbine. Concrete foundations for the turbine towers will need to be constructed as well as permanent hard standing bases of 20m by 20m made of compacted gravel and approximately 40 m x 40 m adjacent to each turbine location for use of the cranes used to construct the turbines. Permanent access roads between each turbine of approximately 7 m wide would also need to be constructed or existing roads upgraded. Activities during the construction phase of the project could thus be expected to result in some disturbance of cover vegetation and where access routes and cabling need to cross freshwater features, some disturbance to the bed and banks of the drainage features.

During the operation phase the turbines will operate continuously, unattended and with low maintenance required for more than 20 years. The wind energy facilities would be monitored and controlled remotely, with maintenance only taking place when required. The hard surfaces created by the development may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas.

Impact of the Access Routes and other linear infrastructure developments associated with the wind energy facility (total combined impact for study area): An impact of limited significance is expected at the points at which the infrastructure will need to cross of streams/drainage lines during and after the construction phase. The major impacts are associated with the access roads and relate to loss of habitat within streams, riparian areas and wetland/pan habitats, loss of indigenous vegetation within riparian zones and potential invasive alien plant growth as well as the potential for flow and water quality impacts and the direct impacts on the soil (erosion of drainage channels).

<table>
<tr><td colspan="3">Nature of impact: Impact of the construction of the wind turbines and buildings associated with the wind energy facility during the construction phase</td></tr>
<tr><td colspan="3">Listed Activities:
» GN 544:10, 11(iii)(iv)(x)(xi),47(ii), 18(i)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Local (1)</td></tr>
<tr><td>Duration</td><td>Short-term (2)</td><td>Short-term (2)</td></tr>
<tr><td>Magnitude</td><td>Medium (5)</td><td>Low (3)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Improbable (2)</td></tr>
<tr><td>Significance</td><td>Low (27)</td><td>Low (12)</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Low</td><td>High</td></tr>
<tr><td>Irreplaceable loss of resources</td><td>Yes</td><td></td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td>Mitigation</td><td colspan="2">» Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facility.
» A buffer of at least 35m (from centre of stream for smaller drainage lines and from top of bank for larger tributaries) should be maintained adjacent to the identified freshwater features, and 75m for the pans and wetland areas.
» Any of the cleared areas that are not hardened surfaces are rehabilitated after construction is completed by re-vegetating the areas disturbed by the construction activities with suitable indigenous plants.
» Invasive alien plants that currently exist within the immediate area of the construction activities should also be removed and the sites.
» To reduce the risk of erosion, the locality of the turbines and structures should preferably not be on any steep slopes or within the wide wash areas on the plains.
» Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines.
» Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed.
» Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the river system and regularly serviced.</td></tr>
<tr><td>Cumulative Impacts</td><td colspan="2">Cumulative impacts are likely to very low after mitigation</td></tr>
</table>

Residual Impacts	Limited, if the site is controlled and maintained.

Nature of impact: Proposed implementation and use of access routes and other linear infrastructure associated with the wind energy facility during the construction phase		
Listed Activities: » GN 544:10, 11(iii)(iv)(x)(xi),47(ii), 18(i) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (5)	Medium (5)
Probability	Probable (3)	Improbable (3)
Significance	**Low (27)**	**Low (27)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	
Mitigation	» The existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. » Where new roads need to be constructed the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area and within the stream beds. For new access roads to the turbines, these should rather be along the ridges of the hills than in the drainage/stream beds. Where access routes need to be constructed through streams/drainage lines, the disturbance of the channel should be limited. » Wetland and pan areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 75m buffer zone as far as possible. » All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. Road infrastructure, and cable alignments should coincide as much as possible to minimize the impact.	
Cumulative Impacts	Cumulative impacts are likely to very low after mitigation	
Residual Impacts	Limited, if the site is controlled and maintained.	

Nature of impact: Maintenance of wind energy facility during the operation phase		
Listed Activities: » GN 544:10, 11(iii)(iv)(x)(xi),47(ii), 18(i) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 16 (iii) & (iv) (a) ii (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	
Mitigation	» Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified infrastructure routes. » Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants. » Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities site. Should any erosion features develop, they should be stabilised as soon as possible. » Water supply, sanitation services as well as solid waste management should preferably be provided by an off-site service provider.	
Cumulative Impacts	Cumulative impacts are likely to very low after mitigation	
Residual Impacts	Limited, if the site is controlled and maintained.	

8.3.3 Comparative Assessment of Access Road Alternatives

Both alternative access roads are existing gravel roads which will not impact on any of the freshwater features identified.There is therefore **no significant** difference in the potential impacts associated with the two access road routes and therefore, there is **no preference** between the alternatives.

8.3.4 Implications for Project Implementation

» The access routes and cables between turbines, as well as any other infrastructure associated with the wind energy facility should also preferably be located outside of the freshwater features and the recommended buffer zones.
» Use should be made of the existing roads and disturbed areas to limit increasing the disturbance to the area.
» A water use authorisation application may need to be submitted to the Department of Water and Sanitation: Northern Cape Regional Office for approval of the water use aspects of the proposed activities. In all likelihood the proposed activities could be authorised in terms of the General Authorisation for Section 21 (c) and (i) water use activities if the final layout plan for the wind energy facility is such that disturbance of the freshwater drainage lines is minimal and the recommended mitigation measures provided in this report are implemented.

Assessment of Potential Impacts on Avifauna

8.4.1 Specialist Findings

An approximate total of 209 bird species could occur in the study area, based on what has been recorded in the relevant six quarter degree squares by the first bird atlas project (Harrison *et al* 1997), and the second atlas project (www.sabap2.adu.org.za). This is a relatively good diversity of species, reflecting the diversity of habitats, including both mountains and low lying flats. In total 16 of these species could be considered threatened. This site falls within the SA037 Platberg-Karoo Conservancy Important Bird Area (Barnes 1998).

Pre-construction bird monitoring covering four seasons has been conducted on site, and was undertaken in compliance with the best practice guidelines written by Jenkins, van Rooyen, Smallie, Harrison, Diamond, and Smit (2012). This monitoring has included 32 days on site by a team of four skilled observers who worked in pairs. Small terrestrial species have been recorded on a total of approximately 12 km of walked transects (repeated 4 times). Large terrestrials species and raptors have been recorded on an approximate 47 km of driven transects (repeated 4 times). Eleven focal sites (ten of which are dams) were monitored in each season. Approximately 85 incidental records of target species and an additional five species considered relevant to record despite not being target species (i.e. African Harrier Hawk, Booted Eagle, Rufous-chested Sparrowhawk, Spur-winged Goose and Steppe Buzzard) were collected. A total of 192 hours of bird flight observation have been made on site and appropriately recorded.

The key findings arising from monitoring conducted on the site are as follows:

» A total of 26 target bird species were identified as potentially important at the outset of the programme. Fifteen of these were subsequently recorded on site, out of a total of 124 bird species recorded during the year.
» Walked transects on site recorded a total of 68 small bird species during the year, with a slight peak in species richness in autumn and winter (although abundance of individual birds was lower in winter). None of the species recorded were Red Listed small passerines.
» Driven transects on site recorded 15 bird species in total, with a slightly lower species richness in autumn and winter. Only two species were recorded in all four seasons, the Northern Black Korhaan, and Southern Pale Chanting Goshawk.
» None of the dams on or near the site held any water during the monitoring period, and as a result, held no significant birds. A Verreaux's Eagle nest was found approximately 2.2 km off site on the escarpment edge. Considering this distance of 2.2 km in combination with relatively infrequent records of this species flying on the site, no additional buffer is considered necessary.

» Most incidental sightings of target species were in the south-east of the site, in the flatter areas and no turbines are planned in the preliminary layout assessed.
» The species recorded flying most frequently on site were the Northern Black Korhaan, and Southern Pale Chanting Goshawk. The Lesser Kestrel and Amur Falcon were recorded infrequently on site, which may be as a result of low food occurrence during the monitoring programme, although it can be anticipated that these flocking species will occur in high numbers on the site at some point during the lifespan of this project when food is more abundant.
» Due to the overall low flight activity recorded on site, the collision risk index that was developed highlighted very little in the way of spatial patterns in flight activity. No turbine re-positioning is recommended as a result of the collision risk index.
» Based on a formal risk assessment, two species emerge as being of 'medium' risk of impact by the proposed wind farm, the Northern Black Korhaan and the Southern Pale Chanting Goshawk.
» The significance of impacts on avifauna as a result of habitat destruction, disturbance of birds, and displacement of birds is rated as medium significance. Collision of birds with turbines was rated as low significance.
» Site sensitivity mapping has identified buffers around dams, within which no turbines should ideally be built. There are no turbines located within these buffer areas.

8.4.2 Identified Impacts

Destruction of bird habitat during construction of the facility: Although the habitat on the project site is reasonably common throughout the Karoo, the De Aar area has been identified for the conservation of birds as indicated by its status as the Platberg Karoo Conservancy Important Bird Area. The removal and alteration of natural vegetation or habitat on the site is therefore considered to be of medium significance, and is difficult to mitigate.

Disturbance of birds during construction: Construction of a project of this magnitude will inevitably disturb birds on the site and in surrounding areas. This impact is of medium significance. This will most likely be a relatively short lasting impact and birds will recover thereafter.

Displacement of birds from the site and barrier effects: This impact is considered to be of medium significance, since the infrastructure will take up a large area, and is likely to exclude certain bird species from foraging in the area. Because no Red Listed or other target species have been found breeding on site, this impact is not anticipated to be of high significance.

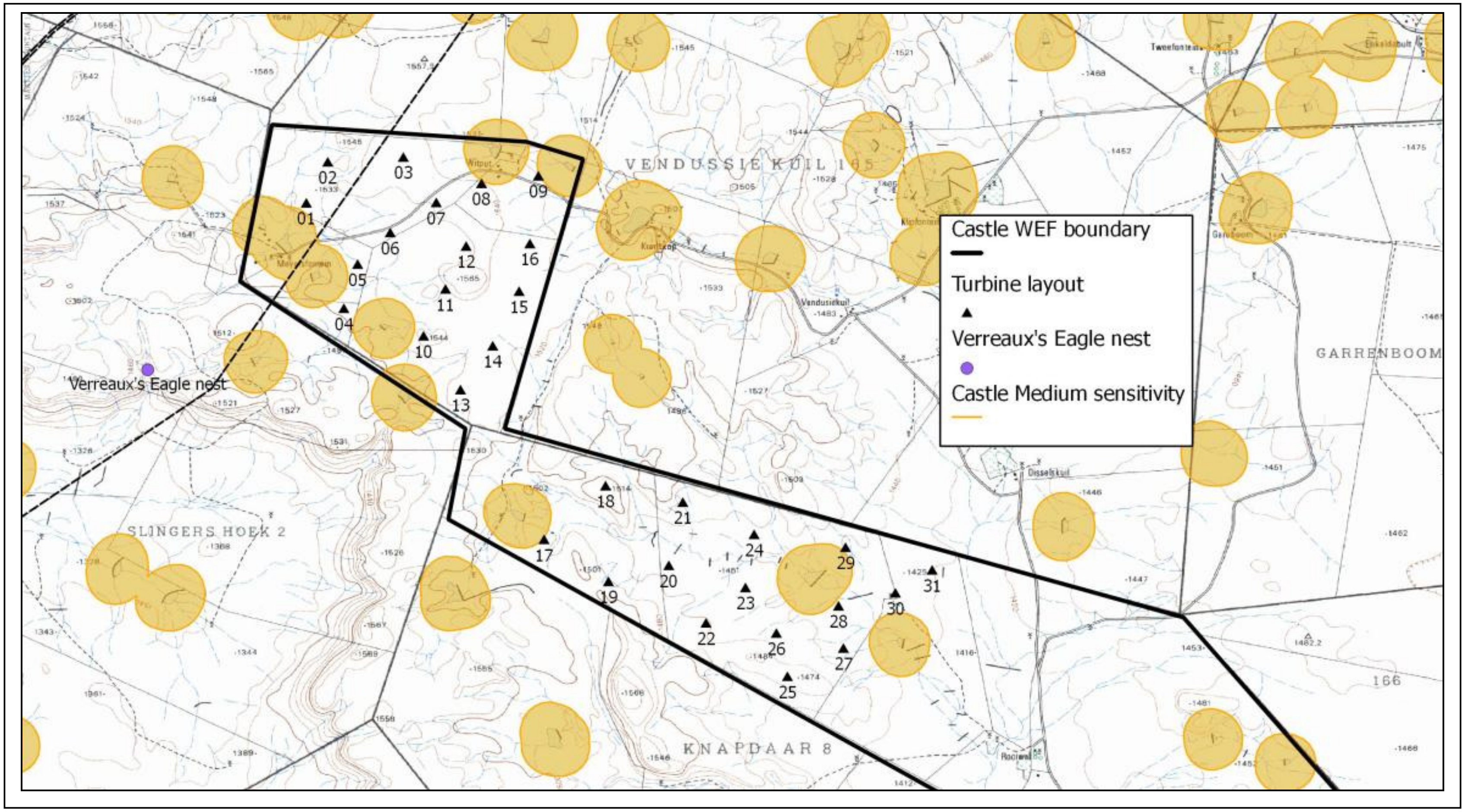


Figure 8.5: Avifaunal sensitivity analysis for the Castle Wind Energy Facility.

This impact is very difficult, if not impossible to mitigate for once the facility is built, and therefore remains at medium significance post mitigation.

Collision of birds with turbine blades: Due to the relatively low level of flight activity on site for most target bird species (the Verreaux's Eagle, Northern Black Kor haan and Jackal Buzzard), this impact is considered to be of low significance.

Nature of impact: Destruction of natural bird habitat on and near site – impact on sensitive and threatened species and habitat specialists		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without mitigation	**With mitigation**
Extent	Local (1)	N/A
Duration	Permanent (5)	N/A
Magnitude	Low (4) –	N/A
Probability	Definite (5)	N/A
Significance	**Medium (50)**	**N/A**
Status (positive or negative)	Negative	
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on.	
Mitigation: The impact cannot be fully avoided Avoid construction of infrastructure in sensitive zones identified (this has already been considered in the current layout) (refer to Figure 8.5).		
Cumulative impacts: High – the Castle site is almost surrounded by two other preferred bidder Round 3 wind energy facilities.		
Residual Impacts: High – difficult to rehabilitate vegetation.		

Nature of impact: Disturbance of birds on site and in surrounding area. Sensitive and threatened species are of most concern and particularly while breeding.		
Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without mitigation	**With mitigation**
Extent	Local – 1	N/A
Duration	Short – 1	N/A
Magnitude	Moderate – 6	N/A
Probability	Highly probable – 4	N/A

Significance	**Medium (32)**	**N/A**
Status (positive or negative)	Negative	
Reversibility	High	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on.	
Mitigation: Avoid construction of infrastructure in the sensitive areas identified – as per the 31 turbine layout (refer to Figure 8.5). The impacts cannot be fully avoided, therefore the significance rating pre and post mitigation will remain the same.		
Cumulative impacts: High – the Castle site is almost surrounded by two other authorized wind energy facilities.		
Residual Impacts: None		

Nature of impact: Displacement of birds from the site and barrier effects		
Listed Activities: » GN 545: 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i)		
	Without mitigation	**With mitigation**
Extent	Regional – 2	N/A
Duration	Long term – 4	N/A
Magnitude	Low – 4	N/A
Probability	Probable – 3	N/A
Significance	**Medium (30)**	**N/A**
Status (positive or negative)	Negative	
Reversibility	High	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on.	
Mitigation: Avoid construction of infrastructure in sensitive areas identified (refer to Figure 8.5). The impacts cannot be fully avoided, therefore the significance rating pre and post mitigation will remain the same.		
Cumulative impacts: High – the Castle site is almost surrounded by two other preferred bidder wind energy facilities.		
Residual Impacts: None		

Nature of impact: Collision of birds with turbine blades		
Listed Activities: » GN 545: 1,15		
	Without mitigation	**With mitigation**
Extent	Local – 1	Local – 1
Duration	Long term – 4	Long term – 4
Magnitude	Low – 4	Low – 4
Probability	Probable – 3	Possible – 2

Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	
Reversibility	Low – birds are killed	
Irreplaceable loss of resources?	High – birds are killed	
Can impacts be mitigated?	Partially	
Mitigation: Avoid construction of turbines in sensitive areas identified (refer to Figure 8.5).		
Cumulative impacts: High – the Castle site is almost surrounded by two other preferred bidder wind energy facilities.		
Residual Impacts: None - if turbines are decommissioned, impact will cease.		

8.4.3 Comparative Assessment of Impact of Access Road Alternatives on the birds

The alternative access roads are existing gravel roads and will therefore not result in the disturbance and displacement of the birds. There is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.3.5 Implications for Project Implementation

» No infrastructure should be built in the medium to high sensitivity areas identified by this study (as identified on Figure 8.5).
» On site sensitivity mapping has identified buffers around dam features which may hold water during high rainfall events, within which no turbines should ideally be built.
» The Verreaux's Eagle nest located approximately 2.2 km off site on the escarpment edge does not require any additional buffer considering the distance from turbines and the infrequent records of this species flying on the site.
» All power line linking the turbines and linking turbine strings to the on-site substation should be placed underground.
» A final avifaunal walk through should be conducted prior to construction to ensure that all the above aspects have been adequately managed and to ground truth the final layout of all infrastructure. This will most likely be done as part of the site specific Environmental Management Programme. This will also allow the development of specific management actions for the Environmental Control Officer during construction, and training for relevant on site personnel if necessary.
» The 'during' and post-construction bird monitoring programme outlined in the Avifaunal Assessment Report should be implemented by a suitably qualified and accredited avifaunal specialist. Post construction monitoring of live bird abundance and movement should be conducted for at least 1 year and carcass

searches for at least 2 -3 years and repeated every 5 years thereafter. This monitoring should be done in accordance with the latest version of the best practice guidelines available at the time (Jenkins et al, 2012).

8.4 Assessment of potential impacts on Bats

Bat activity has been monitored using active and passive bat monitoring techniques. Active monitoring has been carried out through site visits with transects made throughout the site with a vehicle mounted bat detector. Passive detection has commenced through the mounting of passive bat monitoring systems (SM2BAT+ time expansion type bat detectors) placed on four monitoring masts on site, specifically three short 11m masts and one meteorological mast.

One weatherproof ultrasound microphone was mounted at a height of 10 meters on each short mast, while two microphones were mounted at 10m and 50m heights on the meteorological mast. These microphones were then connected to the SM2BAT+ bat detectors.

Each detector was set to operate in continuous trigger mode from dusk each evening until dawn (times were correlated with latitude and longitude). Trigger mode is the setting for a bat detector in which any frequency which exceeds 16 KHz and 18 dB will trigger the detector to record for the duration of the sound and 500 ms after the sound has ceased. Based on the 12 months monitoring and the layout provided there are no turbines located in moderate or high bird sensitive buffers or areas.

8.5.1 Specialist Findings

There are three bat species recorded in the vicinity of the site that occur commonly in the area, that are likely to occur on site based on their probably of occurrence and widespread distribution. These species are of importance due to their likelihood of being impacted by the proposed wind energy facility, which is a combination of abundance and behaviour. The relevant species are listed below:

» *Miniopterus natalensis;*
» *Neoromicia capensis;* and
» *Tadarida aegyptiaca.*

The key findings arising from 12 month monitoring conducted on site are as follows:

» As mentioned above the *Neoromicia capensis* and *Tadarida aegyptiaca* are very common across the site, with *Miniopterus natalensis* occurring in significantly lower numbers. The common bat species, found in high numbers, are highly important ecologically, since they are mostly responsible for the ecosystem services provided by insectivorous bats. It is thus pertinent to conserve these species from the negative impacts of wind farms. Figure 8.6 below displays the sum total of bat passes for each species detected by each monitoring system

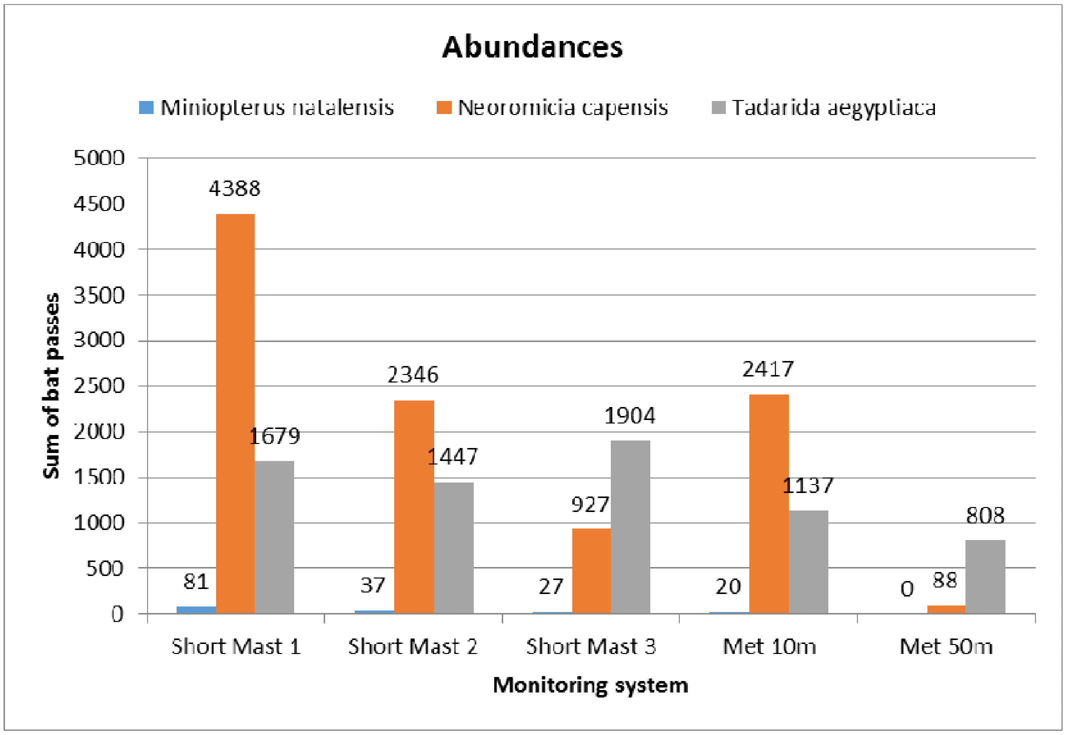


Figure 8.6: Sum of bat passes detected per species per monitoring system

The *Tadarida aegyptiaca* species showed declined activity levels over the winter months with a general increase over the spring season. The average number of passes was highest over summer from October to January (refer to Figure 8.7).

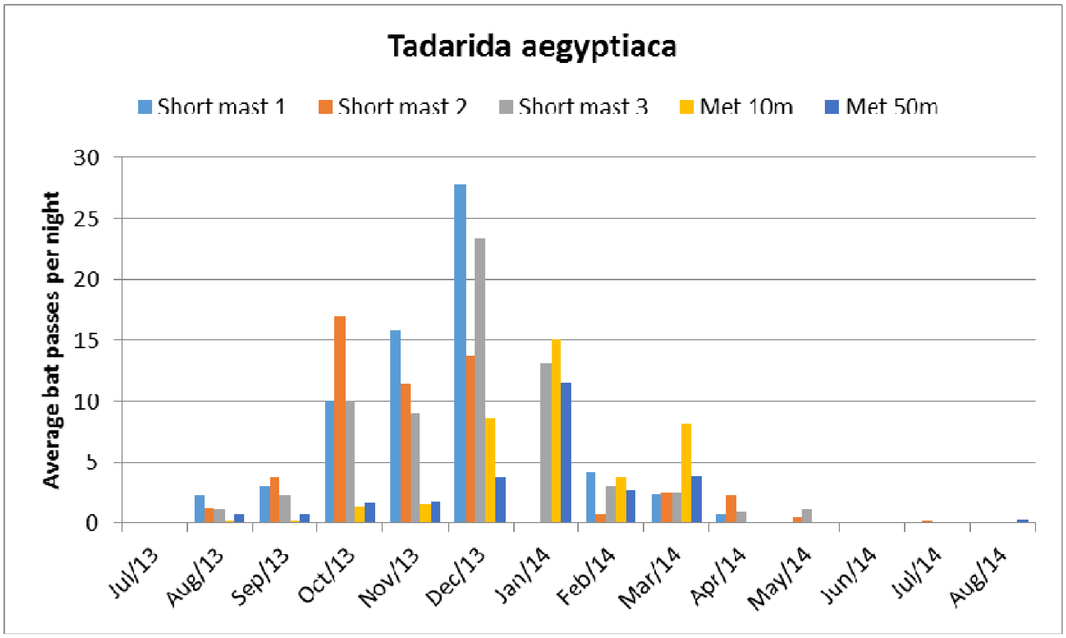


Figure 8.7: Average bat passes per night for *Tadarida aegyptiaca* over the full monitoring period

Neoromicia capensis species also displays lower activity over the cold winter months with a steady increase into spring. Highest activity levels were detected over the autumn months of February to May (Refer to Figure 8.8).

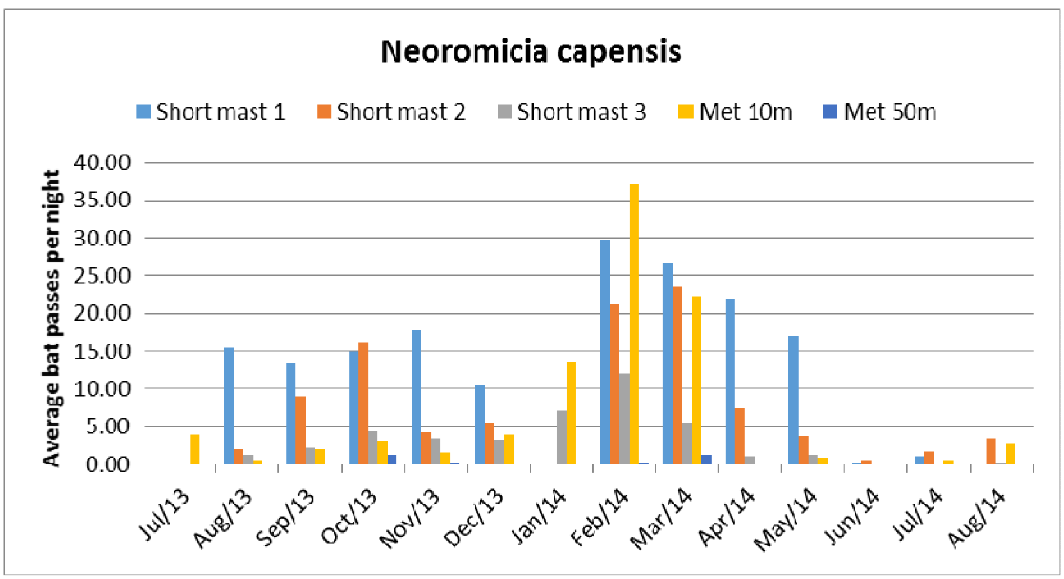


Figure 8.8: Average bat passes per night for *Neoromicia capensis* over the full monitoring period

The *Miniopterus natalensis* species was detected in low numbers over most of the year, with highest detections over the autumn months of February to May (refer to Figure 8.9).

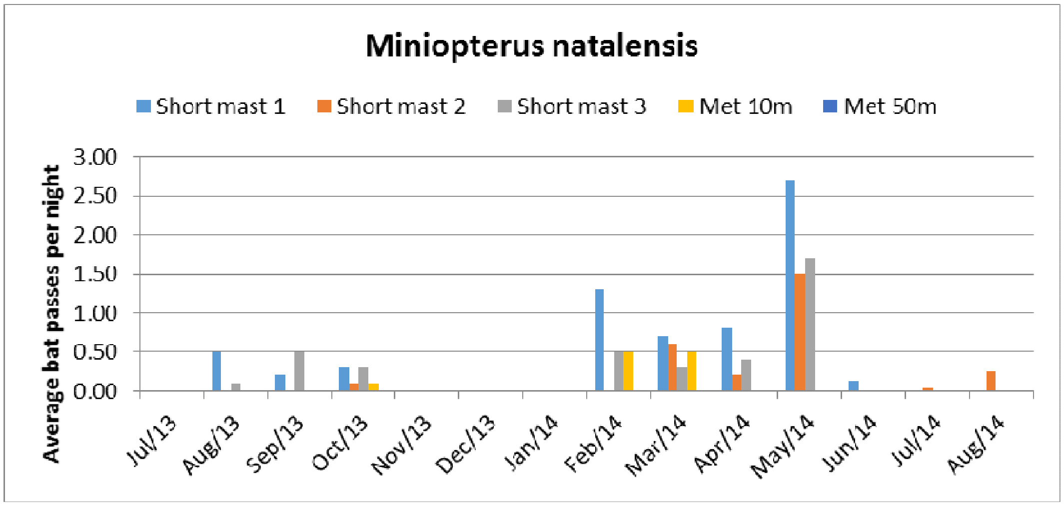


Figure 8.9: Average bat passes per night for *Miniopterus natalensis* over the full monitoring period

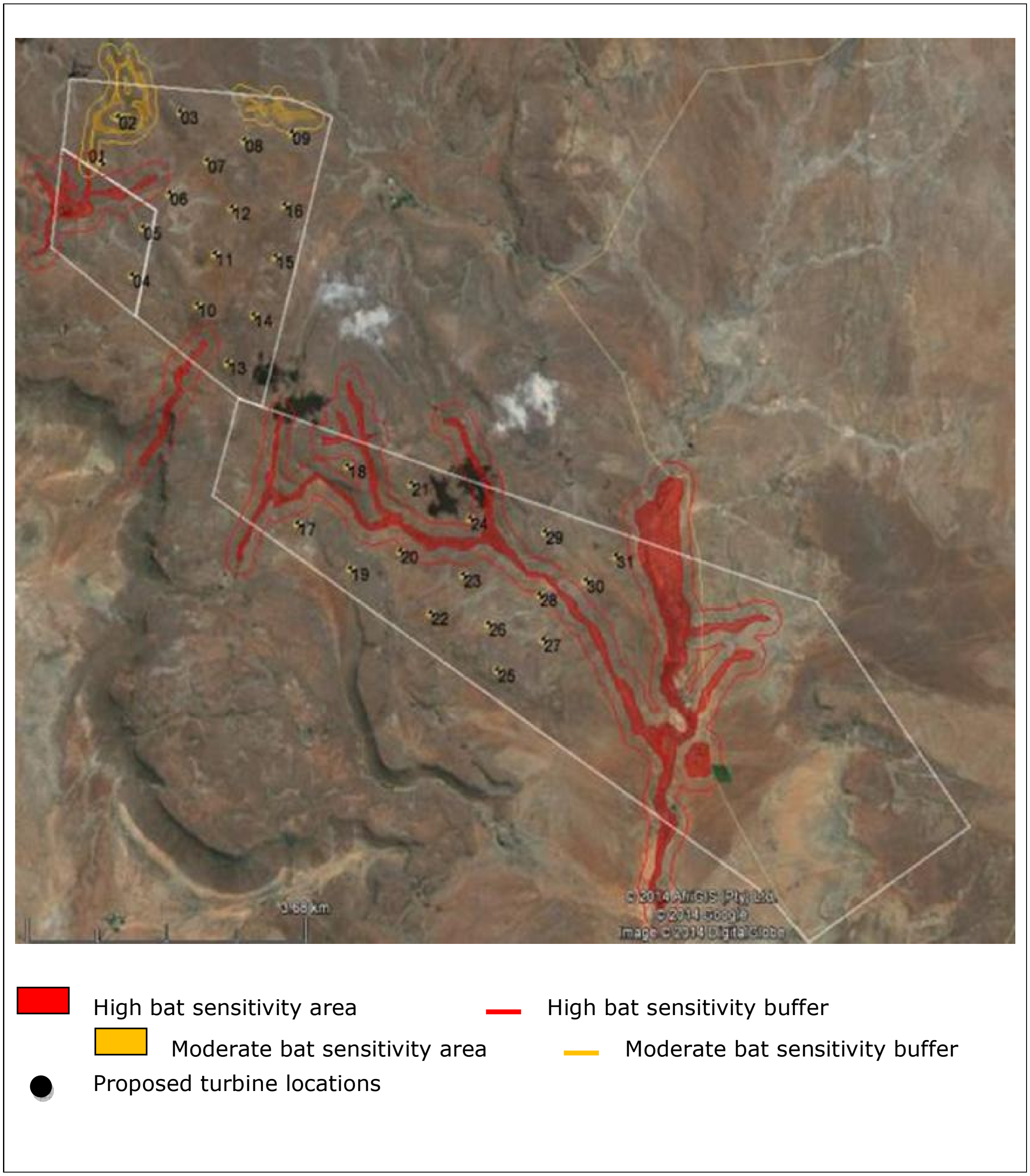


Figure 8.10: Areas of high and moderate bat sensitivity with associated buffers and proposed turbine layout

8.5.2 Identified Impacts

Destruction of bat roosts due to earthworks and blasting: During construction, the earthworks and especially blasting can damage bat roosts in rock crevices. Intense blasting close to a rock crevice roost can cause mortality to the inhabitants of the roost.

Impact of artificial lighting on bats: During construction and decomissioning the use of strong artificial lights used at the work environment during night time will attract insects and thereby also bats. Only certain species of bats will however readily forage around strong lights, whereas others avoid such lights even if there is insect prey available. This can draw insect prey away from other natural areas and thereby artificially favour certain species, affecting bat diversity in the area.

Foraging habitat loss during construction: Some foraging habitat will be permanently lost by construction of turbines and access roads. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles.

Bat mortality: The incident of bat fatalities for migrating species has been found to be directly related to turbine height, increasing exponentially with altitude, as this disrupts the migratory flight paths (Howe *et al*. 2002; Barclay *et al*. 2007). Although the number of fatalities of migrating species increased with turbine height, this correlation was not found for increased rotor sweep (Howe *et al*. 2002; Barclay *et al*. 2007). Despite the high incidence of deaths caused by direct impact with the blades, most bat mortalities have been found to be caused by barotrauma (Baerwald*et al*. 2008). This is a condition where low air pressure found around the moving blades of wind turbines, causes the lungs of a bat to collapse, resulting in fatal internal haemorrhaging (Kunz *et al*. 2007). Baerwald*et al*. (2008) found that 90% of bat fatalities around wind turbines involved internal haemorrhaging consistent with barotrauma.

<table>
<tr><td colspan="3">Nature of impact: Destruction of bat roosts due to earthworks and blasting</td></tr>
<tr><td colspan="3">Relevant Listed Activities:
» GN 544:10, 47(ii)
» GN 545: 1, 15.
» GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>High (3)</td><td>Low (2)</td></tr>
<tr><td>Duration</td><td>Long-term (4)</td><td>Long-term (4)</td></tr>
<tr><td>Magnitude</td><td>Moderate (6)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>Unlikely (2)</td></tr>
</table>

Significance	**Medium (52)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Very low	Very low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Adhere to the sensitivity map during turbine placement (refer to Figure 8.10). » Blasting should be minimised and used only when necessary.		
Cumulative impacts: Destruction of roosting space leads to increased inter and intra-specific competition resulting in decreased bat population sizes.		
Residual Impacts: Bat populations may be slow to recover resulting in depressed bat numbers over several years.		

Nature of impact:Artificial lighting during construction		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without mitigation	**With mitigation**
Extent	Low (3)	Low (1)
Duration	Construction period (1)	Construction period (1)
Magnitude	Low (2)	Very low (1)
Probability	Probable (4)	Probable (4)
Significance	**Low (24)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	**Yes**	
Mitigation: Limit the use of strong artificial lighting at night time during construction.		
Cumulative impacts: None		
Residual Impacts: None		

Nature of impact: Artificial lighting during operational phase		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without mitigation	**With mitigation**
Extent	Low(1)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (2)	Low (1)
Probability	Probable (4)	Probable (4)

Significance	**Low (24)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Consciously switch off all lights when not required and avoid allowing lights to burn throughout the night if not needed. » If suitable for the purpose utilise lighting temperatures (colours/wavelengths) that attract less insects, such products do exist.		
Cumulative impacts: None		
Residual Impacts: None		

Nature of impact: Foraging habitat loss		
Relevant Listed Activities: » GN 544:10 » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (3)	Very low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Adhere to the sensitivity map during turbine placement (refer to Figure 8.10). » Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. » Damaged areas not required after construction should be rehabilitated by an experienced vegetation succession specialist.		
Cumulative impacts: foraging habitat clearence due to the development of other renewable projects in the area could significantly affect the success of local bat populations such that declines in population sizes may occur.		
Residual Impacts: Bat populations may be slow to recover resulting in depressed bat		

numbers over several years.

Nature of impact: Temporary foraging habitat loss will occur during decommissioning due to storage areas and movement of heavy vehicles.		
Relevant Listed Activities: » GN 544:10 » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (3)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**30 (Low)**	**24 (Low)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	**Irreversible**	**Irreversible**
Irreplaceable loss of resources?	**Yes**	**Yes**
Can impacts be mitigated?	**Yes**	
Mitigation: » Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. » Damaged areas not required after decommissioning should be rehabilitated by an experienced vegetation succession specialist.		
Cumulative impacts: Foraging habitat clearence could significantly affect the success of local bat populations such that declines in population sizes may occur.		
Residual Impacts: Bat populations may be slow to recover resulting in depressed bat numbers over several years.		

Nature of the impact: Bat mortalities due to direct blade impact or barotrauma during foraging activities (no migration)		
Relevent Linsted Activities: » GN 545: 1		
	Without mitigation	**With mitigation**
Extent	High (3)	High (3)
Duration	Long-term (5)	Long-term (4)
Magnitude	High (9)	Low (4)
Probability	Probable (4)	Unlikely (2)
Significance	**68 (High)**	**22 (Low)**
Status (positive or negative)	**Negative**	**Negative**

Reversibility	**Irreversible**	**Irreversible**
Irreplaceable loss of resources?	**Yes**	**Yes**
Can impacts be mitigated?	**Yes**	
Mitigation: » Avoid areas of High bat sensitivity and their buffers as well as preferably avoid areas of Moderate bat sensitivity and their buffers – as taken into consideration in terms of the current layout.		
Cumulative impacts: This impact will affect both resident and migratory species. There is a significant potential for a long-term reduction in the size of the population of all impacted bat species. However there is very little information concerning population sizes of most South African bat species, making the significance of wind energy impacts on local bat populations very difficult to predict. Bat mortalities as a result of direct blade impact or barotrauma during foraging activities may have cumulative effects that may have greater consequences for long-lived, low-fecundity species such as bats.		
Residual Impacts: If the impact is too severe local bat populations will not recover from mortalities.		

8.5.3 Comparative Assessment of Impact of Access Road Alternatives on Bats

The alternative access roads are existing gravel roads and will therefore not result in the disturbance and displacement of the bats. There is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.4.4 Implications for Project Implementation

» High sensitivity areas and their respective buffers are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site. These areas are 'no-go' areas and turbines must not be placed in these areas.
» Areas of Moderate bat sensitivity and their buffers must be avoided.
» A minimum of two year operational monitoring must be undertaken as soon as turbines are functional, with auditing continuing throughout the lifespan of the Castle Wind Energy Facility.

8.5 Assessment of Potential Impacts on Soil, Land Use, Land Capability and Agricultural Potential

8.6.1 Specialist Findings

Land capability of the Castle Wind Energy Facility is limited by the mountainous, rocky terrain, the shallow soils and the aridity of the region. The site is used for sheep farming. The natural grazing capacity is low and varies between 18 - 30 hectares per large stock unit across the site. There is a very small area of cultivated, irrigated land surrounding the farm house (Rooi Kraal) which is located on the Farm Knapdaar. The low rainfall, high potential evaporation, high maximum and low minimum temperatures, coupled with shallow soils covering most of the site, limits any additional land-use activities. A small area of 7.5 ha near the Rooiwal homestead in the south-eastern part of the study area, is cultivated and irrigated using borehole/groundwater. A number of non-perennial streams are present on the site, but the dominant source of water for agricultural purposes is groundwater.

Three land types dominate the Castle Wind Energy Facility site, namely Fb72, Fb73 and Ae142. The agricultural potential of the land covered by Ae142 is low and land-use restricted to low intensity grazing due to the climatic constraints. The potential of large parts of the land type can however be dramatically increased should adequate irrigation water be available. The agricultural potential of the land covered by Fb72 and Fb73 is low due to the soil and climatic constraints.

Six soil types were identifies within the study area:

» **Cv/Hu**: These are deep (>1 000 mm) well drained soils of the Hutton and Clovely soil form. These soils are restricted to the south-western corner of the Castle Wind Energy Facility study area. The clay content of these soils is low and their morphology indicates that both internal and external drainage is good. They are not sensitive to erosion.
» **Du/Sw**: These soils of the Dundee and Swartland forms occur in valley bottom positions of the site. The Du formed to alluvial depositions and alluvial stratifications are still visible. Due to the duplex nature of the Swartland soils as well as high Na^+ contents in the B-horizon, these soils are susceptible to erosion.
» **Hu/Gs**: These soils have a small storage capacity which makes them sensitive to erosion with limited agricultural potential.
» **Ms/Gs**: The limited storage capacity of these soils limits the agricultural potential to natural grazing and makes these soils susceptible to erosion.
» **R/Ms**: Limited or no storage capacity will result in overland flow due to infiltration excess and this soil association is susceptible to erosion.

» **Sw**: These soils can be dispersive and susceptible to erosion. The strong structure of the pedocutanic B horizon will limit root penetration and water infiltration.

The overall agricultural potential of the site is very low, largely restricted by aridic climate conditions and shallow soils. The Cv/Hu soil associations are the only areas of the site suitable for crop production should adequate irrigation water be available. No turbines are proposed for the area associated with this soil association. Land capability is the combination of soil suitability and climate factors. The entire site has a land capability classification, on the 8 Category scale, of Class 7 (i.e. non-arable, low potential grazing land).

8.6.2 Identified Impacts

Impact of the construction of concrete foundations on agricultural potential
The proposed positions of the turbines are all on soils with very low agricultural potential, shallow and sensitive to erosion due to limited storage capacity and moderately steep slopes.

Construction of buildings and other infrastructure: The construction of workshop, offices and substation could lead to the loss of agricultural land and potential erosion. The impact of these constructions is expected to be medium as there are no mitigation measures that can be proposed that will reduce the impact.

Impact of the expansion on the road network: The impact of the construction of roads is expected to be low due to the low agricultural potential of the land. The site has a potential of experiencing extensive soil erosion, however the impact of soil erosion is expected to be low on condition that mitigation measures must be implemented.

Impact of increased vehicle activity during construction and operation:
A concern for sheep farmers are dust generation associated with more traffic on the farms, resulting in lower quality wool. If managed correctly the cumulative impact of vehicles on dust creation can be limited.

Nature of impact: Constructing concrete foundations for 31 turbines leading to the loss of agricultural land and increased potential erosion		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 10 (a)(ii)(bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**

Extent (E)	Site (1)	N/A
Duration (D)	Permanent (5)	N/A
Magnitude (M)	Medium (2)	N/A
Probability (P)	highly probable (4)	N/A
Significance (S)	**Medium (32)**	**N/A**
Status	Negative	
Reversal and mitigation	None; limit footprint and ensure that adequate erosion measures are in place	
Cumulative impact	The agricultural potential of the site and the soil erosion will be low and the cumulative impacts are therefore expected to be low.	
Residual impact	If surface water from concrete foundations and access roads are not managed correctly it might lead to severe erosion.	

Nature of impact: Constructing workshop, offices and substation leading to the loss of agricultural land and increased potential erosion		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent (E)	Site (1)	N/A
Duration (D)	Permanent (5)	N/A
Magnitude (M)	Medium (2)	N/A
Probability (P)	highly probable (4)	N/A
Significance (S)	**Medium (32)**	**N/A**
Status	Negative	
Reversal and mitigation	None; limit footprint and ensure that adequate erosion measures are in place	
Cumulative impact	None; limit footprint and ensure that adequate erosion measures are in place	
Residual impact	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	

Nature of impact: Constructing of access roads to turbines and new buildings leading to the loss of agricultural land and increased potential erosion.		
Relevant Listed Activities: » GN 544:11, 47(ii) » GN 545: 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent (E)	Site -2 dimensional (1)	N/A
Duration (D)	Permanent (5)	N/A
Magnitude (M)	Medium (2)	N/A

Probability (P)	highly probable (4)	N/A
Significance (S)	**Medium (32)**	**N/A**
Status	Negative	
Reversal and mitigation	None; use existing roads as far as possible, adequate erosion measures are vital (especially at river channel crossings and towards turbines at high elevations against steep slopes)	
Cumulative impact	None; limit footprint and ensure that adequate erosion measures are in place	
Residual impact	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	

Nature: Increased vehicle activity and associated dust generation.		
Relevant Listed Activities: » GN 545: 1, 15		
Extent (E)	Local (2)	N/A
Duration (D)	Short term, generally restricted to construction period (2)	N/A
Magnitude (M)	Medium (2)	N/A
Probability (P)	Improbable (2)	N/A
Significance (S)	**Low** (12)	N/A
Status	Negative	
Reversal and mitigation	None; limit vehicle movement and ensure that road surfaces are moist during maximum vehicle movement periods	
Cumulative impact	None; limit footprint and ensure that adequate erosion measures are in place	
Residual impact	The agricultural potential of this site is low and the cumulative impacts are therefore expected to be low.	

8.6.3 Comparative Assessment of Access Road Alternatives

Both the northern and southern access routes alternatives may result in increased erosion risk as a result of soil disturbance as well as increased runoff generated. It is anticipated that the impact will be low, there is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.6.4 Implications for Project Implementation

Due to the arid climate of the study area, coupled with shallow soils the agricultural potential is limited to low intensity grazing. The impact of the proposed development agricultural resources is therefore considered to be small. It is however important that the direct footprint of infrastructure be kept to a minimum and that adequate erosion measures and mitigation strategies are in place to ensure that the proposed project and current agricultural practices continue in sustainable symbioses. There are therefore no implications for the project development from an agricultural perspective.

8.6 Assessment of Potential Social Impacts

8.7.1 Specialist findings

The construction phase for the proposed Castle wind energy facility is expected to extend over a period of ~ 18 months and create approximately 250 construction related jobs. Of this total approximately ~25 % (62) will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 35 % (88) to semi-skilled personnel (drivers, equipment operators), and ~ 40% (100) to low skilled personnel (construction labourers, security staff). The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from De Aar and Philipstown. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low. This is an issue that will need to be addressed during the recruitment process. The proponent will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community.

The key positive social issues associated with the construction and operation phase include:

Potential positive impacts- Construction Phase

» Creation of employment and business opportunities and opportunity for skills development and on-site training.

Potential positive impacts- Operation Phase

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a Community Trust; and
» The establishment of renewable energy infrastructure.

The significance of the majority of potential negative impacts with mitigation was assessed to be of Low significance. All of the potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. In addition, given that the majority of the low and semi-skilled construction workers can be sourced from the local area the potential risk at a community level to local family structures and social networks is regarded as Low negative significance. However, the impact on individuals who are directly impacted on by construction workers and or job seekers (i.e. contract HIV/ AIDS) was assessed to be of High negative significance. The Castle Wind Energy Facility will create a limited number of employment opportunities during the operation phase (~ 16-20). The potential socio-economic benefits will therefore be limited. However, the majority of the employment opportunities are likely to benefit HD members of the community. The proponent has also indicated that they are committed to implementing a training and skills development programme during the operational phase and are also required, as part of the REIPPP process, to ensure that the community development targets are met as presented to the DOE during the bidding programme. Such a programme would support the strategic goals of promoting local employment and skills development contained in the municipal IDP.

The key positive social issues associated with the construction and operation phase include:

Potential negative impacts- Construction Phase

» Impacts associated with the presence of construction workers on site
» Influx of job seekers to the area;
» Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site;
» Increased risk of veld fires associated with construction-related activities;
» Threat to safety and security of farmers associated with the presence of construction workers on site;
» Impact of heavy vehicles, including damage to roads, safety, noise and dust; and
» Potential loss of grazing land associated with construction-related activities.

Potential negative impacts- Operational Phase

» The visual impacts and associated impact on sense of place;
» Potential impact on tourism (however this impact could also be positive as the facility could attract visitors);
» Influx of job seekers to the area; and

8.7.2 Identified Impacts

Creation of employment and business opportunities: The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area, specifically residents from De Aar. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low. This is an issue that will need to be addressed during the recruitment process. The proponent will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community. Implementation of the enhancement measures listed below can enhance these opportunities.This issue also highlights the importance of implementing a training and skills development programme before the construction phase commences.

Presence of construction workers in the area: The presence of construction workers poses a potential risk to family structures and social networks in the area, specifically local communities in De Aar and possibly Phillipstown. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can affect the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks.

While the potential threat posed by construction workers to the community as a whole is likely to be low, the impact on individual members who are affected by the behavior of construction workers has the potential to be high, specifically if they are affected by STDs etc.

Influx of job seekers to the area: Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed Castle Wind Energy Facility may, on its' own, not result in an influx of significant numbers of job seekers to De Aar, the establishment of a number of other renewable energy projects in the area has the potential to attract job seekers to the area. Given the number of renewable energy projects in the area this has in all likelihood already occurred.

The potential social impacts associated with the influx of job seekers include:

- » Impacts on existing social networks and community structures;
- » Competition for housing, specifically low cost housing;
- » Competition for scarce jobs;
- » Increase in incidences of crime; and
- » An increase in sexually transmitted diseases (STDs).

Loss of farm labour: Experience from other projects indicates that the loss of farm workers is an issue of concern. In most instances local farmers are unlikely to be in a position to compete with the salaries offered by the renewable energy companies during the construction phase. As a result farm laborers may be tempted to resign from their current positions on farms. The loss of skilled and experienced farm labor would have a negative impact on local farmers.

The potential impacts for the affected farmers associated with the loss of permanent farm labour to the construction phase are exacerbated by the security of tenure that permanent farm laborers enjoy in terms of the Extension of Security and Tenure Act (ESTA). Farm labourers who are eligible under ESTA and who take up jobs during the construction phase will be entitled stay on in their houses on the farms in question. The net effect is that the farmer may have to incur costs associated with the construction of new dwellings for new labour appointed to replace the labour lost to the construction phase. The farmer may also have to continue subsidizing services such as potable water to people who are no longer in his employ.

While the proposed Castle Wind Energy Facility on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of renewable energy projects in the area has the potential to impact on the farming sector. However, at the end of the day farm labor can be replaced. The potential impacts on farm operations are therefore likely to be temporary. In addition, the findings of the Social Impact Assessment indicate that the farming activities in the area are not labor intensive. In this regard the majority of the farms in the study area are not occupied.
The farm workers that take up jobs during the construction phase are also at risk. While some farm workers may be re-employed once the construction has been completed, others may not be so fortunate. The low education levels associated with the farm worker community would effectively mean that alternative employment opportunities outside the agricultural sector will not be accessible to them. These farm workers and their families therefore stand to be negatively impacted upon in the medium to long term. The low education levels of local farm workers are however also likely to reduce the chances of them being employed during the construction phase.

On the positive side, some farm workers may view work associated with the construction phase as an opportunity to gain skills and relocate to De Aar and other towns in the area.

While the proposed wind energy facility on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of renewable energy projects in the area has the potential to impact on the farming sector. . Farm labour is replacable, however and the potential impacts on farm operations are therefore likely to be temporary.

Increased risk of stock theft, poaching and damage to farm infrastructure:
The presence of construction workers on the site increases the potential risk of

stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Livestock and game losses may also result from gates being left open and/or fences being damaged. The local farm owners in the area who were interviewed indicated that stock theft was currently not a major concern. However, concerns were raised regarding the presence of construction workers in the area. As indicated above, all of the local farmers in the area noted that no construction workers should be allowed to stay on the site overnight with the exception of security personnel.

The local farmers also indicated that the developer should compensate local farmers for any losses that could be attributed to the activities undertaken during the construction phase.

Increased risk of veld fires: The presence of construction workers and construction-related activities on the site poses an increased risk of veld fires that in turn pose a threat to the livestock, wildlife, and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened.

» The potential risk of veld fires is heightened by windy conditions in the area, specifically during the dry, windy winter months.
» The dominant agricultural activity in the broader area is stock farming (sheep). As such, the livelihoods of the farmers in the area are dependent on grazing on their farms. Any loss of grazing due to a fire would therefore impact negatively on the affected farmers livelihoods; and
» The risk of fire related damage is exacerbated by the limited access to fire-fighting vehicles.

However, it should be noted that the low, Karoo scrub is not highly prone to run-away fires. Despite this fact, appropriate precautions would however need to be taken by the contractor during the construction phase to avoid fire.

Impacts associated with construction phase and movement of construction vehicles: Each wind turbine is comprised of the wind tower (approximately 120m tall), the nacelle and rotor, and three blades. Abnormally sized vehicles will be required to transport these components to site, because of their size and weight. In addition, further trips will be required to transport construction equipment (graders, excavators and cement trucks), as well as electrical infrastructure where necessary (cables, substations and transformers) and construction materials (cement etc). Based on traffic study undertaken for a similar sized Wind Energy Facility, over the construction period of 18 months it is expected that in the region of 173 trucks would travel to the site every month, or 40 per week, or 8 per day. It expected that 20% of the above would be heavy truck traffic (Arup, September, 2012).

Based on the information from the proponent, the majority of the components associated with the proposed wind energy facility are likely to be transported to the site by road from Port Elizabeth via the N10, which links Port Elizabeth in the south east with De Aar in the north-west. The movement of large heavy loads during the construction phase, has the potential to create delays and safety impacts for other road users travelling along either of the two routes. These impacts can however be mitigated by timing the trips to avoid times of the year when traffic volumes are likely to be higher. For instance this could be at the start and end of school holidays, long weekends and weekends in general etc.

The option of railing material from Port Elizabeth should also investigated. This would reduce the potential impact on other road users along the N10. Based comments from interviews undertaken for other renewable energy projects near De Aar, Mr. Bangani (NAFCOC representative) and Mr Jack (the then Emthanjeni Local Municipality IDP and LED Manager) both indicated that the option of using rail to transport equipment to the Pixley ka Seme District Municipality should be investigated. Mr Bangani indicated that the establishment proposed of a Renewable Energy Hub centred around De Aar also created an opportunity to revitalise the railway sector in De Aar.

In terms of access to the site, the site will be accessed from the N10 via the R389, which links the N10 with Philipstown, which is located to the north east of De Aar. The findings of the SIA indicate that the volume of traffic on the R389 is low. The social impacts associated with the movement of construction related traffic along this road are therefore likely to be low.

The movement of heavy vehicles along the local farm road in the area will however damage the road surfaces. This damage will impact on local farmers in the area and will need to be addressed before the contractor leaves site.

The issue of dust impacts was also raised. Dust and impacts on vegetation and local roads were key issues raised by all interviewees. These comments were based on experience with the solar projects constructed in the area (De Aar Solar, Solar Capital, Kalkbult). Dust impacts affect farm houses and productive vegetation. Due to arid climate, vegetation is not regularly “washed” by rainfall, and thus some dieback may occur. Vegetation could also be affected by heavy vehicles not sticking to designated roads.

Damage to and loss of farmland: The activities associated with the construction phase have the potential to result in the loss of land available for grazing. Mr van der Merwe, the farm owner indicated however that the project would unlikley affect his farming activities and that the carrying capacity of the veld was low. Only one landowner is affected by the WEF development namely Mr van der Merwe, who has entered into a lease agreement with the proponent. The loss of productive farmland would therefore be offset by the income from the lease agreement.

The final disturbance footprint can also be reduced by careful site design and placement of the wind turbines and associated infrastructure. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

Benefits associated with the establishment of a community trust: In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a community trust which is funded by revenue generated from the sale of energy. The proponent has indicated that they are committed to establishment of a community trust.

Community Trusts provide an opportunity to generate a reliable and steady revenue stream over a 20 year period. This revenue can be used to fund development initiatives in the area and support the local economic and community development. The 20 year timeframe also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed wind energy facility can be used to support a number of social and economic initiatives in the area, including:

» Education (adult and child);
» Health care;
» Training and skills development; and
» Support for SMME's.

Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust. In addition, there may be delays in the setting up of Community Trusts.

Impact on tourism: The Northern Cape PGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile ecosystems and vulnerability to climatic variation. The document also indicates that due to the provinces exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Therefore caution must be taken to ensure that the development of renewable energy projects, such as the proposed wind energy facility, do not impact negatively on the tourism potential of the Province.

Based on the findings of the site visit however, the proposed facility is not likely to impact on the tourism sector in the area or the Province. This is linked to the remote location of the site and the negative impact of the existing power lines on the visual character of the area and its sense of place. In addition, the area has been identified as a Renewable Energy Hub and the site is surrounded by other renewable energy projects. The significance of this issue is therefore rated as Low negative. The findings of the Social Impact Assessment also indicate that the establishment of the proposed wind energy facility may also attract tourists to the area. The significance of this potential benefit is also rated as Low positive.

Assessment of no-development option: The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producers of carbon emissions in the world, this would represent a negative social cost. In addition, the employment opportunities associated with the construction and operational phase, as well as the benefits associated with the establishment of a Community Trust would be forgone.

Nature of impact: Creation of employment and business opportunities during the construction phase		
Relevant Listed Activities: » ***GN 545: 1, 15***		
	Without Enhancement	**With Enhancement**
Extent	Local – Regional (2)	Local – Regional (3)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Enhancement : In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented: **Employment** » Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. » Where feasible, efforts should be made to employ local contactors that are compliant		

with Black Economic Empowerment (BEE) criteria; » Before the construction phase commences the proponent and its contractors should meet with representatives from the Emthanjeni Local Municipality to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase. » The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase. » Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. **Business** » The proponent should seek to develop a database of local companies, specifically BEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work; and » The Emthanjeni Local Municipality, in conjunction with the local Chamber of Commerce and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.
Cumulative impacts: Opportunity to up-grade and improve skills levels in the area.
Residual impacts: Improved pool of skills and experience in the local area.

Nature of impact: Creation of employment and business opportunities associated with the operational phase		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15		
	Without Enhancement	**With Enhancement**
Extent	Local (1)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (24)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	

Can impact be enhanced?	Yes	
Enhancement: See below		
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area		
Residual impacts: None		

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
Relevant Listed Activities: » GN 545: 1, 15		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STD's etc. (5)	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STD's etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)** **Moderate-High for specific individuals who may be affected by STD's etc. (57)**	**Low for the community as a whole (24)** **Moderate-High for specific individuals who may be affected by STD's etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: The potential risks associated with construction workers can be mitigated. The aspects that should be covered include:		

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks; » The proponent and the contractors should develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation; » The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; » The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis; » The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks; » The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks; and » As per the agreement with the local farmers in the area, no construction workers will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.
Cumulative impacts: Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community. The development of other solar energy projects in the area may exacerbate these impacts.
Residual impacts: Community members affected by STDs etc.

Nature of impact: Potential impacts on family structures, social networks and community services associated with the influx of job seekers- Construction.		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)

Magnitude	Minor for the community as a whole (2) High-Very High for specific individuals who may be affected by STD's etc. (10)	Minor for community as a whole (2) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27) Medium -High for specific individuals who may be affected by STD's etc. (54)**	**Low for the community as a whole (27) Medium-High for specific individuals who may be affected by STD's etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
» **Mitigation:** It is almost impossible to stop people from coming to the area in search of a job, specifically given that the Pixley ka Seme District Municipality and Emthanjeni Local Municipality have identified renewable energy as a future growth sector. However, as indicated above, the proponent should ensure that the employment criteria favour local residents in the area. In addition the proponent should implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in De Aar and other towns in the Emthanjeni Local Municipality.		
Cumulative impacts: Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.		
Residual impacts: The proposed development is of such a nature that the status quo could be regained after decommissioning the plant.		

Nature of impact: Potential impacts on family structures, social networks and community services associated with the influx of job seekers- Operation		
Relevant Listed Activities: » GN 545:1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)

Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)	Minor for community as a whole (2) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	Medium for the community as a whole (33) Medium -High for specific individuals who may be affected by STD's etc. (51)	Low for the community as a whole (27) Medium-High for specific individuals who may be affected by STD's etc. (51)
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: • » Implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in De Aar and other local towns in the Emthanjeni and Renosterberg Local Municipalities.		
Cumulative impacts: Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.		
Residual impacts: The residual impact of health related risks cannot be reversed to the status quo after the construction or decommissioning of the plant has taken place.		

Nature of impact: Potential impact on local farmers associated with loss of farm labour to the construction and operation phase		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local and Regional (2)	Local and Regional (1)

Duration	Medium Term (3) (Assumed that farm labour can be replaced)	Medium Term (3) (Assumed that farm labour can be replaced)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (24)
Status	Negative	Negative
Reversibility	Yes, if farm workers return of are replaced	Yes, if farm workers return of are replaced
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: While the proponent can liaise with local farmers in the area and take steps not to employ local farm worker were possible, it is not possible to prevent farm workers from applying for work for self-improvement. There are therefore no recommended mitigation measures. Also farm labour can be replaced. The impacts would therefore be temporary. Farm workers who apply for construction related work should also be informed that the nature of the work is temporary. In addition they should be informed of the potential negative consequences of their actions, which include the potential loss of their permanent farm job.		
Cumulative impacts: Impacts on farm operations due to loss of experienced farm labour.		
Residual impacts: Increase in unemployment amongst local farm workers who are not rehired once construction worker comes to an end. On positive side, may result in increased skills for local farm workers and improve their economic mobility.		

Nature of impact: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)

Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (33)	Low (24)
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes

Mitigation: The mitigation measures that can be considered to address the potential impact on livestock, game, and farm infrastructure include:

- » The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase;
- » The proponent should develop a Code of Conduct for construction workers before the contractors move onto site;
- » The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities;
- » The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;
- » Contractors appointed by the proponent should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- » Contractors appointed by the proponent should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; and
- » The housing of construction workers on the site should be limited to security personnel.

Cumulative impacts: No**,** provided that losses are compensated.

Residual impacts: None

Nature of impact: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires		
Relevant Listed Activities: » GN 545: 1, 15.		
	Without Mitigation	**With Mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation: The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages. This includes losses associated veld fires. In addition, the potential increased risk of veld fires can be effectively mitigated. Mitigation measures include:

» A fire-break should be constructed around the perimeter of the site office area prior to the commencement of the construction phase;
» Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;
» Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months;
» Contractor to provide adequate firefighting equipment on-site;
» Contractor to provide fire-fighting training to selected construction staff;
» No construction staff, with the exception of security staff, to be accommodated on site over night; and
» As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also

compensate the firefighting costs borne by farmers and local authorities. In addition the landowners and developers should also ensure that they join the local fire protection agency.
Cumulative impacts: No, provided losses are compensated for.
Residual impacts: None

Nature of impact: Potential noise, dust and safety impacts associated with construction related activities and the movement of construction related traffic to and from the site		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without Mitigation	**With Mitigation**
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: The proponent should enter into an agreement with the local municipalities whereby the company will compensate for proven damage to local roads as a result of construction vehicle traffic. In addition, the potential impacts associated with heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include: » Abnormal loads should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.; » The contractor must ensure that all damage caused to local farm roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor; » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; and		

» All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.
Cumulative impacts: If damage to roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were no responsible for the damage.
Residual impacts: Reduced quality of road surfaces and impact on road users

Nature of impact: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development		
Relevant Listed Activities: » GN 545: 1		
	Without Enhancement	**With Enhancement**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Mitigation Measures: In order to maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented: » The proponent in consultation with the Emthanjeni and Renosterberg Local Municipalities should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; and » The proponent in consultation with the Emthanjeni and Renosterberg Local Municipalities should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the wind energy facility are managed for benefit of the community as a whole and not individuals within the community.		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: None		

Nature: Potential impact of the wind energy facility on local tourism		
Relevant Listed Activities: » GN 545: 1		
	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24) (Applies to both – and +)**	**Low (27) (Applies to both – and +)**
Status	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Mitigation Measures: The recommendations contained in the Visual Impact Assessment should be implemented. In terms of efforts to enhance the proposed benefits to tourism: » The proponent should liaise with representatives from the Emthanjeni and Renosterberg Local Municipalities and local tourism representatives to raise awareness of the proposed facility; and » The proponent should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.		
Cumulative impacts: Potential negative and or positive impact on tourism in the Emthanjeni and Renosterberg Local Municipal areas.		
Residual impacts: None		

Nature: The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy
Relevant Listed Activities:

» GN 545: 1, 15		
	Without Mitigation	**With Mitigation**
Extent	Local-International (4)	Local-International (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (54)**	**Medium (54)**
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Mitigation measures: The development of the proposed wind energy facility would represent an enhancement measure. However, the impact of large facilities on the sense of place and landscape are issues need to be addressed in the location, design and layout of the proposed plant.		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: There will not be any residual impacts as no development would have taken place.		

8.7.3 Comparative Assessment of Impact of Access Road Alternatives on Social Impact

Both the northern and southern access routes are existing gravel routes which are used regularly by farm owners and occupiers in the area. The utilisation of existing roads is supported, and the use of one designated route is supported in order to keep all construction traffic limed to a single corridor. The influx of construction vehicles will negatively impact on the local farm owners. As the roads are currently utilised by local traffic, this needs to be considered in the construction phase and during traffic control and planning. **Alternative 2** is considered the preferred alternative as there are no homesteads situated along the access road. Where either alternative is used, the proponent would be required to ensure that damage to the road surface is monitored and repaired on a regular basis, and that the road is returned to its original state once the construction phase is completed.

» **Access Road Alternative 1 (referred to as the Northern Access Road):** the site will be accessible from northern gravel access road from the R389 to

Philipstown and Hanover, via existing gravel farm roads. There are several homesteads located along the access road and the homesteads will most likely have a negative impact on traffic, generate noise and dust in the area.

» **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from southern gravel access road from the R389 to Philipstown from the N10, via an existing gravel road. The southern access road has been identified as a preferred alternative as there are no homesteads located along the access roads.

8.7.4 Implications for Project Implementation

» The developer in consultation with the Emthanjeni and Renosterberg Local Municipalities should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the Community Trust from the wind energy facility are managed for benefit of the community as a whole and not individuals within the community.
» The developer in consultation with the Emthanjeni and Renosterberg Local Municipalities should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community.
» The developer should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.
» The developer should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase.

8.8 Assessment of Potential Visual Impacts

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General. The approach utilised to identify issues related to the visual impact included the following activities:

» The creation of a detailed digital terrain model (DTM) of the potentially affected environment;

- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The identification of sensitive environments upon which the proposed facility could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses should take into account the dimensions of the proposed structures.

8.8.1 Specialist findings

The results of the viewshed analyses for the proposed facility is shown in Figure 8.11 and Figure 8.12. The viewshed analyses were undertaken from the 31 wind turbine positions within the proposed development area at an offset of 120m above average ground level (i.e. the approximate hub-height of the wind turbine infrastructure). This was done in order to determine the visual exposure (visibility) of the area under investigation, simulating the height of the proposed structures associated with the facility.

The viewshed not only indicates areas from which the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed). The dark orange areas indicate a high frequency (i.e. 29-31 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-3 turbines or parts thereof may be visible).

It must be noted that the viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed facility, therefore signifying a worst-case scenario.

It is evident from the viewshed analyses that the proposed facility would have a large area of potential visual exposure within the central to southern sections of the study area. This is attributed to the sizable wind turbine structures, the location of the structures on top of the plateau and the generally flat topography to the south. The visual exposure to the north is effectively interrupted by the northern escarpment due to the relative setback distance of the wind turbines from this escarpment. The visually exposed terrain, for the most part, falls within vacant natural land, although some sensitive visual receptors may be encountered at farm residences and along major roads.

Within a **5km radius** from the proposed facility, the wind turbines would likely be exposed to a number of farm residences and sections of secondary roads traversing near or over the development site. Affected farmsteads, excluding the ones located within the development site, may include: *Kranskop, Klipfontein, Vendusiekraal, Disselskuil* and *Slingershoek*.

Visibility within the **5-10km** radius from the development site becomes scattered due to the shielding effect of the escarpment surrounding the site. This is quite evident to the north, where the wind turbines are not expected to be visible at all, and some sections to the south. Sections of secondary roads may experience views of the facility where it traverses within this zone. Affected homesteads, from where the turbine structures may be visible, includes: *Tweefontein, Enkeldebult, Garrenboom, Groenpan, Die Dam* and *Matjiesfontein.*

The intensity of visual exposure is expected to subside beyond a **10km** radius. This zone contains large tracts of natural land, limited sections of the R389 and other secondary roads, and a number of farm residences. These include: *Leeuwkuil, Trekpoort, Plessisvlakte, Rooidam, Skietkuil, Sipreshof, Bloemhof, Rusoord* and *Jakkalsfontein.*

Visibility beyond a **radius of 20km** from the facility is deemed to be negligible, as the structures are unlikely to be visible with the naked eye, or totally absorbed within the landscape.

It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact. It must however be noted that a large section of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall within farms earmarked for the development of the two Longyuan Mulilo De Aar North and South Wind Energy Facilities (which will be constructed in 2015) future/possible wind energy facilities. The construction of the Mulilo facilities will greatly affect the visual experience (and potential visual impact) of the Castle Wind Energy Facility. There will be an increased cumulative visual exposure of turbines within the region and, depending on the number of turbines erected, even a negation of the individual visual exposure associated with this Wind Energy Facility. A number of wind turbine positions (21), associated with the Longyuan Mulilo De Aar South Wind Energy Facility were however made available to perform a cumulative visual exposure calculation. The results are is discussed below.

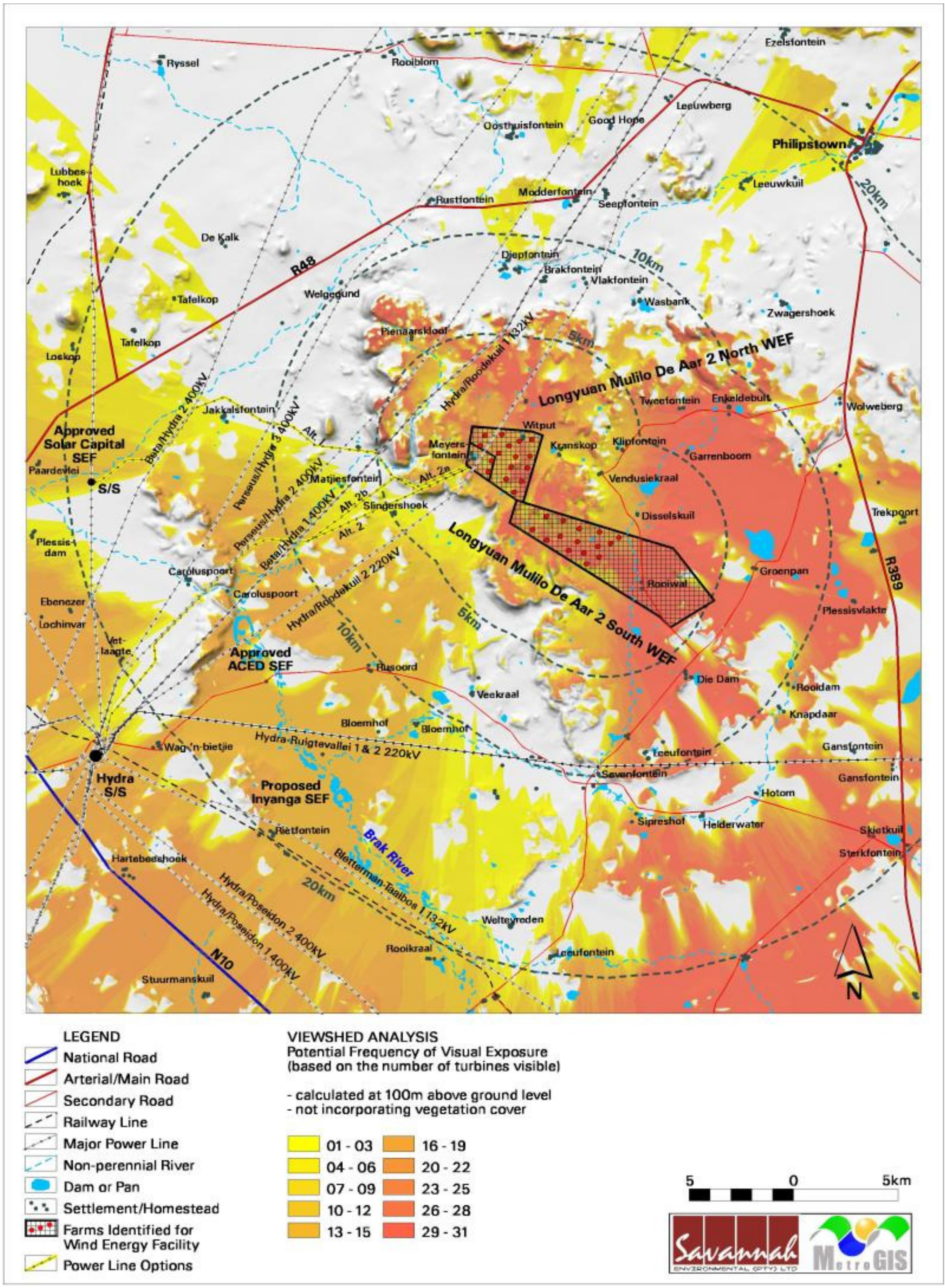


Figure 8.11: Potential visual exposure of the proposed wind energy facility.

(Note: the visible area indicates areas from which any number of wind turbines (with a minimum of one turbine) may be visible.

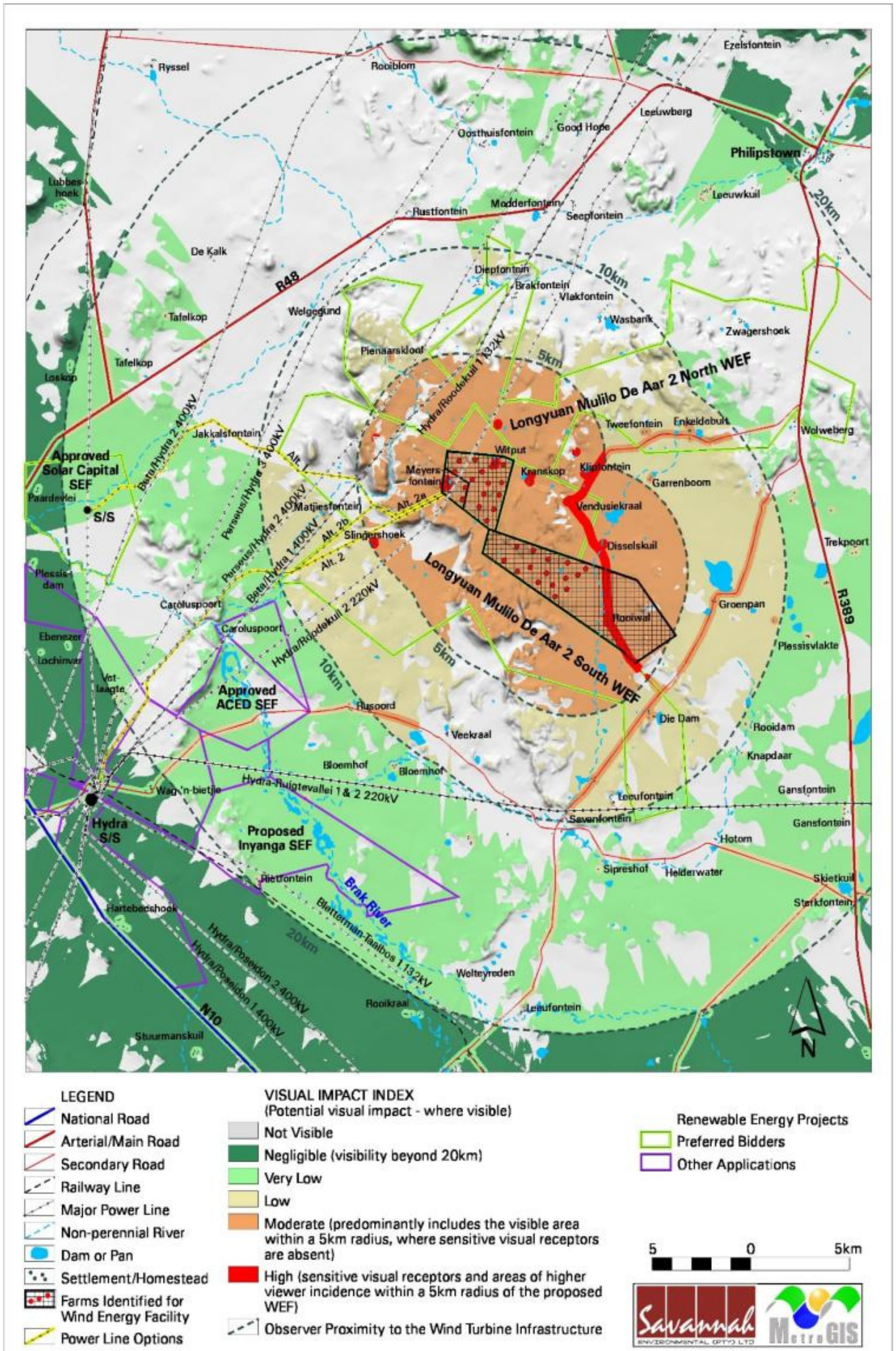


Figure 8.12: Visual impact index of the proposed Castle Wind Energy Facility.

8.8.2 Identified Impacts

Potential visual impact on users of arterial and secondary roads in close proximity to the proposed facility: The visual impact of the wind energy facility on the secondary road traversing the proposed development site is expected to be of high significance, especially within a radius of 5km from the proposed facility. The relatively low anticipated usage of this road reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice.

Potential visual impact on residents of homesteads and settlements in close proximity to the proposed facility: The potential visual impact on residents of settlements and homesteads within a 5-10km radius of the proposed wind energy facility is expected to be of high significance. These settlements and homesteads include *Klipfontein, Disselskuil, Vendusiekraal*, *Rooiwal, Slingershoek, Pienaarskloof, Tweefontein, Garrenboom, Groenpan,* and *Die Dam* (amongst others).

The location of these homesteads (excluding *Klipfontein* and *Disselskuil*) on properties earmarked for future or potential wind energy facility developments reduces the probability of this impact occurring. Others, e.g. *Vendusiekraal* and *Kranskop*, are believed to be derelict or uninhabited. In the event that the homesteads are deserted, the visual impact will be non-existent, until such time as it is inhabited again. No mitigation of this impact is possible, but measures are recommended as best practice.

Potential visual impact on sensitive visual receptors within the region: The visual impact on the users of roads and the residents of settlements and homesteads within the region (i.e. beyond the 10 km radius) is expected to be of low significance, considering the generally remote location of the proposed wind energy facility. The potential future development of neighbouring wind energy facilities may drastically change the overall cumulative visual impact within the region.

Currently, the relatively low incidence of visual receptors within this environment reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice.

Potential visual impact of onsite ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility: In site ancillary infrastructure associated with the wind energy facility includes the substation, internal access roads, workshop and office. This infrastructure will be located within the facility footprint, but may still be visible to visual receptors in close proximity to the proposed wind energy facility.

The roads have the potential of manifesting as landscape scarring. Other infrastructure have the potential of creating visual clutter, contributing to cumulative impacts, therefore having the potential of visual impact within the viewshed areas.

No dedicated viewsheds have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure is likely to be of low significance both before and after mitigation.

Potential visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility: Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, a 480m buffer along the edge of the outer most turbines is submitted as the zone within which there is a risk of shadow flicker occurring. There are no roads or places of residence within the 480 m buffer. The significance of shadow flicker is therefore anticipated to be **low**.

Potential visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility: Lighting impacts relate to the effects of glare and sky glow. Sources of glare light include both direct lighting and the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance.

Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The wind energy facility may contribute to the effect of sky glow within this environment.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light. The assessment of this anticipated impact, which is likely to be of moderate significance, and may be mitigated to low.

Potential visual impact of construction on sensitive visual receptors in close proximity to the proposed facility: During construction, there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance a visual nuisance to other road users and land owners in the area. The clearing of vegetation during construction is unavoidable. Given the large footprint of wind energy facility development, it is likely that large tracks of land may be affected. The rehabilitation of vegetation in this region is difficult, given the hot, dry climatic conditions. Dust from construction work could also result in potential visual impact. This anticipated impact is likely to be of moderate significance, and may be mitigated to low.

Potential visual impact of the proposed facility on the visual quality of the landscape and sense of place of the region: An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has a rural and undeveloped character. Settlements, where these occur, are limited in extent and domestic in scale. These vast, generally undeveloped landscapes are considered to have a high visual quality, except where structures (such as power lines and the Hydra Substation and the existing PV facilities in the area) represent existing visual disturbances.

A specific sense of place related to the wide open, undeveloped space characterises the region, but is not particular to this study area. The anticipated visual impact of the facility on the regional visual quality, and by implication, on the sense of place, is expected to be of low significance.

The low incidence of visual receptors within this environment and the relatively remote location of the proposed facility reduces the probability of this impact occurring. No mitigation of this impact is possible, but measures are recommended as best practice.

Nature of Impact: Visual impact on users of secondary roads within 5km to the proposed facility		
Relevant Listed Activities: » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	Without mitigation	***With mitigation***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	High (8)	N/a
Probability	Highly probable (4)	N/a
Significance	**High (64)**	N/a
Status (positive, neutral or negative)	Negative	N/a
Reversibility	Recoverable	N/a

Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

- » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- » Maintain the general appearance of the facility as a whole.

Decommissioning:

- » Remove infrastructure not required for the post-decommissioning use of the site.
- » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- » Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities which are due to commence construction in 2015, and other renewable energy facilities proposed and approved in the region.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on residents of homesteads and settlements 10 to 50km to the proposed facility

Relevant Listed Activities:

- » GN 545: 1, 15.
- » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)

	No mitigation	***Mitigation considered***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	High (8)	N/a
Probability	Highly probable (4)	N/a
Significance	**High (64)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management: <u>Planning:</u> » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. <u>Operations:</u> » Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities which are due to commence construction in 2015, and other renewable energy facilities proposed and approved in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on sensitive visual receptors within the De Aar Area.		
Relevant Listed Activities: » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb)		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/a
Duration	Long term (4)	N/a
Magnitude	Moderate (6)	N/a
Probability	Improbable (2)	N/a
Significance	**Low (26)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	Yes	
Mitigation / Management: <u>Planning:</u> » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. <u>Operations:</u> » Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		

Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities which are due to commence construction in 2015, and other renewable energy facilities proposed and approved in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of on-site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 10 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (28)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation / Management: Planning: » Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Construction: » Rehabilitation of all construction areas. » Ensure that vegetation is not cleared unnecessarily to make way for access roads and ancillary buildings. Operation: » Maintenance of roads to avoid erosion and suppress dust. Decommissioning: » Removal of infrastructure and roads not required for post decommissioning use and rehabilitation of the footprint areas. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		

Cumulative impacts: The construction of the substation, internal access roads, workshop and office will increase the cumulative visual impact of buildings and industrial type infrastructure within the region. This is relevant in light of existing roads and power lines already present in the area.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors located approximately 5km from the proposed facility.		
Relevant Listed Activities: » GN 545: 1		
	No mitigation	***Mitigation considered***
Extent	Local (4)	N/a
Duration	Long term (4)	N/a
Magnitude	None (0)	N/a
Probability	Very Improbable (1)	N/a
Significance	**Low (8)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: None required.		
Cumulative impacts: None.		
Residual impacts: None.		

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.		
Relevant Listed Activities: » GN 545: 1		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (48)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes

Mitigation:

Planning & operation:

» Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).
» Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.
» Make use of minimum lumen or wattage in fixtures.
» Make use of down-lighters, or shielded fixtures.
» Make use of Low Pressure Sodium lighting or other types of low impact lighting.
» Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

Cumulative impacts:

The two preferred bidder Round 3 wind energy facilities (Longyuan Mulilo De Aar 2 North and South Wind Energy Facility) will be commence construction in 2015 and will require lighting on turbines as well as other night-lighting at the facility. An additional facility to be constructed directly adjacent to these facilities may potentially increase the visual impacts associated with light pollution within an otherwise rural setting, however, as the extent of lighting is limited, the cumulative impact at night will be moderate to low..

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of construction activities and equipment on sensitive visual receptors in close proximity to the proposed facility.

Relevant Listed Activities:

» GN 545: 1, 15

	No mitigation	**_Mitigation considered_**
Extent	Local (4)	Local (4)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Moderate (56)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: <u>Planning:</u> » Retain and maintain natural vegetation in all areas outside of the development footprint. <u>Construction:</u> » Ensure that vegetation is not unnecessarily removed during the construction period. » Reduce the construction period through careful logistical planning and productive implementation of resources. » Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. » Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. » Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. » Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). » Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. » Rehabilitate all disturbed areas immediately after the completion of construction works.
Cumulative impacts: None.
Residual impacts: None, provided rehabilitation works are carried out as specified.

Nature of Impact: Impact of the proposed facility on the visual quality of the landscape and sense of place of the region		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/a
Duration	Long term (4)	N/a
Magnitude	Low (4)	N/a
Probability	Improbable (2)	N/a
Significance	**Low (22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management: Planning: » Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of wind energy facilities together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as two Longyuan Mulilo De Aar 2 North and South Wind Energy Facility and other renewable energy facilities which are to be constructed in 2015 and authorised in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.8.3 Comparative Assessment Impact of Access Road Alternatives Visual Impact

Both the northern and southern access routes are existing gravel routes. In terms of visual impacts as a result of potential upgrading of the road, there is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

8.8.4 Implications for Project Implementation

» Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas wherever possible.
» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
» During the decommissioning phase all areas must be rehabilitated. An ecologist should be consulted regarding rehabilitation specifications.

8.9 Assessment of Potential Noise Impacts

8.9.1 Specialist Findings

With wind energy facilities potential for environmental and economic advantages, wind power generation has significant potential to become a large industry in South Africa. However, when wind farms are near to potential sensitive receptors, consideration must be given to ensuring a compatible co-existence. The potential sensitive receptors should not be adversely affected and yet, at the same time the wind farms need to reach an optimal scale in terms of layout and number of units.

Wind turbines produce sound, primarily due to mechanical operations and aerodynamic effects at the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that can impact on areas at some distance away. When potentially sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not cause undue annoyance or otherwise interfere with the quality of life of the receptors.

It should be noted that this does not suggest that the sound from the wind turbines should not be audible under all circumstances - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source – but rather that the sound due to the wind turbines should be at a reasonable level in relation to the ambient sound levels. There are no noise sources of significance in the area and relative low ambient sound levels are expected, especially at night.

8.9.2 Identified Impacts

Impact Assessment: Construction Phase: Only the calculated daytime ambient noise levels are presented, as construction activities that might impact on sensitive receptors should be limited to the 06:00 – 22:00 time period. The worst case scenario is presented with all activities taking place simultaneously at each proposed wind turbine location during wind-still conditions, in good sound propagation conditions (20ºC and 80% humidity).

Impact Assessment: Operational Phase: The Environmental Noise Impact Assessment focused on the impacts on the surrounding sound environment during times when a quiet environment is highly desirable. Noise limits are therefore appropriate for the most noise-sensitive activity, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc).

Appropriate Zone Sound Levels are therefore important, yet it has been shown that the SANS recommended (fixed) Night Rating Level ($L_{Req,N}$ = 35 dBA) might be inappropriate due to the increased ambient sounds relating to wind action. A more appropriate method to determine the potential noise impact would be to make use of the projected noise levels due to the operation of the WEF as well as the likely ambient sound levels due to wind induced noises.

The C-weighted sound power levels were also evaluated and estimated to be less than 55 dBC (at all NSD) with a 7 m/s wind. Fieldwork has shown that ambient C-weighted sound levels during periods that wind speeds exceed 5 m/s is often higher than 70 dBA and the *projected* C-weighted noise levels are less than the expected C-weighted levels and the risk of low-frequency issues is considered to be low.

Impact tables summarising the significance of impacts on noise resources (with and without mitigation)

Nature: Numerous simultaneous construction activities that could impact on receptors.	
Relevant Listed Activities: » GN 544: 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)	
Acceptable Rating Level	Rural district (excluding construction traffic): 45 dBA outside during day. Use of $L_{Req,D}$ of 45 dBA for rural areas. Ambient sound level = 35 - 45 dBA, used 35 dBA for modelling.
Extent ($\Delta L_{Aeq,D}$>7dBA)	Regional (3)– Because of the quiet ambient sound levels (during periods when wind speeds are less than 4 m/s) measured in the area the change in ambient sound levels could extend further than 1,000 m from activities
Duration	Short (2)– Noisy activities in the vicinity of the receptors would last the duration of the construction period, more likely only a portion of the construction period
Magnitude	Low (2) – Noise Rating Levels << Rating Level
Probability	Possible (2) - While it is likely that the receptors may hear construction noises at times during the construction phase, it is considered unlikely that the noise levels will change the ambient sound levels sufficiently to result in complaints. Considering the precautionary approach the level is raised by 1 – unlikely to possible.
Significance	**Low (14)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of	Not relevant.

resources?	
Comments	Modelling considered a worse-case scenario with significant activities taking place for 16 hours each day at all possible locations
Can impacts be mitigated?	Mitigation not required.
Mitigation:	Not required.
Effectiveness of mitigation:	Not applicable, mitigation not required
Cumulative impacts:	This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area.
Residual Impacts:	This impact will only disappear once construction activities cease.

Nature: Numerous wind turbines operating simultaneously during a period when a quiet environment is desirable.	
Relevant Listed Activities: » GN 544: 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)	
Acceptable Rating Level	Rural district
Extent ($\Delta L_{Aeq,n}$>7dBA)	Local (2) – Impact will extend less than 1,000 meters from activity.
Duration	Long (4) – Facility will operate for a number of years
Magnitude	Low (2) – All NSDs
Probability	**Possible (2**) - Considering the precautionary approach the level is raised by 1 – unlikely to possible.
Significance	**Low (16) for all NSD**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	*Not relevant.*
Comments	-
Can impacts be mitigated?	Yes, not required
Mitigation:	Possible, but not required.
Cumulative impacts:	This impact is cumulative with existing ambient background noises.
Residual Impacts:	This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

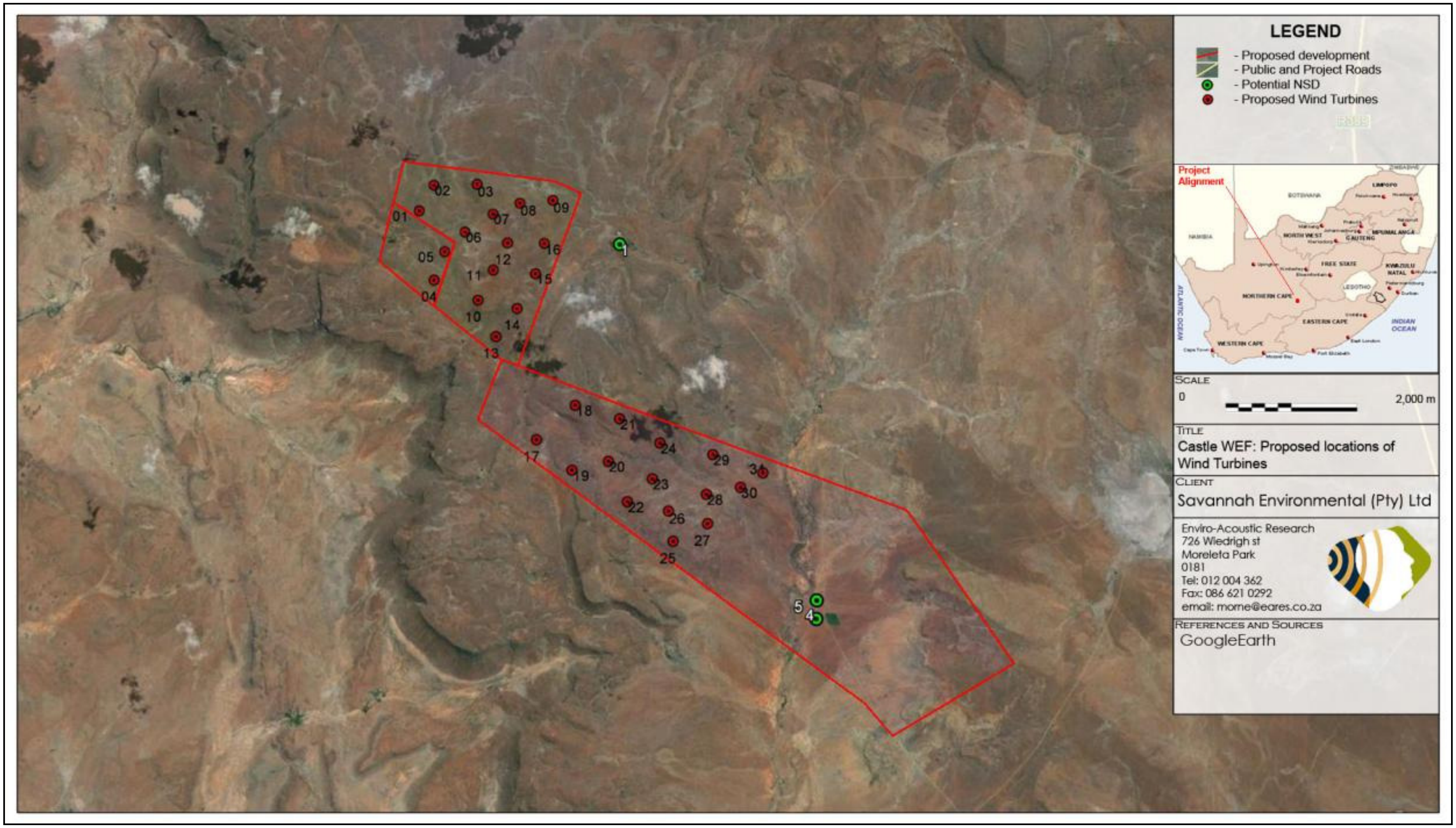


Figure 8.13: Proposed layout of the Castle Wind Energy Facility indicating the noise sensitive developments

8.9.3 Comparative Assessment Impact of Access Road Alternatives on Noise Levels

Both the northern and southern access routes are existing gravel routes. The influx of construction vehicles will result in a negative impact on the local farm owners. Alternative 1 is likely to have a higher negative impact, as it will generate noise which will have an impact on the homesteads along the route and is therefore nominated as the preferred alternative in terms of noise impacts.

8.9.4 Implications for Project Implementation

» Community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon; as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself. Wind projects offer a benefit to the environment and the energy supply for the greater population, and offer economic benefits to the land owners leasing installation sites to the wind farm. A positive community attitude throughout the greater area should be fostered, particularly with those residents near the wind farm.
The developer must implement a line of communication (i.e. a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers. The Wind Energy Facility should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop. For example, sudden and sharp increases in sound levels could result from mechanical malfunctions or perforations or slits in the blades. Problems of this nature can be corrected quickly, and it is in the developer's interest to do so.

8.10 Assessment of Potential Impacts on Heritage - Archaeology

8.10.1 Specialist Findings

The footprint of the proposed turbine positions as indicated in Figure 8.14 and 8.15 were surveyed. At the start of the survey Stone Age material was immediately noticed scattered in varying densities throughout the study area. Low density scatters (between 3 - 5 artefacts per m²) were recorded as find spots. Scatters higher than 5 artefacts per m² were given site numbers and areas where quartzite and quartz outcrops were exploited were also recorded as sites. Scatters with densities less than 3 artefacts per m² were not recorded as they occur throughout the area. Individual occurrences were not point plotted within the recorded scatters; however an attempt was made to determine site extent.

From the site distribution map (Figure 8.14 and 8.10) most of the recorded find spots and sites occur within the southern portion of the surveyed area where the calcrete is eroding from under the Aeolian sands or in areas where hard packed Aeolian sands are found. In the northern portion the Aeolian sands are much deeper, in some cases deeper than 30-40 cm; vegetation in this area is also much higher with grasses and shrubs standing 50-70 cm high hampering archaeological visibility. Artefact counts drops drastically as one move from south to north into this sandy area, however, the occasional MSA or LSA flake was noted in these areas, where the Aeolian sands most probably buried most of the MSA and ESA artefacts.

Nine sites were recorded consisting of six Stone Age sites (Sites 1, 3, 4, 6, 7, 9) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 5) as well as historical/recent exploration or quarrying (Site 8). A further total of 3 find spots were mapped, recorded and digitally photographed. Again, assemblages at the locations are mixed, mainly consisting of MSA and LSA artefacts with some ESA artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure.

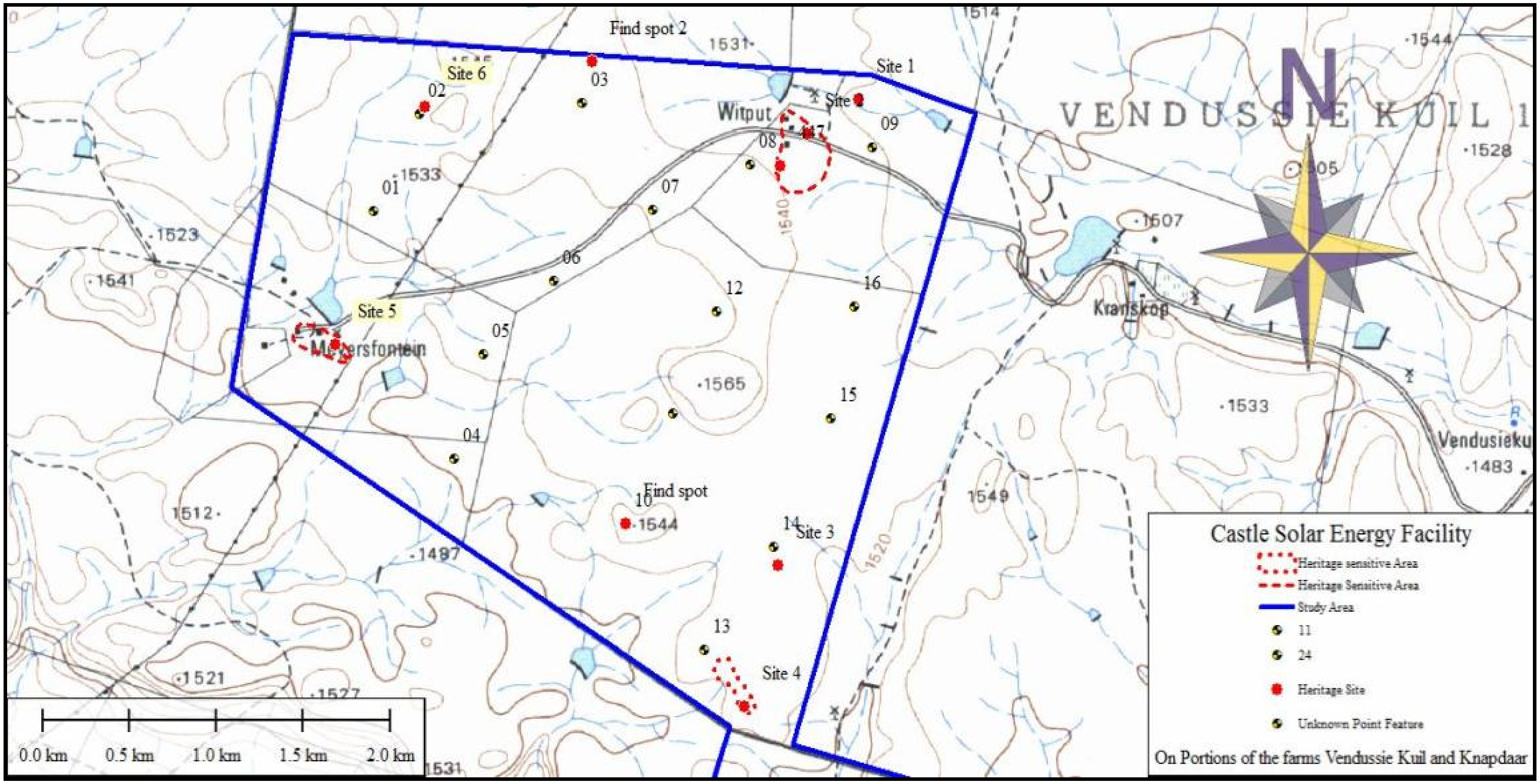


Figure 8.14: Showing the location of recorded sites in relation to turbine positions on the farm Vendussie Kuil.

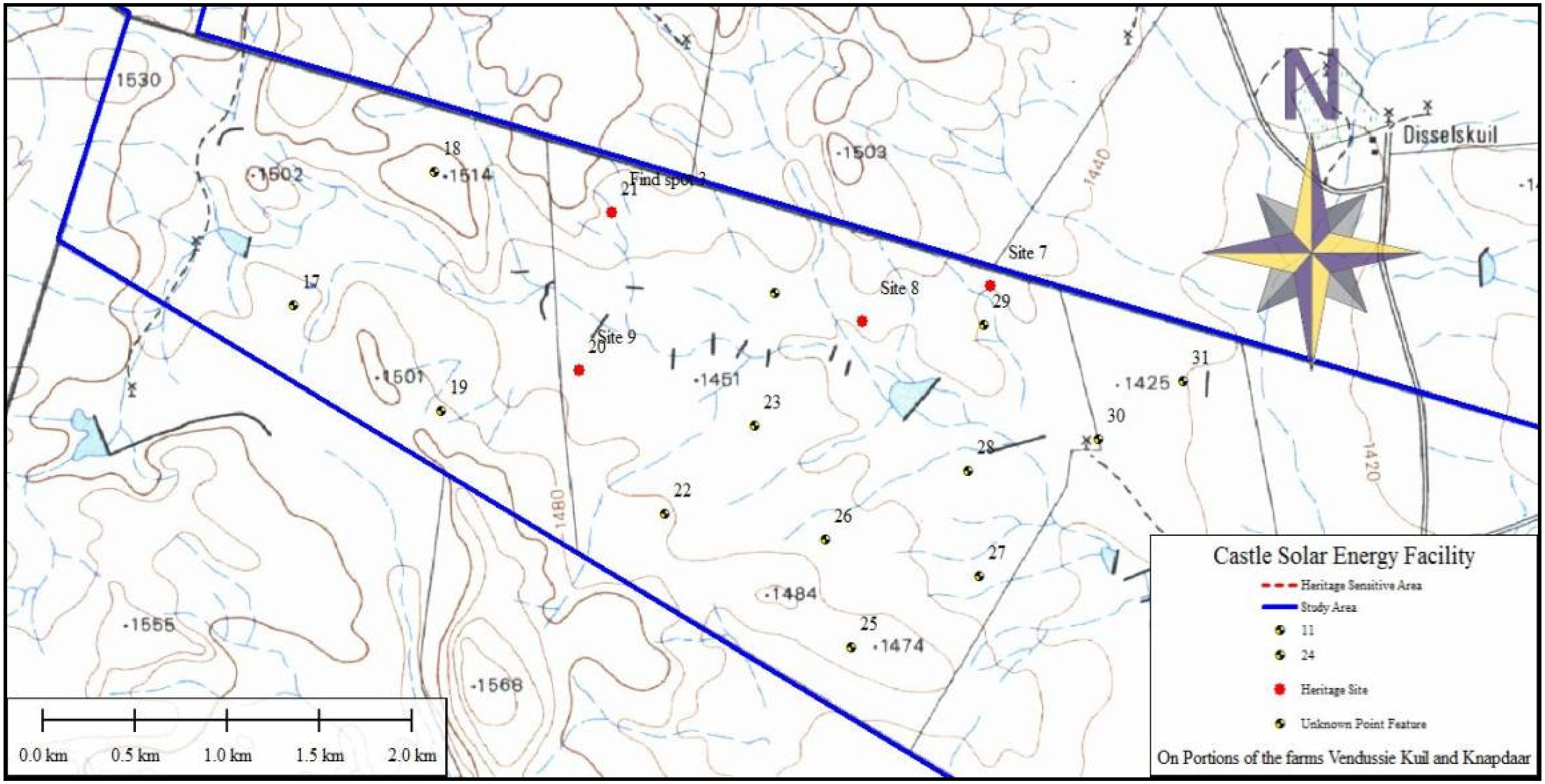


Figure 8.15: Showing the location of recorded sites in relation to turbine positions on the farm Knapdaar.

List of identified sites

Site Number	Landscape	Type Site	Cultural Markers
Site 1	Archaeological	Middle Stone Age	Stone tools with facets on the striking platform scattered around pan
Site 2	Historical	Witput Farm complex	Vernacular buildings
Site3	Archaeological	Stone Age quarry/workshop site	Hornfell outcrop with scar flaking. Low density of MSA flakes
Site 4	Archaeological	Stone Age quarry/workshop site	Hornfell outcrop with scar flaking. Low density of MSA flakes
Site 5	Historical	Meyersfontein Farm complex	Vernacular buildings
Site 6	Archaeological	Later Stone Age	Engravings
Site 7	Archaeological	LSA	Stone enclosure with lithics
Site 8	Historical	Large Kraal	Dry stone walling
Site 9	Archaeological	Stone Age quarry/workshop site	Hornfell outcrop with scar flaking. Medium high density of flakes

List of Find spots

Site Number	Landscape	Type Site	Cultural Markers
Find spot	Archaeological	Middle Stone Age	Stone tools with facets on the striking platform. Snapped blades with dorsal flaking and scrapers
Find spot 2	Archaeological	Middle Stone Age	Rough flakes and chunks, almost no formal tools although some show signs of use.
Find spot 3	Archaeological	MSA/LSA	Highly weathered as well as fresh looking flakes, mostly blades and triangular flakes

8.10.2 Impact tables summarising the significance of impacts on heritage resources (with and without mitigation)

Nature of Impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.		
Relevant Listed Activities: » GN 544:10,13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (2)
Probability	Improbable (3)	Improbable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	The site will not be impacted - no action will be required.	
Mitigation: There are no sensitive sites located close to any turbine and no impact is foreseen on the site and therefore no mitigation is required. However the general location should be demarcated to avoid impact on the site.		
Cumulative impacts: None.		
Residual Impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive		

Nature of impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Historical Material or objects.		
Relevant Listed Activities: » GN 544:10, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)

Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Improbable (2)	Improbable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes. However, the sites will not be impacted - no action will be required.	
Mitigation: No turbine is located close to the sites and no direct impact is foreseen on the site. The area should be demarcated to avoid impact on the site.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. The cumulative impacts will be low.		
Residual Impacts: Depletion of archaeological record of the area.		

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.		
Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (45)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: At Site 9 surface sampling should be conducted and the site should be monitored during		

construction. Preferably, the area should be demarcated to avoid impact on the site. Site 3 and 4 are not impacted by a proposed turbine position and no impact is foreseen on the site but the sites should be demarcated and avoided during construction.
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. The cumulative impacts will be low.
Residual Impacts: Depletion of archaeological record of the area.

Nature impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.		
Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (5)
Probability	Probable (4)	Probable (3)
Significance	**High (60)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: The site is located close to turbine 2 and a direct impact is foreseen on the site. Ideally the area should be demarcated to avoid impact on the site. Alternatively the engraving must be traced and documented and the boulder relocated to a museum.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive, this site is unique and should be recorded as part of the heritage landscape of the area. .		
Residual Impacts: Depletion of Archaeological record of the area.		

Nature impact: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position Stone Age Material or objects.

Relevant Listed Activities:

- GN 544:10, 13, 47(ii)
- GN 545: 1, 15.
- GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:
The site is located 200m from turbine 29 and an indirect impact is foreseen on the site. The site should be demarcated to avoid impact on the site.

Cumulative impacts:
Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.

Residual Impacts: Depletion of Archaeological record of the area.

8.10.3 Comparative Assessment of Impact of Access Road Alternatives on Heritage resources

The scattered/isolated finds during the field survey are not noted to be of major heritage significance. In terms of impacts arising from disturbance and loss as a result of the access roads, there is **no significant** difference. Therefore, there is **no preference** between the alternatives.

8.10.4 Implications for Project Implementation

- At Site 9 (Stone Age quarry/workshop site): the area should be demarcated to avoid impact on the site. Surface sampling should be conducted to record the site.
- Site 3 and 4 (Stone Age quarry/workshop site): these sites are not impacted by a proposed turbine position, however the sites should be demarcated and avoided during construction.

- A direct impact is foreseen on the site 6 (Later Stone Age) located close to turbine 2. Ideally the area should be demarcated to avoid impact on the site. Alternatively the engraving must be traced and documented and the boulder relocated to a museum.
- The site is located 200 m from turbine 29 and an indirect impact is foreseen on the site. The site should be demarcated to avoid impact on the site.
- The location of all the recorded features should be taken into account in the future planning of the wind farm project, especially for internal roads, underground cabling and construction camps as it is recommended that the sites are preserved in situ, and demarcated for future protection.
- The possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded. If during construction any possible finds are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find.

10.11 Assessment of potential impacts on Palaeontology

10.11.1 Specialist Findings

The Castle Wind Energy Facility area is underlain only by the rocks of the Adelaide Subgroup which are fossiliferous and the sands of the Cenozoic regolith are potentially fossiliferous and may, therefore, be negatively impacted by the proposed project. The fossils vertebrate and plant macrofossil assemblages known to occur within the Adelaide Subgroups are highly scientifically significant as they document the early phases of the evolutionary transition from reptile to mammals and are part of the famous *Glossopteris* flora respectively. Should any fossils be present within the regolith they would be potentially highly scientifically significant as they may provide valuable insights into the paleoclimate and paleoecology of the region during the Cenozoic.

There is a potential for negative impact on the palaeontological heritage of the project area throughout the majority of its extent (due to the extensive coverage of the Adelaide Subgroup in particular) and the overall potential risk of a negative impact is categorised as probable. However, the fossils that may be anticipated to be present within these units are potentially highly significant to the cultural and scientific heritage of South Africa. As such, the risk of a negative impact is improbable, but the significance of any negative impact on the fossil assemblages could potentially be high. Any damage that occurs to such fossil material during the excavation and construction phase of the project would be permanent and irreversible.

The potential negative impact to the palaeontological heritage of the area can be substantially mitigated by the implementation of appropriate mitigation processes. A potential positive outcome of these mitigation protocols could be that fossil materials become available for scientific study that would otherwise have been hidden within or beneath the regolith. Should such new palaeontological material be located as a result of this site investigation this could prove to have a positive effect on the understanding of the fossil record of South Africa and positively affect the palaeontological heritage of the country.

10.11.2 Identified Impacts

The potential negative impacts of the proposed project on the palaeontological heritage of the area are:

- Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of those excavations (i.e., the upper-most few meters). Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of the projects infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).
- Movement of fossil materials during the construction phase, such that they are no longer *in situ* when discovered. The fact that the fossils are not *in situ* would either significantly reduce or completely destroy their scientific significance.
- The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities.

Impact tables summarising the significance of impacts on palaeontological resources (with and without mitigation)

Nature of impact: Destruction, damage and loss of provenance of fossil materials		
Relevant Listed Activities: » GN 544:10, 13, 47(ii) » GN 545: 1, 15. » GN546: 4 (a) (ii) (bb), 13(b)& (c) ii (bb), 14(a)(i), 16 (iii) & (iv) (a) ii (bb), 19(a) (ii) (bb)		
	Without Mitigation	**With Mitigation**
Extent:	Low (2)	Low (2)
Duration:	Permanent (5)	Permanent (5)
Magnitude:	High (10)	Minor (2)
Probability:	Probable (3)	Improbable (2)
Significance:	**Moderate (51)**	**Low (18)**
Status:	Positive	Positive
Reversibility:	Impossible	Impossible
Irreplaceable loss of resources:	Low	Low
Can impacts be mitigated:	Yes	
Mitigation: » Selected line staff of the developer should be trained to the types of fossils that may be encountered within the geological units present in the project area. » A close examination of all excavations should be made by the trained line staff while they are occurring. Should any fossil materials be identified, the particular excavation should be halted and SAHRA informed of the discovery.		

» Should any fossil materials be identified during the construction phase a palaeontologist should be appointed to evaluate its significance. » Should scientifically or culturally significant fossil material exist within the project area any negative impact upon it could be mitigated by its excavation (under permit from SAHRA) by a palaeontologist and the resultant material being lodged with an appropriately permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality could be protected and the site of any planned construction moved. » It would be preferential if the deeper excavations particularly those associated with the foundations for the wind turbines were regularly inspected by a palaeontologist during their excavation.
Cumulative impacts: None
Residual impacts: Permanent loss of palaeontological heritage

10.11.3 Comparative Assessment of Access Road Alternatives

The scattered/isolated finds during the field survey are not noted to be of major palaeontological significance. In terms of impacts arising from disturbance and loss as a result of the access roads, there is **no significant** difference. Therefore, there is **no preference** between the alternatives.

10.11.4 Implications for Project Implementation

It is anticipated, herein, that most infrastructural elements will only directly affect the surface of the site to a relatively shallow depth (upper few meters of the land surface). Any fossil materials that remain undiscovered after the construction of the project and which are located beneath the maximum depth of the anticipated excavations will only be negatively affected in so far as they will be unavailable for scientific study for the life expectancy of the infrastructural elements that comprise the project. As such this study has not identified any palaeontological reason to prejudice the progression of the Castle Wind Energy Facility, subject to adequate mitigation programs being put in place. Therefore there are no implications for the project development.

ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS CHAPTER 9

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R543) as meaning "the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

There has been a steady increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. The Department of Energy has, under the REIPPP Programme released requests for proposals to contribute towards Government's renewable energy target of 3725 MW and to stimulate the industry in South Africa.

Due to the growth in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. This chapter considers whether the proposed wind energy facility project's potential impacts become more significant when considered in combination with the other approved or proposed wind energy facility projects within the area.

9.1 Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[5].

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially as a result of the cumulative effects of the Project Castle Wind Energy Facility to be developed in the centre of the two Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility (Round 3 preferred bidder).

» Cumulative impacts potentially as a result of the cumulative effects of the Project Castle Wind Energy Facility added to all other renewable energy facilities proposed to be developed in and around the De Aar area.

Table 9.1 provides details of other known authorised renewable energy applications in the vicinity of the Castle Wind Energy Facility. These projects were identified by CSIR

[5] Definition as provided by DEA in the EIA Regulations.

using the Department of Environmental Affairs Geographic Information System digital data (CSIR, 2013).

Significant cumulative impacts that could occur due to the development of the wind energy facilities and its associated infrastructure in proximity to each other include impacts such as:

» Visual impacts;
» Socio-economic impacts;
» Loss of vegetation and impacts on ecology;
» Impact on bats;
» Impact on birds;
» Impacts to soil;
» Impacts on freshwater resources; and
» Impacts on heritage and palaeontological resources.

9.2 Cumulative Impacts of Renewable Energy Facilities in the De Aar area

As can be seen from Figure 9.1, there are proposed wind and solar developments (which fall within a 50km radius of the Castle Wind Energy Facility) to the north, northwest, west, south and southwest of the current site. While most of the proposed developments have been authorised and are likely to proceed, six wind and solar projects have been awarded a preferred bidder status in Round 1, 2 and 3 of the DoE REIPPP Programme. In the long term, the development of a large number of facilities in the area is likely to occur on account of the numerous power lines which can be used to evacuate the generated power. The Hydra substation is also located at the centre of the transmission grid and has excellent solar and wind resources. It is therefore a preferable location for renewable energy projects. All these projects may not however be able to connect to the Hydra Substation, and therefore, this, together with a number of other factors, are likely to contribute to the potential for cumulative impacts to occur in the area.

Cumulative effects within approximately 50km from the study area (accounting primarily for avifauna, noise, bats, soil, visual, palaeontology, heritage and ecological impacts) have been assessed. The significance of the cumulative impact will be directly influenced by the proximity of two Round three preferred bidder projects (Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility) to the proposed development site.

Several renewable energy projects are being proposed in the De Aar area, with several projects already constructed (solar PV projects only), and others to commence construction in 2015 (includes wind projects). Authorised projects within a 50km radius of the Castle Wind Energy Facility site include (refer to **Figure 9.1**):

Table 9.1: Proposed authorised renewable energy projects within the vicinity of the Castle Wind Energy Facility

Project	Applicant	Technology	DEA Ref. No	Status
Round 1, 2 and 3 Preferred Bidder Projects				
1. Longyuan Mulilo De Aar North Wind Energy Facility	Mulilo Renewable Energy (Pty) Ltd	Wind	12/12/20/2463/2	Authorised Preferred Bidder Round 3
2. Longyuan Mulilo De Aar South Wind Energy Facility	Mulilo Renewable Energy (Pty) Ltd	Wind	12/12/20/2463/1	Authorised Preferred Bidder Round 3
3. De Aar Solar 1 PV power project	South Africa Mainstream Renewable Power Development	Solar PV	12/12/20/2025/2	Phase 2- preferred bidder round 1 (reached COD)
4. Ilanga Lethemba PV Solar Energy Facility in De Aar	Solar Capital (Pty) Ltd	Solar PV	12/12/20/2048/2	Authorised Phase 2 preferred bidder round 3
5. Ilanga Lethemba PV solar energy facility and associated infrastructure on site north East of De Aar	Solar Capital (Pty) Ltd	Solar PV	12/12/20/2048/3	Authorised, Phase 3 is a preferred bidder round 2 & project under Construction
6. Photovoltaic solar Energy Facility on a site southeast of De Aar, Northern Cape	Mulilo Renewable Energy Solar (Pty) Ltd	Solar PV	12/12/20/1673	Authorised and preferred bidder round 1
Authorised Projects				
7. Ilanga Lethemba PV solar energy facility and associated infrastructure on site north East of De Aar	Solar Capital (Pty) Ltd	Solar PV	12/12/20/2048/1&4	Authorised
8. De Aar Solar 1 PV power project	South Africa Mainstream	Solar PV	12/12/20/2025/1	Phase 1 Authorised

Project	Applicant	Technology	DEA Ref. No	Status
	Renewable Power Development			
9. Inyanga Solar Energy Project 1, on the farm Riet Fountain	Islandsite Investment 519 (Pty) Ltd	Solar PV	12/12/20/2497	Authorised
10. Wind power generating facility near De Aar	Mulilo Renewable Energy (Pty) Ltd	Wind	12/12/20/1651	Authorised
11. Solar energy facility (Phase 1-5) on a site near of De Aar	ACED Renewables De Aar,	Solar PV	12/12/20/2250/1-5	Authorised
12. PV Plant on the farm Vetlaagte 4	Inqwaba Energy (Pty) Ltd	Solar PV	14/12/16/3/3/2/382/1-6	Authorised
13. Photovoltaic solar Energy Facility on a site southeast of De Aar, Northern Cape	Inca De Aar Solar (Pty) Ltd	Solar PV	12/12/20/2177	Authorised
14. Renosterberg Wind Farm	Renosterberg Wind Energy Company (Pty) Ltd (RWEC) in partnership with the Industrial Development Corporation of South Africa (IDC).	Wind	14/12/16/3/3/2/404	Authorised

(These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR.)

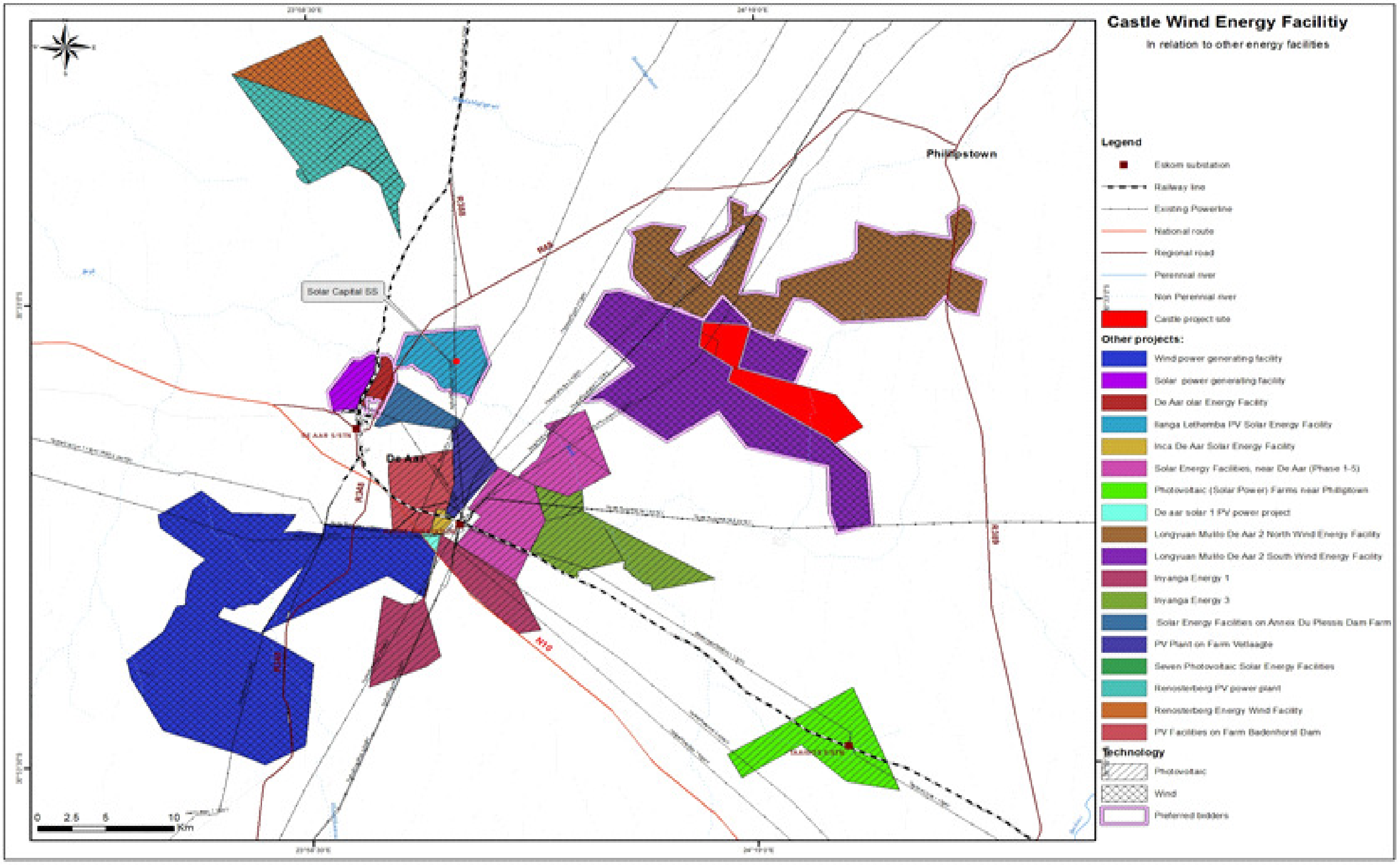


Figure 9.1: Map showing other renewable energy projects within a 50km radius from the Castle Wind Energy Facility (refer to Appendix Q to view the A3 map).

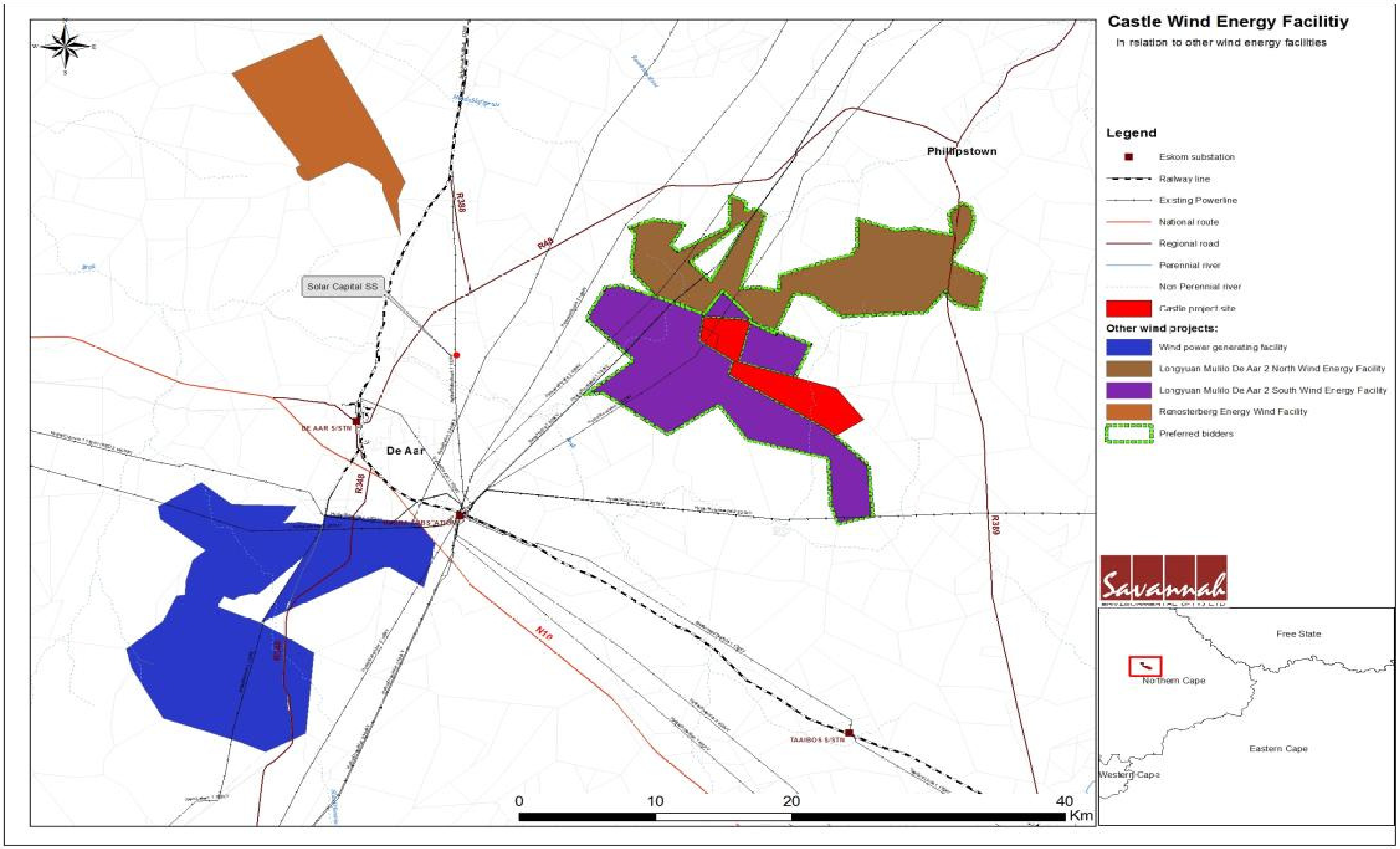


Figure 9.2: Map showing other wind energy projects within a 50km radius from the Castle Wind Energy Facility (refer to Appendix Q to view the A3 map).

The section below explores potential cumulative impacts of other renewable projects within the immediate vicinity (i.e. within 50km) of the proposed Castle Wind Energy Facility. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment due to the limited information available on what is planned for these facilities.

9.2.1. Visual impacts

It is envisaged that the Castle Wind Energy Facility structures (where visible from shorter distances-0- 5km) may constitute a high visual prominence, potentially resulting in a high visual impact. A large portion of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall between farms earmarked for the development of the two De Aar North and South Wind Energy Facilities (Longyuan Mulilo) which are scheduled to be constructed in 2015. A number of wind turbine positions (21), associated with the Longyuan Mulilo De Aar South Wind Energy Facilities were however made available[6] to perform a cumulative visual exposure calculation (refer to Figure 9.3). It should be noted that most of the wind turbine layouts (wind turbine positions) were not available at the time of compiling this report. It is expected that the development of the Castle Wind Energy Facility may contribute to the frequency of visual exposure of turbine structures. It should however also be noted that the Castle Wind Energy Facility will not significantly contribute to the increase in the area of exposure (i.e. the visual exposure is generally expected to be consolidated within an area of existing visual impact), and as such will not contribute to the proliferation of wind turbine structures within the surrounding wind energy facilities within the region.

Depending on the number of applications that are approved in future, the landscape surrounding De Aar may be transformed significantly in order to accommodate these developments. It can therefore be concluded that the construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area as well as other renewable energy facilities proposed in the region. Due to the close proximity of the proposed Castle Wind Energy Facility to the two Longyuan Mulilo De Aar North and South Wind Energy Facility projects, it is expected that the cumulative impact will be **high**.

[6] The Longyuan Mulilo De Aar South Wind Energy Facility layout was provided by juwi (Pty) Ltd

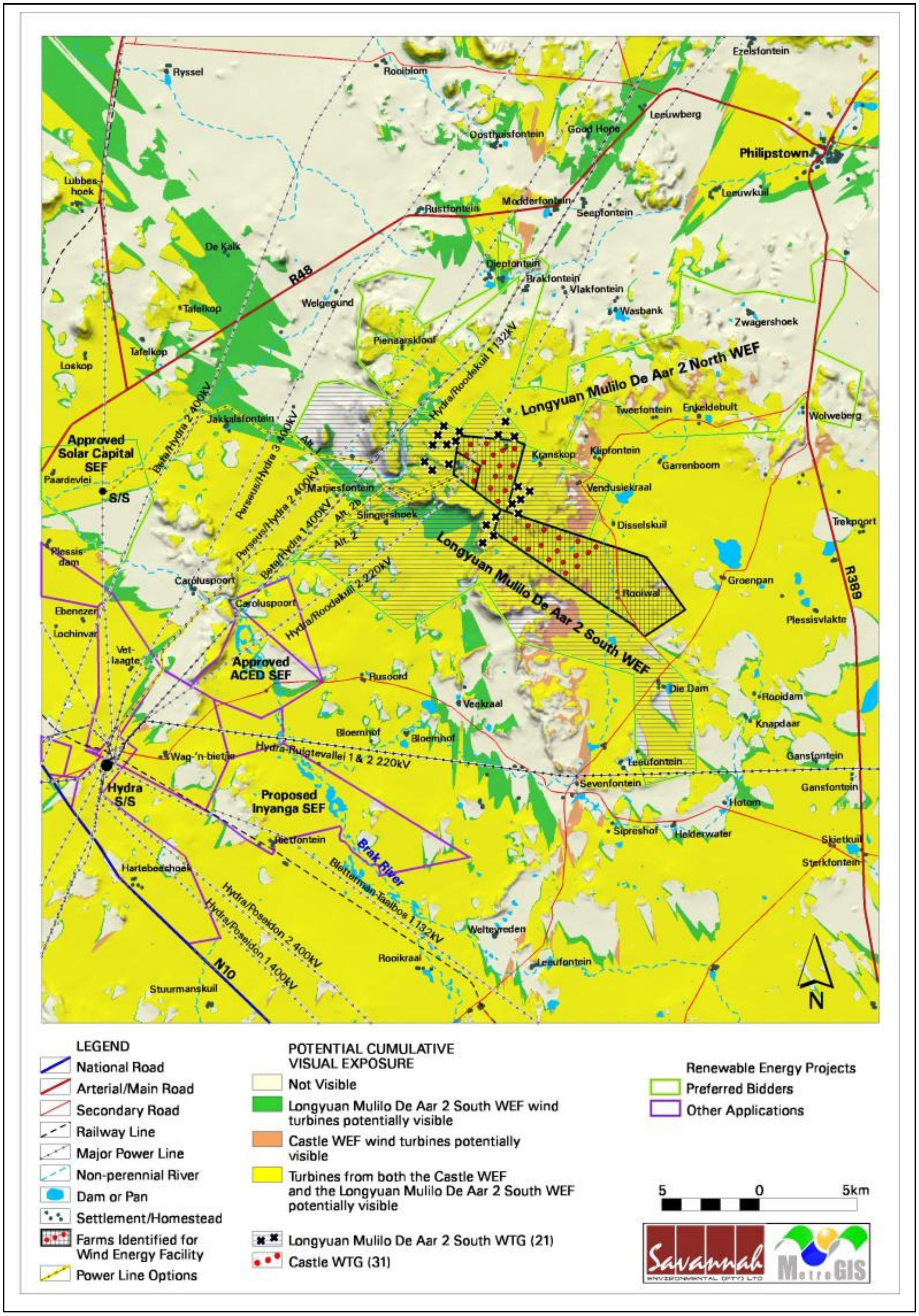


Figure 9.3: Potential cumulative visual exposure of the proposed Castle Wind Energy Facility and 21 turbines located within the Longyuan Mulilo De Aar 2 South Wind Energy Facility

9.2.2. Noise impact

The noise limits are considered appropriate for the most noise-sensitive activitites, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc). Cumulative impacts are therefore considered to be of **low significance**. Considering **Figure 9.4** the following observations are possible:

- The ambient sound levels in the area will increase as wind speeds increase, with all measurements recording sound levels higher than 35 dBA with wind speeds faster than 4.5 m/s;
- At a wind speed of 7 m/s, ambient sound levels is expected to be 37 – 39 dBA. The cumulative noise rating level at NSD01 is calculated to be 37 dBA, similar to the ambient sound level. This will raise the ambient sound levels with approximately 3 dBA and this change is considered as insignificant;
- The cumulative noise rating levels will not be higher than the noise levels recommended at all Noise-sensitive developments (NSDs) for all wind speeds;
- Cumulative noise rating levels is projected not to exceed 45 dBA at any receptor; and
- The operations of the three facilities are unlikely to change the ambient sound levels sufficiently to create annoyance with the facility.

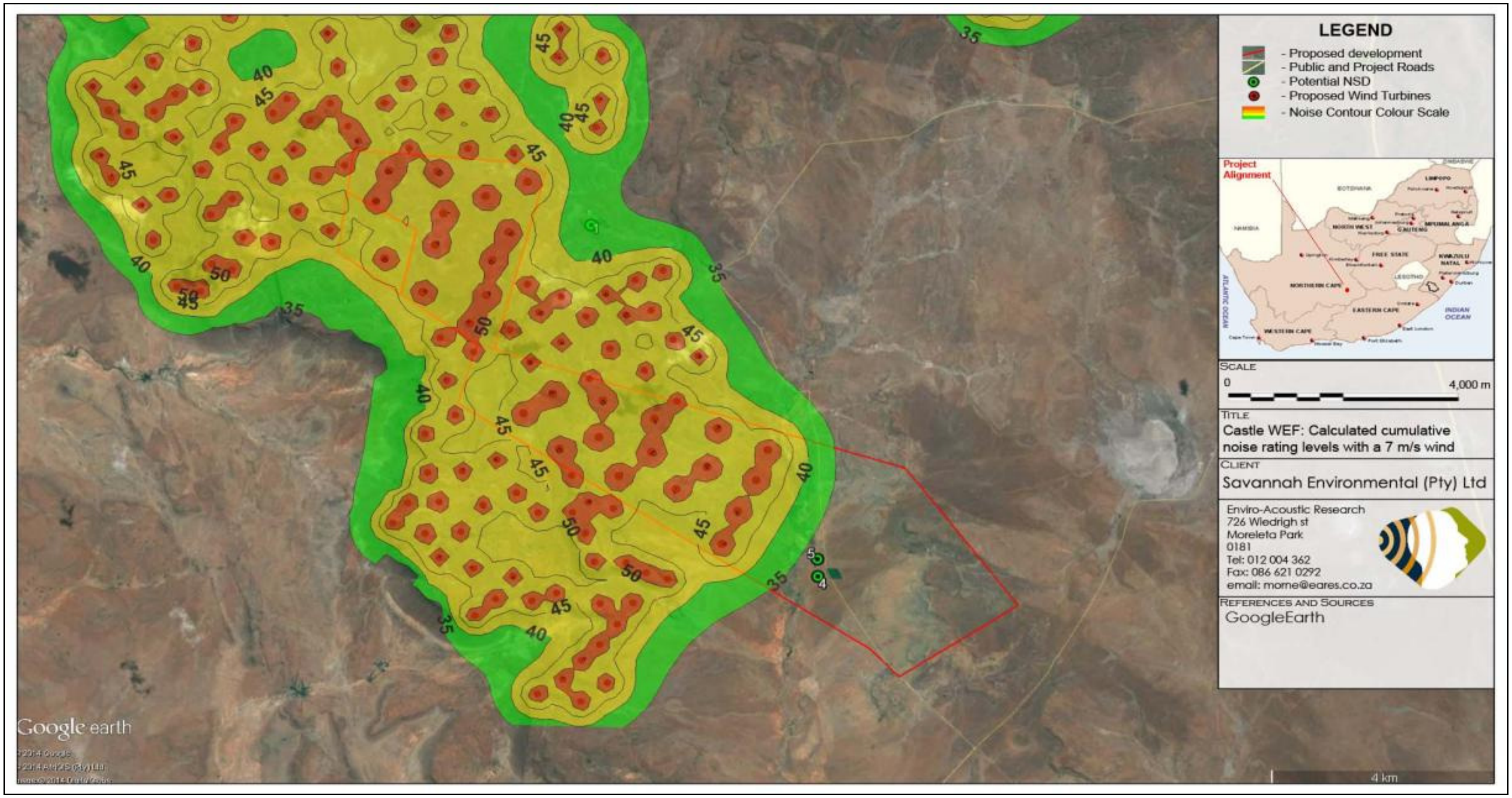


Figure 9.4: Projected Cumulative Night-time Noise Rating Levels; Contours of constant sound levels for a 7 m/s wind (Castle, Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities)

9.2.3. Social impacts

The establishment of the other renewable energy projects in the area also have the potential to result in significant positive cumulative socio-economic impacts for the local municipalities. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. As indicated above, a total of 18 proposed renewable energy projects (excluding the Castle Wind Energy Facility) are located in the vicinity of De Aar. The cumulative positive social and economical impacts will be of **high significance** and the cumulative negative social impacts (visual, sense of place, noise and disturbance during construction) will be of **low significance**.

9.2.4. Ecological impact

Given the abundance of other Renewable Energy applications in the area, with particular reference to the two Round 3 preferred bidder projects (Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities) which are planned to commence construction in 2015, the potential for cumulative impacts is relatively high. This is to some extent moderated by the widespread nature of the Northern Upper Karoo vegetation type which is among the most extensive in the country and the association of Besemkaree Koppies Shrubland with steep slopes which are not suitable for turbine placement, as well as the generally low abundance of species of conservation concern in the area. Furthermore, at a broad level, a concentration of development in the area is not likely to generate significant disruption of most ecological processes as the surrounding landscape is still largely intact and the type of habitats affected are also widely available outside of the affected area. This is specifically applicable to terrestrial ecology. Smaller fauna such as rodents are not likely to be significantly impacted wind energy facilities, while PV facilities will certainly represent some habitat loss for certain species. Medium and larger fauna are likely to be most vulnerable to development as they would be affected by habitat loss, difficulty in passing security fencing as well as noise and disturbance. It can therefore be concluded that the cumulative impact will be of **medium significance**.

9.2.5. Impacts on soil and agricultural potential

The arid climate of the study area coupled with shallow soils limits the agricultural potential to low intensity grazing. Therefore, the cumulative impact of the renewable energy project in the area is expected to be **low** due to the low agricultural potential of the land. Due to the presence of the Ms/Gs soils type (Mispah and Glenrosa forms) which is found in and around the study area has been found to have limited storage capacity and therefore limits the agricultural potential to natural grazing and makes these soils susceptible to erosion.

Therefore, surface water from concrete foundations and access roads must be managed correctly as it might lead to severe erosion. The cumulative impacts on agricultural potential and soil erosion will be of **low significance** (on condition that appropriately mitigation measures are implemented).

9.2.6. Impact on Bats

Development of a number of neighbouring wind farms (the Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities) and including that of the Castle Wind Energy Facility may result in cumulative negative impacts on bats.

Cumulative impacts are direct mortality from collision with turbine blades, and loss or fragmentation of roosting and foraging habitat. These impacts will affect both resident and migratory species. There is a significant potential for a long-term reduction in the size of the population of all impacted bat species. Currently there is very little information concerning population sizes of most South African bat species, making the significance of wind energy impacts on local bat populations very difficult to predict. It is certain that cumulative effects may have greater consequences for long-lived, low-fecundity species such as bats, though this cannot be assessed in a single study, or by considering a single wind farm only.

Wind energy facility development is only one impact affecting bat populations in the region and country, and is likely minor compared to other past, present, and future impacts, including large-scale conversion of native habitats and expansion of urban areas and rural subdivisions. This analysis does not account for the beneficial impacts on habitat associated with a wind energy facility, both from adding value to land and therefore preserving it from subdivision and further habitat fragmentation, or from replacing fossil fuel sources and its associated greenhouse gas emissions. The cumulative impact relating to bat mortality due to direct blade or barotrauma during foraging is considered to be of **high significance pre-mitigation** and **low post-mitigation**.

9.2.7. Cumulative impacts on Birds

The proposed Castle Wind Energy Facility site falls within an Important Bird Area (SA037 Platberg-Karoo Conservancy). This area holds vital populations of two Globally Threatened species, the Lesser Kestrel and the Blue Crane. The Karoo population of Blue Crane is really the only strong population remaining on natural vegetation in southern Africa. Lesser Kestrels are known to roost in both De Aar and Phillipstown, either side of the proposed site. Other important threatened species that the area is important for include Tawny and Martial Eagles, Kori and Ludwig's Bustard, Pallid and Black Harriers, Blue Korhaan, Greater Flamingo, Black Stork, Secretarybird, South African Shelduck and Lanner Falcon (Barnes, 2000; Taylor, 2014). Although most of these threatened species are physically large, a host of small terrestrial species are also found in this area, including: Karoo Long-billed Lark, Karoo Lark, Karoo Chat, Tractrac Chat, Sickle-winged Chat, Layards Titbabbler, Namaqua Warbler, Pale-winged Starling, and Black-headed Canary. Many of these smaller species rely upon riverine woodland (e.g. Karoo Lark), thicket found mostly on slopes, and/or rocky slopes and outcrops (e.g. Karoo Long-billed Lark, Karoo Chat).

There are numerous renewable energy projects currently proposed within this Important Bird Area or conservancy and it is difficult to place in perspective the potential effect of the proposed facilities against the conservation effort of declaring the Platberg Karoo Conservancy and the Important Bird Area. The Important Bird Areas Programme is one of BirdLife International's most important conservation initiatives. It identifies and works to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes/vegetation types. The network of sites is critically important for the survival of naturally occurring populations of threatened species. South Africa currently has 124 IBA's, of which the Platberg Karoo Conservancy is one of the largest.

It could argue at face value that no developments such as the proposed one should be allowed within the Important Bird Area, this is a massive area in which to limit development. On the counter side, there is a danger that if each proposed project is assessed in isolation of the others, its impact on the Important Bird Area (and hence obviously the birds) will appear minimal. However if all of these projects are permitted to proceed, the cumulative impact on birds will be substantial.

The cumulative effects of several facilities on the same species could be considerable, particularly if these are sited in the same region and impact on the same regional population of the species. Also most long-lived slow reproducing Red List species may not be able to sustain any additional mortality factors over and above existing factors. The overall cumulative effects of wind energy facilities on birds in the De Aar area is likely to be of **medium significance prior to mitigation**. It is unlikely that this impact can be mitigated to below medium significance.

9.2.8. Heritage and Impacts

Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. Very sparse heritage traces were found on the site and from an archaeological perspective the observed heritage resources may be regarded as being of generally **low** significance. It still remains important for each facility to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible.

9.2.9. Paleontological Impacts

It is probable that there will a negative impact on the palaeontological heritage of the Adelaide Subgroup. As the Adelaide Subgroup underlies the majority of the project area and is likely to be affected by the construction of project's infrastructure with the overall probability of a negative impact is assessed as being probable. Should any undiscovered fossil materials be impacted upon they may well be of high scientific and cultural significance. An assessment of the significance of any negative impacts made against standardised criteria has indicated that the potential negative impacts resulting from the project are calculated at value of 51 (moderate), but should appropriate mitigation procedures be enacted this value declines to 18 (Low).The project is assessed as having a being positive status and the risks posed by the project are not sufficient to outweigh the positive social value it would provide. Therefore, there are either immediate, or mostly irreversible impacts or there are no impacts at all. The overall significance of the impact can be considered as medium based on the archaeological features located on site, however it is concluded that there are **no cumulative impacts.**

9.2.10. Impact on Freshwater Resources

A number of power projects have been proposed in the area surrounding De Aar, particularly towards the east and south east where they can link up with the existing Hydra substation and transmission lines. Within the immediate surrounding area of the proposed Castle Wind Energy Facility, the other proposed projects are also for wind energy facilities. The nature of these projects allows them to have minimal impact on the surface water features as the turbines can be placed in safe distance from the freshwater features so as to not impact on them. The largest potential impact of these projects is as a result of the associated infrastructure which can be mitigated such that its impact on the aquatic ecosystems is of a **low significance**.

9.3 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Castle Wind Energy Facility falls within the De Aar area which has been earmarked for the development of renewable energy projects (i.e. considered as a Renewable Energy Hub) within the Northern Cape Province. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 50km radius will be built in the short to medium term (i.e. in the next five years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential cumulative impacts of the proposed Castle Wind Energy Facility. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Castle Wind Energy Facility have been summarised below:

Table 9.1: Summary of cumulative impacts associated with the Castle project

Cumulative impacts	**Significance rating - Pre Mitigigation**	**Significance rating - Post Mitigigation**
Visual impact	High	High
Noise impact	Low	Low
Social impact- positive impact (social and economical value)	High	High
Social Impact- negative impacts (visual, sense of place, noise and disturbance diring construction)	Low	Low
Ecological Impact	Medium	Medium
Impact on soil and agricultural potential	Low	Low
Impact on Bats	High	Low
Impact on Birds	Medium	Medium
Heritage impact	Low	Low
Palaeontological impact	No cumulative impacts anticipated	No cumulative impacts anticipated
Impact on freshwater resources	Low	Low

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 10

Castle Wind Farm (Pty) Ltd is proposing the establishment of a wind energy facility and associated infrastructure on an identified site located near De Aar in the Northern Cape Province of South Africa. The proposed site is located within the Emthanjeni Local Municipality and Renosterberg Local Municipality, ~28 km north-east of De Aar and ~22 km south-west of Philipstown. This proposed project is referred to as the Castle Wind Energy Facility. This development is proposed to comprise a cluster of up to 31 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed within an area of approximately ~3257ha in extent.

The wind energy facility is proposed to be located on the following farm portions:

- Portion 12 of Farm 165 (Vendussie Kuil);
- Portion 13 of Farm 165 (Vendussie Kuil); and
- The Remaining Extent of Portion 0 of Farm 8 (Knapdaar).

Infrastructure associated with the wind energy facility is proposed to include:

- **31 wind turbines** with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 132m. The generating capacity of the facility will depend on the final turbine selected for implementation by Castle Wind Farm (Pty) Limited;
- Turbine foundation/footprint;
- Temporary Batching plant
- 31 Crane hardstand areas
- **Cabling** between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation;
- Temporary Laydown areas;
- **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m)
- **Internal access roads** (approximately 7m wide) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. Due to the dispersed distribution pattern of the wind turbines however, this will necessitate the construction of new access roads in some areas.
- Workshop area / office for control, maintenance and storage.

The environmental impact assessment (EIA) for the proposed Castle Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 33306, in terms of Section 24(5) of the National

Environmental Management Act (NEMA; Act No 107 of 1998) and the EIA Regulations of June 2010.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed development forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

10.1 Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies and addendums to these studies as contained within **Appendices F-O,** provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA Report by providing a summary of the conclusions of the assessment of the Castle wind energy facility and associated infrastructure on the site near De Aar. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

A 28 turbine layout was developed to ensure maximum wind farm efficiency during the Final Scoping Phase, with the use of an initial road layout and the use of the sensitivities which had been identified during this phase. Subsequent to submitting the layout however, the landowner requested a larger buffer around his homestead, new sensitivities were identified and further discussion with the Project's civil engineering consultants necessitated an amendment to the layout. The final layout was amended to 31 turbines after it was concluded that the construction challenges will be significantly less than previously expected, primarily due to the improved road design, and that the previous turbine spacing had been unnecessarily large.

The section which follows provides a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

10.1.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of 31 turbines and associated infrastructure, Table 9.1 indicates the significance ratings for the potential environmental and social impacts associated with the project.

As indicated in Chapter 6, the significance weightings for potential impact have been rated as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

Table 10.1: Summary of potential impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Impacts on Ecology		
Impacts on vegetation and protected plant species	Medium (52)	Low (27)
Faunal impacts due to construction activities	Medium (48)	Low (30)
Faunal impacts due to operational activities	Medium (36)	Low (24)
Faunal impacts due to decommissioning activities	Low (24)	Low (15)
Increased alien plant invasion risk	Medium (40)	Low (21)
Increased erosion risk due to presence and operation of the facility.	Medium (44)	Low (14)
Impacts on Avifauna		
Destruction of natural bird habitat on and near site – impact on sensitive and threatened species and habitat specialists	Medium (50)	Medium (50)
Impact on birds due to disturbance of habitat	Medium (32)	Medium (32)
Displacement of birds from the site and barrier effects	Medium (30)	Medium (30)
Collision of birds with turbine blades	Low (27)	Low (18)
Impacts on Bats		

Nature	Without mitigation	With mitigation
Disturbance and/or destruction of bat roosts due to construction activities	Medium (52)	Medium (20)
Strong artificial lights used at the work environment during night time	Low (16)	Low (12)
Foraging habitat loss	Low (30)	Low (24)
Bat mortalities due to direct blade impact or barotrauma during foraging activities	High (68)	Low (22)
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with agricultural potential and land capability and impact on land-use	Medium (32)	N/A
Soil contamination / soil erosion during the construction of the facility	Medium (32)	N/A
Increased vehicle activity and associated dust generation	Low (12)	Low (12)
Social Impacts		
Creation of Employment and Business Opportunities during the construction and operation phase **(Positive Impact)**	Medium (32)	Medium (36)
Potential impacts on family structures and social networks associated with the presence of construction workers	Low (27)	Low (24)
Potential impact on local farmers associated with loss of farm labour to the construction and operation phase	Low (27)	Low (24)
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	Medium (33)	Low (24)
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires	Medium (36)	Low (24)
Potential noise, dust and safety impacts associated with construction related activities and the movement of construction related traffic to and from the site	Low (27)	Low (24)
Damage to and loss of farmland during construction	Medium (36)	Low (28)
Benefits associated with the establishment of a community trust **(Positive Impact)**	Medium (36)	High + (65)
Operational Phase -Creation of Long-	Low (21)	Medium (24)

Nature	Without mitigation	With mitigation
Term employment and business opportunities (Positive Impact)		
Impact of the wind energy facility on tourism in the region	Low (24)	Low (27)
Visual Impacts		
Visual impact on sensitive visual receptors within the region	Low (26)	N/A
Change in visual character and sense of place	Low (22)	N/A
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	High (64)	N/A
Visual impact of onsite ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility	Low (28)	Low (12)
Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility	Low (8)	N/A
Visual impact of the proposed facility on the visual quality of the landscape and sense of place of the region	Low (22)	N/A
Noise Impacts		
Noise impacts due to construction activities	Low (14)	N/A
Noise impacts from the wind turbines – operational phase	Low (16)	N/A
Impacts on Heritage Artefacts		
Disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position stone age material, historical material or objects.	Medium (30)	Low (24)
Destruction, damage and loss of provenance of fossil materials	Medium (51)	Low (18)

Based on the specialist findings, no environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix Q**.

10.1.2 Comparison of Access Road Alternatives

The primary access road to the site would be off the R389 to Philipstown and Hanover. Two reasonable and feasible alternatives have been considered:

- **Access Road Alternative 1 (referred to as the Northern Access Road):** The site will be accessible from the existing northern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 19.5km from the R389 to the proposed site and several homesteads are situated along this access roads.
- **Access Road Alternative 2 (referred to as the Southern Access Road) - Preferred alternative:** The site will be accessible from the existing southern gravel access road from the R389 to Philipstown and Hanover. The existing access road is approximately 18.5km from the R389 to the proposed site.

Based on the assessment of the access roads in Chapter 8, there are no impacts of unacceptably high significance associated with either access road alternative assessed for the proposed project. In addition, there is little or no difference between the impacts associated with the two access road alternatives as both routes are existing gravel routes, an there is no significant difference in the potential impacts associated with the two access road alternatives. Therefore, there is **no preference** between the access alternatives. However from a social perspective, **Alternative 2** is considered the preferred alternative as there are no homesteads situated along the access road.

10.1.3 Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind energy facility relate to the direct loss of vegetation and species of concern, disturbance of animals and loss of habitat and impacts on soils. A wind energy facility is, however, dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 32.6km^2 was considered for the facility, of which ~1.3% will be utilised for the development footprint of the proposed wind energy facility, and will be permanently transformed. The bulk of the development site would not suffer any level of disturbance as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

Permanently affected areas comprise 31 turbine footprints (31 foundation areas & 31 crane hardstand areas), access roads (up to 7m in width), one 132 kV substation footprint and an operations and service building area. It should be noted that the site currently has several access roads which are used for farming activities. It is planned that where existing access roads are able to be utilised within the development footprint, these are utilised, widened and upgraded where possible. The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
31 turbine footprints (each 20m x 20m) and crane hardstand areas (each 70 x 30)	77500
Permanent access roads underlain with cabling where possible (7 m wide and 42.145 km long)	295015
One on-substation footprint (100m x 100m)	40000
Operations and service building area (30m x 30m)	900
TOTAL	422515m^2 (of a total area of 32570000m^2) **i.e. 3.07% of site**

Approximately 3.07% of the entire extent of the site can be anticipated to be permanently disturbed during the construction/operation by the development footprint Castle Wind Energy Facility.

Temporarily affected areas comprise laydown areas for turbines (i.e. each with a minimum footprint of 52 m^2 per turbine). The underground cabling to connect the turbines to the on-site substations will make use of the permanent access roads to be constructed on site. A trench of approximately 1 m deep will be excavated in which the cabling will be laid; thereafter the area will be rehabilitated.

Facility component - temporary	**Approximate area/extent (in m^2)**
Laydown areas for turbines (i.e. each 2100 m^2)	65100
Internal access roads during construction	295015
Batching plant	2500
TOTAL	**362 615 m^2** (of a total area of 32570000m^2) = **~1.1 % of site**

Temporarily affected areas of the proposed wind energy facility will amount to ~0.9 % of the total ha of the broader site.

10.2 Cumulative Impacts

Cumulative impacts of a development project consider impacts resulting from incremental actions from the development, in addition to other past, present or future impacts resulting from other developments/actions/projects. This assumes the knowledge of other developments or actions whose effects could be cumulative to the ones resulting from the project being assessed. As it is not reasonably viable to consider all the varying existing or proposed developments for a certain area, the consideration of cumulative impact will focus on impacts arising from developments which are similar in nature.

The main known activities or projects, relevant for the cumulative impacts analysis, known in the broader area of the Castle Wind Energy Facility are the disturbance to or altering of the environment, as well as impacts arising from other proposed wind energy facilities. Based on the information available at the time of undertaking the EIA, two other wind energy facilities have been authorised and are planned on adjacent farm portions to the Castle Wind Energy Facility site (shown in Figure 10.2). These two facilities include:

- The Longyuan Mulilo De Aar 2 North Wind Energy Facility- is a Round 3 preferred bidder of the REIPPP Programme.
- The Longyuan Mulilo De Aar 2 South Wind Energy Facility- is a Round 3 preferred bidder of the REIPPP Programme.

Cumulative impacts are summarised below and have been considered within the detailed specialist studies, where applicable (refer to **Appendices F – O** and Chapter 9):

The potential cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

- *Visual impact* - A large portion of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall between farms earmarked for the development of the two De Aar North and South Wind Energy Facilities (Longyuan Mulilo) which are scheduled to be constructed in 2015. The development of the Castle Wind Energy Facility will not significantly contribute to the increase in the area of exposure (i.e. the visual exposure is generally expected to be consolidated within an area of existing visual impact), and as such will not contribute to the proliferation of wind turbine structures within the surrounding wind energy facilities within the region. It is therefore expected that the cumulative impact will be **high**.
- *Social impacts* - The establishment of the other renewable energy projects in the area also have the potential to result in significant positive

cumulative socio-economic impacts (creation of employment, skills development and training opportunities creation of downstream business opportunities and stimulation of the local property market) for the local municipalities. The cumulative positive social and economical impacts will be of **high positive significance** and the negative social impacts (visual, sense of place, noise and disturbance during construction) will be of **low negative significance**.

» *Ecological impacts* - Given the abundance of other Renewable Energy applications in the area, with particular reference to the two Round 3 preferred bidder projects (Longyuan Mulilo De Aar North and Longyuan Mulilo De Aar South Wind Energy Facilities) which are planned to commence construction in 2015, the potential for cumulative impacts is relatively high. At a broad level, a concentration of development in the area is not likely to generate significant disruption of most ecological processes as the surrounding landscape is still largely intact and the type of habitats affected are also widely available outside of the affected area. This is specifically applicable to terrestrial ecology and may not apply to volant mammals and birds. It can therefore be concluded that the cumulative impact will be of **medium significance**.
» *Impact on Freshwater Resources* - The nature of the two wind energy projects to be constructed will result in minimal cumulative impacts on the surface water features as the turbines can be placed in safe distance from the freshwater features so as to not impact on them. The largest potential impact of these projects is as a result of the associated infrastructure which can be mitigated such that its impact on the aquatic ecosystems is of a **low significance**.
» *Impact on birds* - The proposed Castle Wind Energy Facility site falls within an Important Bird Area (SA037 Platberg-Karoo Conservancy). This area holds vital populations of two Globally Threatened species, the Lesser Kestrel and the Blue Crane. There are numerous renewable energy projects currently proposed within this Important Bird Area or conservancy and it is difficult to place in perspective the potential effect of the proposed facilities against the conservation effort of declaring the Platberg Karoo Conservancy and the Important Bird Area. There is however a danger that if each proposed project is assessed in isolation of the others, its impact on the Important Bird Area (and hence obviously the birds) will appear minimal. However, if all of these projects are permitted to proceed, the cumulative impact on birds will be substantial. The overall cumulative effects of wind energy facilities on birds in the De Aar area is likely to be of **medium significance prior to mitigation**. It is unlikely that this impact can be mitigated to below medium significance.
» *Impact on Bats* - Cumulative impacts are direct mortality from collision with turbine blades, and loss or fragmentation of roosting and foraging habitat. These impacts will affect both resident and migratory species.

There is a significant potential for a long-term reduction in the size of the population of all impacted bat species. It is certain that cumulative effects may have greater consequences for long-lived, low-fecundity species such as bats, though this cannot be assessed in a single study, or by considering a single wind farm only. The cumulative impact relating to bat mortality due to direct blade or barotrauma during foraging is considered to be of **high significance pre-mitigation** and **low post-mitigation**.

» *Soils and agricultural potential* impacts - The arid climate of the study area coupled with shallow soils limits the agricultural potential to low intensity grazing. Therefore, the cumulative impact of the renewable energy project in the area is expected to be **low** due to the low agricultural potential of the land. Due to the presence of the Ms/Gs soils type which is found in and around the study area has been found to have limited storage capacity and therefore limits the agricultural potential to natural grazing and makes these soils susceptible to erosion. The cumulative impacts on agricultural potential and soil erosion will be of **low significance** (on condition that appropriately mitigation measures are implemented).
» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Noise modelling of the Castle Wind Energy Facility revealed that the projected cumulative noise levels due to the operation of the Castle and the Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities due to the wind turbines is not significant when considering the ambient sound levels as measured on-site.), The cumulative impacts are therefore considered to be of **low significance**
» *Heritage impacts:* Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. Very sparse heritage traces were found on the site and from an archaeological perspective the observed heritage resources may be regarded as being of generally **low** significance.
» *Palaeontological impacts* – It is probable that there will a negative impact on the palaeontological heritage of the Adelaide Subgroup. As the Adelaide Subgroup underlies the majority of the project area and is likely to be affected by the construction of project's infrastructure with the overall probability of a negative impact is assessed as being probable. Should any undiscovered fossil materials be impacted upon they may well be of high scientific and cultural significance. An assessment of the significance of any negative impacts made against standardised criteria has indicated that the potential negative impacts resulting from the project are calculated at value of 51 (moderate), but should appropriate mitigation procedures be enacted this value declines to 18 (Low).The project is assessed as having a being positive status and the risks posed by the project are not sufficient

to outweigh the positive social value it would provide provided that the mitigation protocols are emplaced.

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Castle Wind Energy Facility falls within the De Aar area which has been earmarked for the development of renewable energy projects (i.e. considered as a Renewable Energy Hub) within the Northern Cape Province. It should also be noted that the Castle Wind Energy Facility will be located between the Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility preferred bidder projects (the construction of the Castle Wind Energy Facility would be considered as infill) which are scheduled to be constructed in 2015. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 50km radius will be built in the short to medium term (i.e. in the next five years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential cumulative impacts of the proposed Castle Wind Energy Facility. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Castle Wind Energy Facility have been summarised below:

Table 10.2: Significance of potential cumulative impacts identified

Cumulative impacts	Significance rating - Pre Mitigigation	Significance rating - Post Mitigigation
Visual impact	High	High
Noise impact	Low	Low
Social impact- positive impact (social and economical value)	High	High

Social Impact- negative impacts (visual, sense of place, noise and disturbance diring construction)	Low	Low
Ecological Impact	Medium	Medium
Impact on soil and agricultural potential	Low	Low
Impact on Bats	High	Low
Impact on Birds	Medium	Medium
Heritage impact	Low	Low
Palaeontological impact	No cumulative impacts anticipated	No cumulative impacts anticipated
Impact on freshwater resources	Low	Low

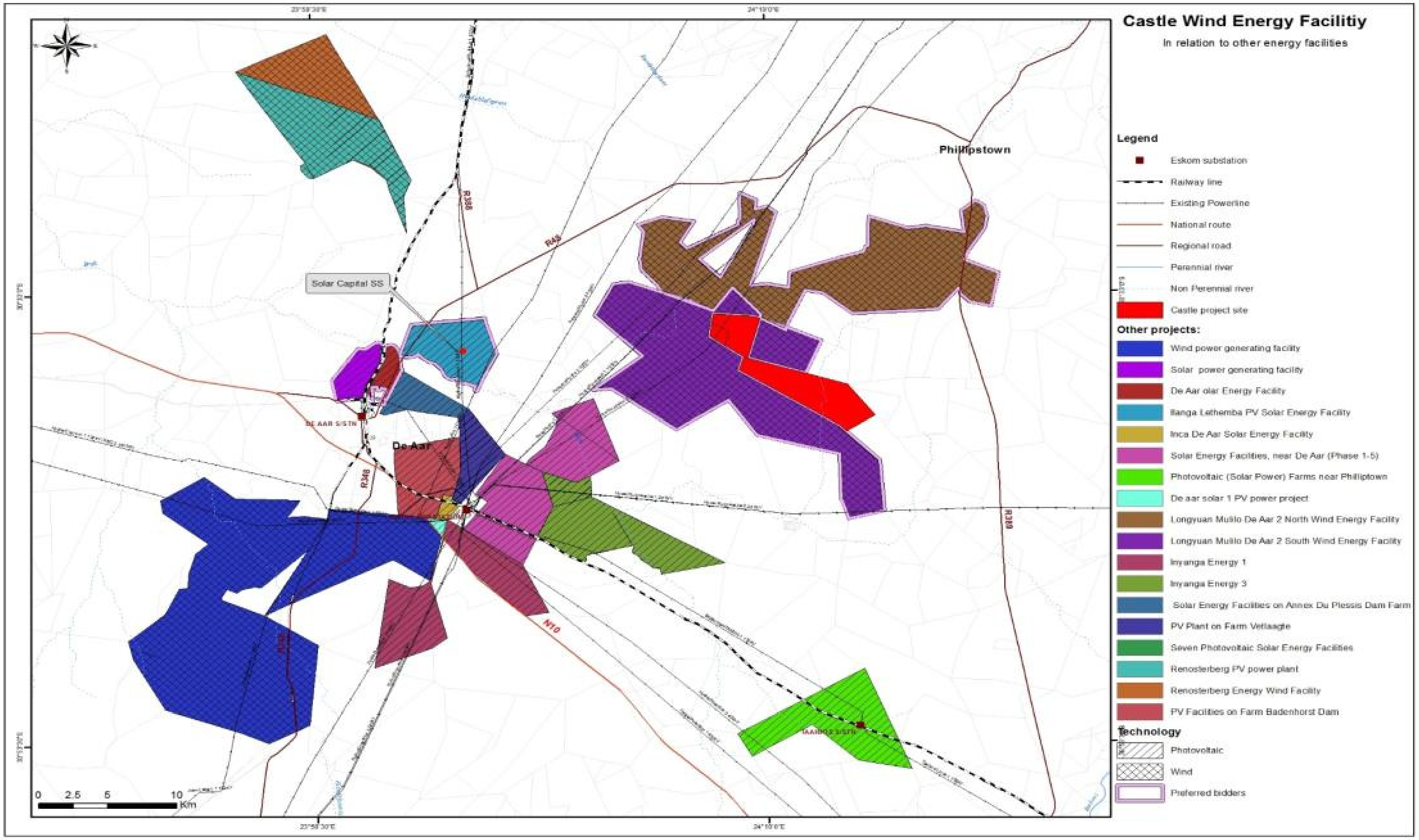


Figure 10.1: Map showing other renewable energy projects in the study area (refer to **Appendix P** for an A3 map)

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Figure 10.2: Layout indicating the location of the Castle Wind Energy Facility in relation to two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities (Preferred bidder round 3) (refer to **Appendix P** for an A3 map)

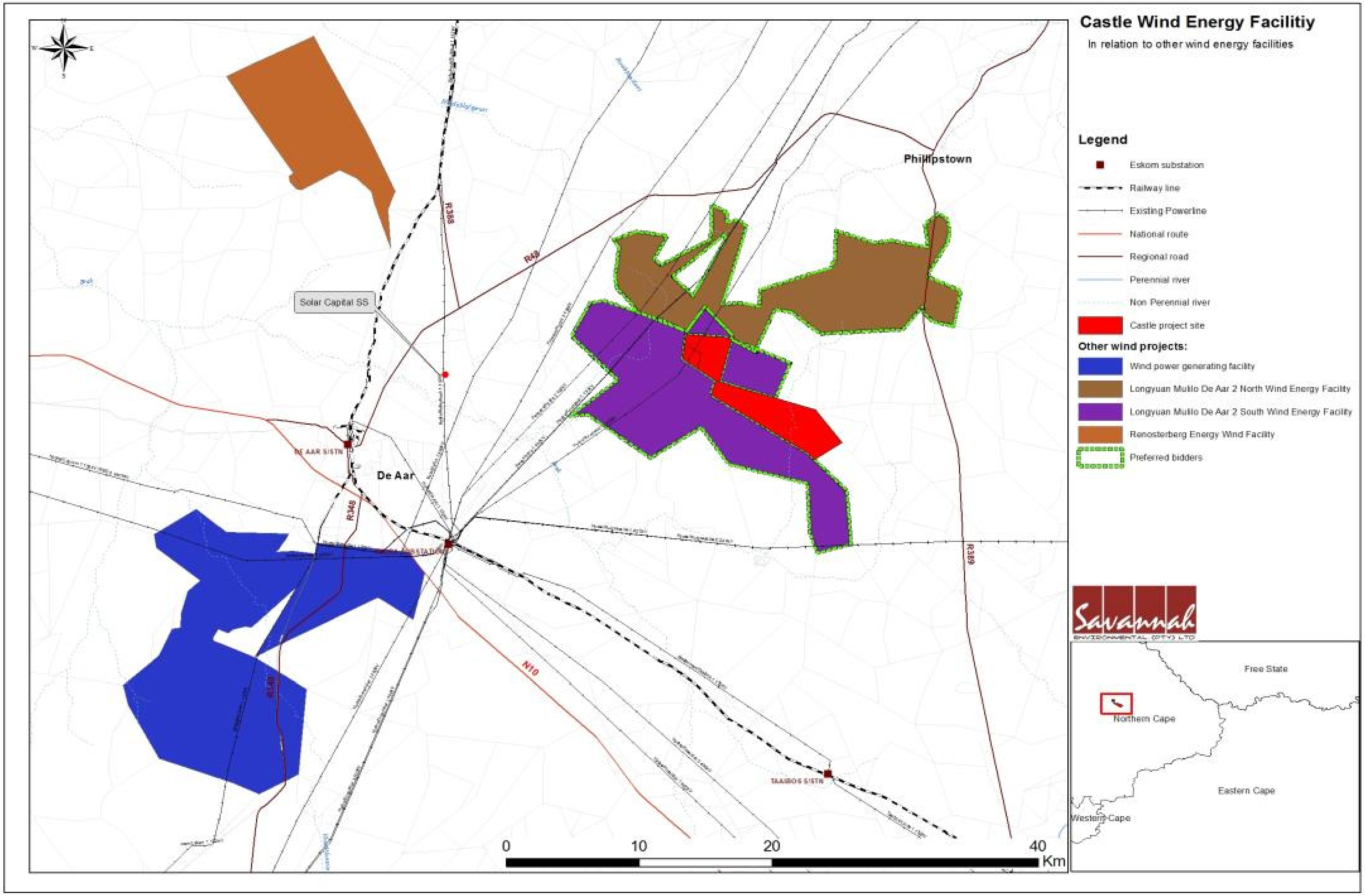

Figure 10.3: Map showing other wind energy projects in the study area (refer to **Appendix P** for an A3 map)

10.3 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Castle Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to Figure 10.3 and A3 map in Appendix P). The following sensitive areas/environmental features have been identified on the site and are able to be mapped:

» **Ecology*:*** The major sensitive feature of the site are the larger drainage lines which are fairly well developed, with significant amounts of tall woody biomass which contrasts with the surrounding landscape. The steeper, south-facing slopes are also considered ecologically sensitive on account of their woody biomass and more mesic environment. The less steep rocky areas are considered moderately sensitive on account of the presence of a variety of species of conservation concern. The remaining flats and gentle slopes are of lower sensitivity and typically consist of low shrubland or grassy shrubland representative of the Northern Upper Karoo vegetation type (which is a least threatened vegetation type). The majority of the turbines are located within these lower sensitivity areas. There are 4 turbines located within the moderately sensitive rocky areas, and no turbines are located on very steep slopes or within drainage lines (i.e. within highly sensitive areas).

» **Freshwater ecosystems:** The Brak River and its larger tributaries within the study area are considered to be of a moderate to low ecological importance and Sensitivity. The ecological importance and sensitivity of the ephemeral tributaries are considered to be negligible. The ecological importance and sensitivity of the pans is very similar to that of the ephemeral streams, which is, marginal or negligible while the valley bottom wetlands are directly related to the Brak River and its larger tributaries, that is, moderate to low. There are no turbines located within the a 100m of any delineated drainage line/ streams or wetlands/pans. It is recommended that the turbine be shifted further southwards. Initially turbines 27 and 28 were located approximately 30m and 70m away from small drainage lines respecitvely, however as a mitigatory strategy, the turbines have been relocated further away from these drainage lines as recommended.

» ***Bats sensitive areas:*** Potential roosting sites are present along several drainage lines and rocky elevations found throughout the proposed study site. These areas often have favourable weather conditions which cause increases in insect abundance and thus possible increases in bat activity. No turbines are located within any of the bat high sensitivity areas and their respective buffers, which are considered to be critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site. These areas are 'no-go' areas and turbines should not be located in these areas.

» ***Bird Habitat and Sensitive Areas:*** The species recorded flying most frequently on site were the Northern Black Korhaan, and Southern Pale Chanting Goshawk. The Lesser Kestrel and Amur Falcon were recorded infrequently on site, which may be as a result of low food occurrence during the monitoring programme (and these flocking species may occur in high numbers on site at some point during the lifespan of this project when food is more abundant). Due to the overall low flight activity recorded on site, the collision risk index that was developed highlighted very little in the way of spatial patterns in flight activity. No turbine re-positioning is recommended as a result of the collision risk index. Most flight activity recorded was in the flatter lower lying areas to the east, which are not targeted for turbine placement. Based on a formal risk assessment, two species emerge as being of 'medium' risk of impact by the proposed wind farm, the Northern Black Korhaan and the Southern Pale Chanting Goshawk. The significance of impacts on avifauna as a result of habitat destruction, disturbance of birds, and displacement of birds is rated as medium significance. Collision of birds with turbines is rated as low significance. Site sensitivity mapping has identified buffers around dams, within which no turbines should ideally be built. The Avifaunal Assessment Report identified three turbines: T3; T4; and T13 which were slightly located within the bird sensitive buffer areas. As a mitigatory strategy the turbines have subsequently been relocated outside the sensitivity buffer areas previously identified.

» ***Heritage artefacts:*** Nine sites were recorded consisting of six Stone Age sites (Site 1, 3, 4, 6, 7, 9) a stone kraal (Site 2 that is a no-go area in development with a 100m buffer from the kraal wall) and 2 historical sites consisting of porcelain, glass and metal artefacts (Site 5) as well as historical/recent exploration or quarrying (Site 8). A further total of 3 find spots were recorded. Assemblages at the locations are mixed, mainly consisting of Middle (MSA) and Late Stone Age (LSA) artefacts with some Early Stone Age (ESA) artefacts recorded. The latter are mostly heavily weathered, testifying to their prolonged exposure. No graves were observed in the study area. Artefacts consist mostly of blades, triangular flakes (some with dorsal flaking) and cores (identified as site 9) and site also consists of a large boulder with the engravings of two elephants on it (site 6) were found located in close proximity to turbine 2, however the area can be demarcated to avoid impacts.

» ***Noise Sensitive Receptors (NSEs):*** Noise sensitive receptors do occur in and around the site. The significance of the noise impact is considered to be of a low significance for all Noise Sensitive Developments.

» ***Visual receptors:*** The wind turbines would likely be exposed to a number of farm residences and sections of secondary roads traversing near or over the development site. Affected farmsteads, excluding the ones located within the development site, may include: Kranskop, Klipfontein, Vendusiekraal, Disselskuil and Slingershoek. It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact. It must however be noted that a large section of the potential viewshed area of the Castle Wind Energy Facility turbines, especially within a 10km radius of the facility, fall within farms earmarked for construction of the Longyuan Mulilo De Aar 2 North Wind Energy Facility and Longyuan Mulilo De Aar 2 South Wind Energy Facility in 2015.

Turbine positioning should take cognisance of sensitive areas (as indicated on Figure 10.4). Should mitigation measures in the EMPr be adhered to, impacts on the identified sensitive areas can be adequately managed.

Planning of infrastructure location on the site needs to take some factors into account with respect to existing disturbance on site. Existing road infrastructure is planned to be used as far as possible for providing access to proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats and that the risk of erosion or down-slope impacts are not increased. Road infrastructure and underground cable alignments should coincide as much as possible.

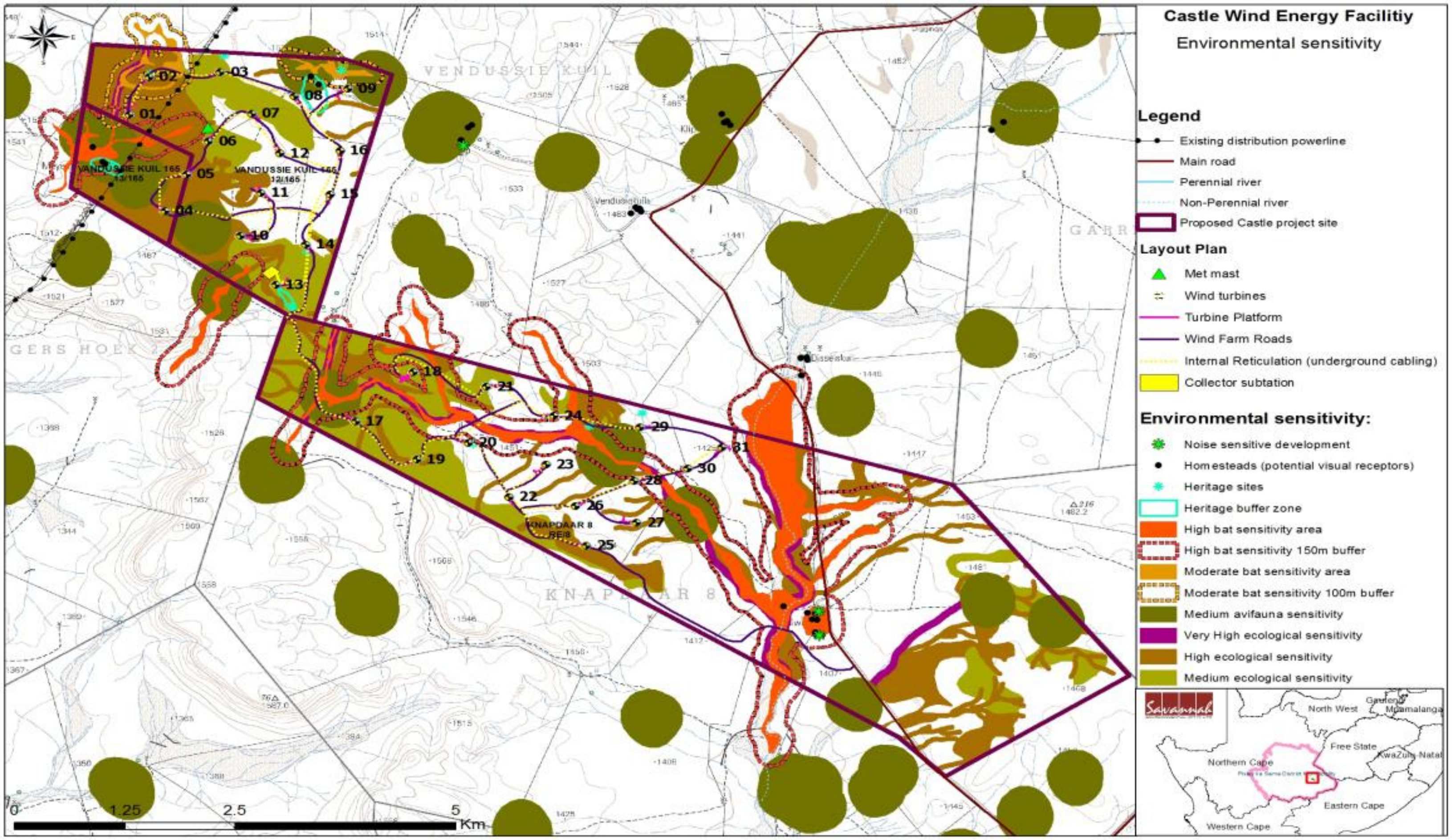

Figure 10.4: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed development footprint for the Castle Wind Energy Facility (**Appendix P** contains an A3 map)

10.4 Overall Conclusion (Impact Statement)

The principles of NEMA have been considered in this assessment through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation at a national scale.

The EIA process has been undertaken in accordance with the requirements of the EIA Regulations and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority. The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the biophysical environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of sustainable environmental management.

Through pre-feasibility assessments and research, the viability of establishing the Castle Wind Energy Facility in the Northern Cape has been established by Castle Wind Farm (Pty) Ltd. The positive implications of establishing the Castle Wind Energy Facility on the demarcated site include:

- The project would assist the South African government in reaching their set targets for renewable energy.
- The potential to harness and utilise excellent wind energy resources on this site would be realised.
- The National electricity grid in the Northern Cape would benefit from the additional generated power.
- Promotion of clean, renewable energy in South Africa.
- Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

- There are no environmental fatal flaws that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation, monitoring and management measures are implemented.

» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» The Castle Wind Energy Facility site is located between the two Longyuan Mulilo De Aar 2 North and South Wind Energy Facilities, which have been awarded preferred bidder status in Round 3 of the DoE REIPPP Programme. Due to the close proximity of the two facilities to the proposed wind energy facility and other numerous wind and solar facilities within the area, this area could be considered as a renewable energy development zone, and consolidates impacts in a single node with a proven wind resource. The development of facilities in viable nodes presents some benefits to the environment through minimisation of the extent of impacts.

The significance levels of the majority of identified negative impacts can generally be reduced to acceptable levels by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the confidence in the environmental assessment undertaken is regarded as acceptable.

The identified 'no go' areas for the construction of infrastructure (including turbines) to be observed during construction and operation include:

» High sensitivity areas and their respective buffers are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site.
» Buffer around dams, streams, rivers and wetland, within which no turbines should be constructed. There are no turbines located within the a 100m of any delineated drainage line/ streams or wetlands/pans, Artefacts consist mostly of blades, triangular flakes (some with dorsal flaking) and cores (identified as site 9) and site also consists of a large boulder with the engravings of two elephants on it (site 6) were found located in close proximity to turbine 2, however the area can be demarcated to avoid impacts.

10.5 Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Castle Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level, provided appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

The following infrastructure would be included within an authorisation issued for the project:

» **31 wind turbines** with a generating capacity of up to 3.5MW each, with a hub height of up to 120m and a rotor diameter of up to 132m. The generating capacity of the facility will depend on the final turbine selected for implementation by Castel Wind Farm (Pty) Limited;
» **31 crane hardstand areas** for turbines
» Turbine foundation/footprint;
» **Cabling** between turbines to be laid underground (1-2m deep) along the road verge where practical to connect to an on-site substation;
» Temporary Laydown areas ;
» **On-site substation** (132kV) which will be an approximate compound size of 100 m x 100 m)
» **Temporary Batching plant**
» **Internal access roads** (approximately 7m wide) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
» Workshop area / office for control, maintenance and storage.

The following conditions would be required to be included within an environmental authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within **Appendices F - O** must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The

implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained to carry out a restricted activity involving a specimen of a listed threatened or protected species.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» The final location of the wind turbines and associated infrastructure within identified sensitive areas must be informed by walk-through surveys to be undertaken by ecological, heritage and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
» Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bats.
» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible.
» Adequate stormwater management measures to be put in place as the soils on the site are prone to erosion.
» Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
» Construction managers should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
» Applications for all other relevant and required permits if required to be obtained by the developer must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, water use licencing for disturbance to any water courses/ drainage lines and, permit to remove heritage artefacts and/ disturbance of protected vegetation.

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