Environmental Impact Assessment Process
Final Environmental impact assessment report
Proposed Poortjies Wind Energy Facility near Pofadder, Northern Cape Province
DEA Reference Number:
14/12/16/3/3/2/681

Final Report
February 2015

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PROJECT DETAILS

DEA Reference No.	**:**	14/12/16/3/3/2/681
Title	**:**	Environmental Impact Assessment Process Final Environmental Assessment Report: Proposed Poortjies Wind Energy Facility Near Pofadder, Northern Cape Province
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Project Developer	**:**	South Africa Mainstream Renewable Power Developments (Pty) Ltd
Report Status	**:**	Final Environmental Impact Assessment Report for public review
Submission Date	**:**	February 2015

When used as a reference this report should be cited as: Savannah Environmental (2015) Final Environmental Management Plan: Poortjies Wind Energy Facility, located near Pofadder in the Northern Cape Province.

PURPOSE OF THE FINAL ENVIRONMENTAL IMPACT ASSESSMENT

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) commissioned an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind farm on a site near Pofadder in the Northern Cape Province. The project will be referred to as the "P 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. Mainstream 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 a Final EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

As outlined in the Acceptance of the scoping report dated April 2014, Savannah Environmental has compiled a table (refer to Table 1 below) which outline the requirements and 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)	All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the Final 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. 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).	Refer to Chapter 5 Refer Chapter 7,8,9 and Appendix L (EMPr)
b)	Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final EIAr. This includes but not limited to the Free State Department of Economic Development, Tourism and Environmental Affairs, 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), EWT and BirdLife SA, the South African Heritage Agency (SAHRA), SABAAP, the Department of Rural Development and Land Reform and the Square Kilometre Array (SKA). 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. 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. 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.	.Refer to Appendix c (Organs of State Correspondence) and Appendix C (Comments Received) Refer to Chapter 7 (assessment of impacts) and Appendix C - Comments & Response Report Refer to Appendix C (stakeholder correspondence) and C (organs of state correspondence) 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 PV positions and associated infrastructure. The maps must be of acceptable quality and as a minimum, have the following attributes:	Refer to Appendix O

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)	The EAP is advised to conduct a surface hydrological study as part of the EIAr.	Refer to Appendix F (Aquatic Impact Assessment Report)
	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 C
	The EIAr must also include a comments and responses report in accordance with Regulation 28(m) of the Regulations, 2010	Refer to Appendix C
	The EIAr must include the detail inclusive of the PPP in accordance with Regulation 54 to 57 of the EIA Regulation.	Refer to Chapter 5 and Appendix C
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 3.
	The EIAr must provide an assessment on the glint and glare and provide mitigation measure to reduce the impacts.	Refer to Chapter 7 and Appendix J
e)	The EIAr must provide a layout which depicts the entire facility, i.e. the wind and grid connection infrastructure as well	Refer Appendix P
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 (Table 2.1). 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 2.1.
	Reference in each EIAr must be made to the remainder of the project, i.e. the wind (3) and solar applications and the link between the projects	Refer to Chapter 1
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 N
h)	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Appendix N
i)	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix N
j)	A shapefile of the preferred development layout footprint must be submitted to this Department.	N/A

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
k)	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following: All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted. The final site layout map. Measures as dictated by the final site layout map and micro-siting, An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. 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. 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. 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. An open space management plan to be implemented during the construction and operation of the facility 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 A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment 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 An erosion management plan for monitoring and rehabilitating	Refer to Appendix O (EMPr) Refer to Appendix O (EMPr) Refer to Appendix O (EMPr) Refer to Appendix O (EMPr) Refer to Appendix O (EMPr) Refer to Appendix B of the EMPr Refer to Appendix A of the EMPr Refer to Appendix A of the EMPr Refer to Appendix I (EMPr) Refer to Appendix F (EMPr) Development Refer to Appendix F (EMPr) Refer to Appendix G of the EMPr Refer to Appendix C (EMPr) Refer to Appendix O (EMPr) – Chapter 5 – Objective 7

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion 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 7 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

TABLE 2: LEGAL REQUIREMENTS OF SECTION 31 OF THE EIA REGULATIONS

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 1.5 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: » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts (Chapter 7 & 8) ii. Appendix C
(f) a description of the need and desirability of the proposed activity;	Chapter 2 Section 2.1
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 2.4
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Chapter 5 Section 5.4

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)
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 7.11, Chapter 7 and Chapter 9
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Chapter 7 and 9
(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 C
(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 7
(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 7 and 8
(n) a description of any assumptions, uncertainties and gaps in knowledge	Specialist reports (Appendix D-M)
(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	Chapter 9
(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 9
(q) a environmental management programme containing the aspects contemplated in regulation 33	Appendix O
(r) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix D-M
(s) any specific information that may be required by the competent authority.	Refer to Table 1 of the EIR.

INVITATION TO COMMENT ON THE FINAL 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 from **05 January 2015 – 13 February 2015** at the following locations:

- Pofadder Public Library; and
- Aggeneys Library.

The report also available for download at:

- www.savannahSa.com

The Final Basic Assessment Report is available for review and electronic copies may be requested from Savannah offices or downloads can be done from the Savannah website and comments should be sent directly to the DEA.

SUMMARY

Background and Project Overview

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) is proposing to establish a wind energy facility and associated infrastructure on a site located approximately 22 km south-west of Pofadder in the Northern Cape Province (refer to Figure 1.1).

This facility forms part of a larger Renewable Energy Facility which also incorporates two other commercial wind energy facilities and one (1) solar energy facility and associated infrastructure. A broader area of approximately 175 km^2 is being considered within which the renewable energy facilities are to be constructed (refer to Figure 1.2). The proposed Renewable Energy Facilities are proposed on the following farms:

- Namies Suid Portion 1/212;
- Namies Suid Portion 2/212;
- Poortje Portion1/209; and
- Poortje RE/209

Four separate application forms were submitted to the DEA, and the following reference numbers were allocated:

- 14/12/16/3/3/2/680 (Khai-Ma wind energy facility) - The Khai-Ma Wind Energy Facility is located on the Portion 1 of the farm Poortje 209, the Remainder of the farm Poortje 209and Namies Suid 212 Portion 1;
- **14/12/16/3/3/2/681 (Poortjies wind energy facility), which is the subject of this report**-- the facility is located on Portion 1 of the farm Poortje 209 and the Remainder of the farm Poortje;
- 14/12/16/3/3/2/682 (Korana wind energy facility)- the facility is located on Portion 1 and 2 of the farm Namies Suid 212 and Portion 1 of the Farm Poortje 209; and
- 14/12/16/3/3/2/683 (Korana solar energy facility) - the facility is located on Portion 2 of the farm Namies Suid 212.

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 50 wind turbines (the number of turbines could however range from 35 to 94, this is on the assumption that each turbine will have a generating capacity ranging between 1.5 – 4MW); with a hub height of up to 140m and a rotor diameter of up to 140m. The entire facility would have a capacity of up to 100 MW.

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

- wind turbines (the number of turbines could however range from 35 to 94, this is on the assumption that each turbine will

have a generating capacity ranging between 1.5 – 4MW).
» Foundations to support both the turbine towers;
» Cabling between the project components, to be lain underground where practical;
» A satellite 132 kV substation to facilitate grid connection;
» Internal access roads (~33km);
» Workshop area for maintenance and storage; and
» Permanent wind monitoring masts.

Substation alternatives

Two alternative locations are proposed for the construction of the 132kV Substation, Operations and Maintenance buildings and location of the laydown areas are considered in this report. The alternative infrastructure sites are located as follows (refer to Figure 2.3):

» **Alternative 1** is located in the south of the project area (29° 26'15.68"S and 19° 19'32.21"E) – **Preferred Alternative**.
» **Alternative 2** is located in the north of the project area (29° 24'30.71"S and 19° 19'31.26 E).

The broader site can be accessed using the N14 via two alternative gravel access roads, namely Namies Suid North and Poortjies South Two reasonable and feasible alternatives are have been considered (refer to Figure 2.4).

Alternative access to site during construction and operation

» **Alternative 1- Namies Suid North** - this Access Alternative is an existing gravel road which is approximately 49.5km long with an average width of ~7.5m. For the Namies Suid North access adjustments to the width and vertical alignment will have to be undertaken before safe abnormal load access can be guaranteed. There are also sections through the proposed land parcels of the proposed that may require widening to accommodate abnormal load access. Approximately 5.3km of new road will have to be constructed within the site.

» **Alternative 2- Poortjies South (Preferred route alternative) -** The Poortjies South access road is an existing gravel road that is approximately 63km long with an average width of ~ 10m. This access road is longer but has a more suitable vertical and horizontal alignment for abnormal load access. There is only one corner that may require horizontal re-alignment within the current road reserve.

Savannah Environmental was contracted by Mainstream 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).

This Environmental Impact Assessment Report consists of the following sections:

» **Chapter 1** provides a project overview and an overview of the environmental impact assessment
» **Chapter 2** provides the project description, need and desirability, site selection information 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 Poortjies Wind Energy Facility
» **Chapter 4** provides the strategic context for energy planning in South Africa
» **Chapter 5** outlines the process which was followed during the Scoping and EIA Phase of the project, including the stakeholder consultation programme that was undertaken
» **Chapter 6** describes the existing biophysical and socio-economic environment affected by the proposed project
» **Chapter 7** describes the assessment of the identified environmental impacts associated with the proposed Poortjies Wind Energy Facility and recommended mitigation measures
» **Chapter 8** describes the assessment of cumulative impacts associated with the proposed Poortjies Wind Energy Facility and recommended mitigation measures
» **Chapter 9** presents the conclusions of the impact assessment, recommendations and impact statement
» **Chapter 10** contains a list references used in compiling the Final EIA report and specialist reports

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 addressed those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) 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 sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project.

The release of a Final EIA Report aims to provide stakeholders with an opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. This Final EIA Report has incorporated all issues and responses raised during the public review of the Draft Scoping Report prior to submission to

the National Department of Environmental Affairs (DEA).

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility and associated infrastructure.
» 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.

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study 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. This layout includes 70 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium 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 **Environmental Management Programme (EMPr)** included within **Appendix O**.

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 Poortjies 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:

» 50 wind turbines (the number of turbines could however range from 35 to 94, this is on the assumption that each turbine will have a generating capacity ranging between 1.5 – 4MW).
» Foundations to support both the turbine towers;
» Cabling between the project components, to be lain underground where practical;
» A satellite 132 kV substation to facilitate grid connection;
» Internal access roads (~33km);
» Workshop area for maintenance and storage; and
» Permanent wind monitoring masts.

The construction of the Poortjies Wind Energy Facility will lead to permanent disturbance of an area of approximately 561 000m^2 in extent (i.e. 1.7% of the site). Permanently affected areas include the turbine footprints and associated infrastructure, as well as the internal access roads. From the specialist investigations undertaken for the proposed Khai-Ma Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figures 9.1/9.2 and A3 map in Appendix O**). The following sensitive areas/environmental features have been identified on the site:

» ***Bats sensitive areas*** - The locations of potential bat roosts identified through the pre-construction monitoring are shown in Figure 2. As it may be possible to limit bat roost abandonment by avoiding construction activities near roosts, it is recommended that a buffer of 300 m and 500 m should be observed around these (depending on the type of roost) and all other potential roosts identified in the Development site.
» ***Fauna*** - Areas designated with a high sensitivity are landscape features providing rocky habitats. These rocky habitats are highly sensitive due to the high biodiversity and abundance of fauna that they support. The seasonal waterways and water bodies are designated as moderate sensitivity since these water features and their associated habitat support life on site and attract faunal activity within and around them.
» ***Visual receptors*** occur in the study area. The visual impacts of the wind energy facility will be of a medium- high significance. It is however not possible to mitigate visual impacts.
» ***Bird Habitat and Sensitive Areas -*** Turbine positioning should take cognisance of sensitive areas identified for the site (as indicated on Figure 2).

On the basis of the sensitivities identified, the areas which can be

considered as a 'no go' areas for the construction of infrastructure (including turbines) are:

» The seasonal drainage lines and quartzite ridges should be treated as ecologically sensitive and should be avoided. No construction should take place within 50 m of the nominal centre line of the drainage lines or quartzite ridges.
» 200m no-go buffer is proposed around water points to prevent disturbance and displacement of breeding Southern Pale Chanting Goshawks.
» A 50m no-turbine buffer around drainage lines (optimal Red Lark habitat). A total exclusion zone will not be feasible as the internal road network will have to cross drainage lines at some point. However, the construction of infrastructure in drainage lines should be kept to an absolute minimum, and avoided where possible.
» Identified bat roosts with 300m – 500m buffer depending on the type of roost.
» High sensitivity areas in terms of faunal habitat.

No turbines should be located within the environmental sensitive areas listed above. Based on the findings of the EIA studies undertaken and the recommendations above, the original proposed layout for the project (as presented within this EIA) was revised in order to avoid areas of high sensitivity. Both the original layout (Figure 9.2) and the revised layout (Figure 9.3) are shown below.

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 D - M** must be implemented.
» The Environmental Management Programme (EMPr) as contained within Appendix O 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.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction. This layout should take cognisance of all

sensitive and no go areas identified within this EIA.

» An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
» All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» 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 bat communities. Where necessary, additional mitigation measures should be implemented to minimise impacts on these communities.
» Disturbed areas during construction should be kept to a minimum and rehabilitated as quickly as possible.
» Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation. Adequate storm-water 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/foremen 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).
» All other relevant and required permits be obtained by the developer prior to the commencement of construction.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.

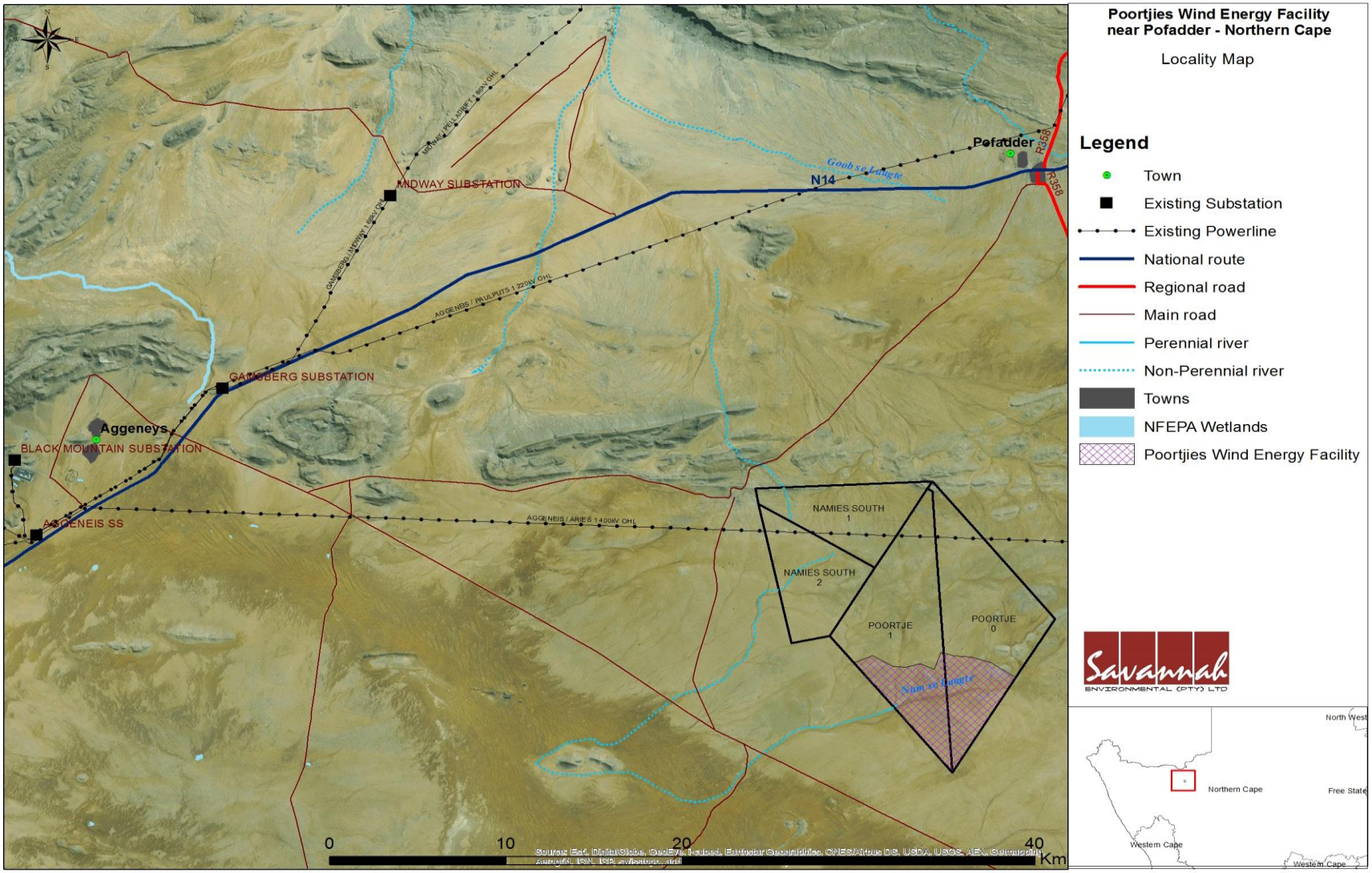

Figure 1: Locality map showing the study area for the establishment of the Pootjies Wind Energy (Northern Cape)

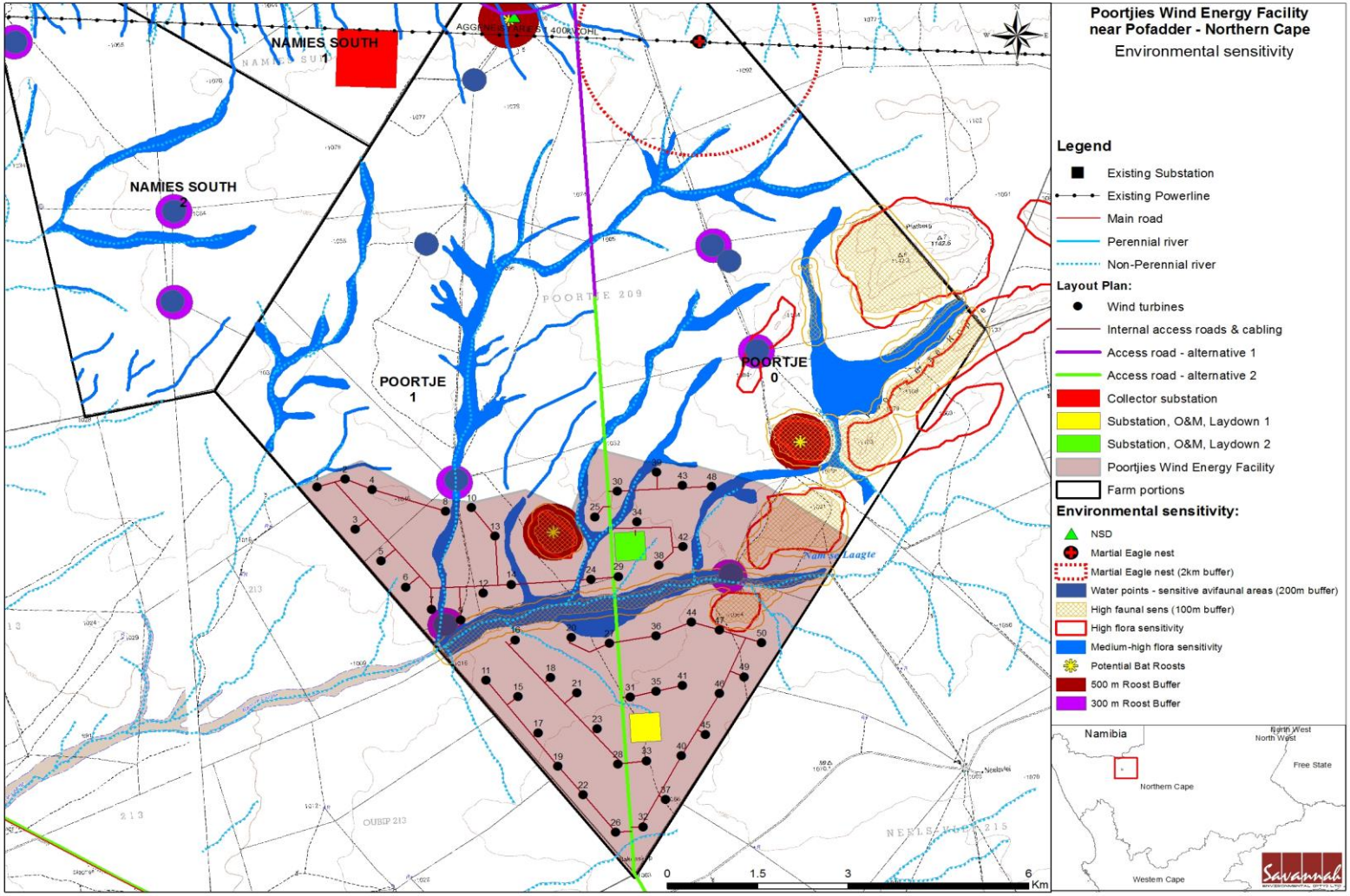

Figure 2: Environmental sensitivity map for the proposed Poortjies Wind Energy Facility in relation to the proposed Facility layout

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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: It is the flow of air over the blades and through the rotor area that makes a wind turbine function. 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 the 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: 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.

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.

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).

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. It is approximately 80 – 140 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. 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.

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*

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) is proposing to establish a wind energy facility and associated infrastructure on a site located approximately 22 km south-west of Pofadder in the Northern Cape Province (refer to Figure 1.1).

This facility forms part of a larger Renewable Energy Facility which also incorporates two other commercial wind energy facilities and one (1) solar energy facility and associated infrastructure. A broader area of approximately 175 km^2 is being considered within which the renewable energy facilities are to be constructed (refer to Figure 1.2). The proposed Renewable Energy Facilities are proposed on the following farms:

» Namies Suid Portion 1/212;
» Namies Suid Portion 2/212;
» Poortje Portion1/209; and
» Poortje RE/209

Four separate application forms were submitted to the DEA, and the following reference numbers were allocated:

» **14/12/16/3/3/2/681 (Poortjies wind energy facility)-** which is the subject of this report- the facility is located on Portion 1 of the farm Poortje 209 and the Remainder of the farm Poortje;
» 14/12/16/3/3/2/680 (Khai-Ma wind energy facility), the Khai-Ma Wind Energy Facility is located on the Portion 1 of the farm Poortje 209, the Remainder of the farm Poortje 209and Namies Suid 212 Portion 1;
» 14/12/16/3/3/2/682 (Korana wind energy facility)- the facility is located on Portion 1 and 2 of the farm Namies Suid 212 and Portion 1 of the Farm Poortje 209; and
» 14/12/16/3/3/2/683 (Korana solar energy facility) - the facility is located on Portion 2 of the farm Namies Suid 212.

The nature and extent of the proposed **Poortjies wind energy 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 Final Environmental Impact Assessment Report. Site specific environmental issues are considered within specialist studies in order to test the environmental suitability of the site for the proposed development, delineate areas of sensitivity within the site, and ultimately inform the placement of the wind turbines and associated infrastructure on the site.

This Environmental Impact Assessment Report consists of eleven sections:

» **Chapter 1** provides a project overview and an overview of the environmental impact assessment
» **Chapter 2** provides the project description, need and desirability, site selection information 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 Poortjies Wind Energy Facility
» **Chapter 4** provides the strategic context for energy planning in South Africa
» **Chapter 5** outlines the process which was followed during the Scoping and EIA Phase of the project, including the stakeholder consultation programme that was undertaken
» **Chapter 6** describes the existing biophysical and socio-economic environment affected by the proposed project
» **Chapter 7** describes the assessment of the identified environmental impacts associated with the proposed Poortjies Wind Energy Facility and recommended mitigation measures
» **Chapter 8** describes the assessment of cumulative impacts associated with the proposed Poortjies Wind Energy Facility and recommended mitigation measures
» **Chapter 9** presents the conclusions of the impact assessment, recommendations and impact statement
» **Chapter 10** contains a list references used in compiling the Final EIA report and specialist reports

1.1. Project Overview

The proposed project entails the development of the Poortjies Wind Energy Facility on a site near Pofadder. The site falls within the Khai-Ma Local Municipality in the Northern Cape Province. The purpose of the proposed wind energy facility will be to generate electricity to be fed into the National electricity grid. The Wind Energy Facility may be registered with the United Nation's Framework Convention for Climate Change as part of the Clean Development Mechanisms Programme. It may also be registered to form part of the various voluntary carbon credit trading schemes across the world.

The site for the Poortjies Wind Energy Facility was confirmed by Mainstream as being potentially suitable for wind energy generation through an internal site selection and feasibility study, and this area was identified for consideration within an EIA. The study area for the Poortjies Wind Energy Facility (~31.97 km^2 in extent) is proposed to be located on Portion 1 of the farm Poortje 209 and the Remainder of the farm Poortje (refer to Figure 1.1).

The Poortjies Wind Energy Facility site is proposed to accommodate the following infrastructure:

» 50 wind turbines (the number of turbines could however range from 35 to 94, this is on the assumption that each turbine will have a generating capacity ranging between 1.5 – 4MW).
» Foundations to support both the turbine towers;
» Cabling between the project components, to be lain underground where practical;
» A satellite 132 kV substation to facilitate grid connection;
» Internal access roads;
» Workshop area for maintenance and storage; and
» Permanent wind monitoring masts.

The capacity of the wind energy facilities will depend on the most suitable technologies selected by Mainstream, but each facility will be a maximum of 140MW.

The overarching objective for the wind energy facility 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 have not been assessed in detail through the site identification process, these issues are now being considered within site-specific studies and assessments through the EIA process in order to inform the placement of the wind turbines and associated infrastructure on the site.

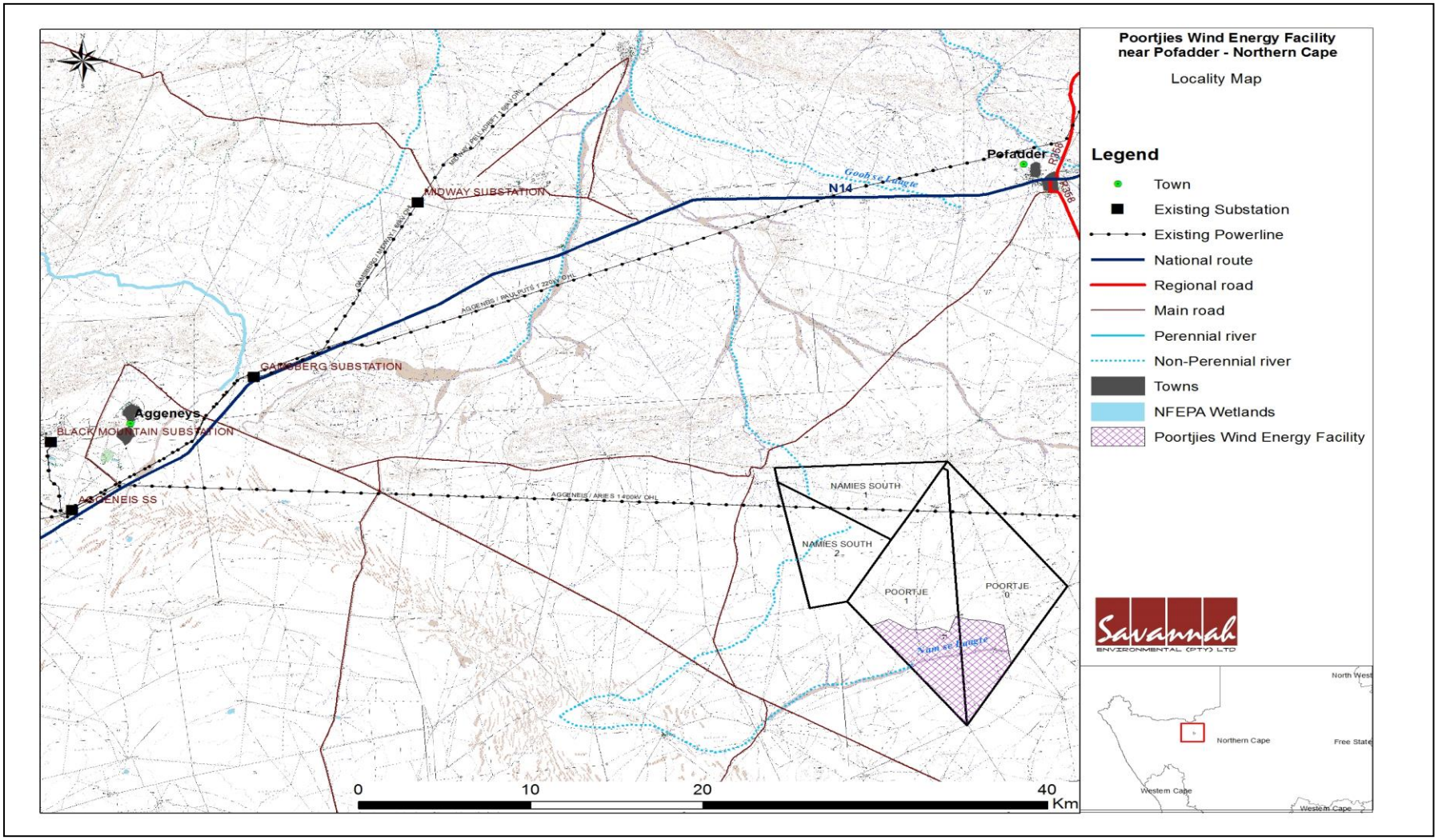


Figure 1.1: Locality map showing the farm portions and study area for the establishment of the Poorjies Wind Energy Facility near Pofadder, Northern Cape Province

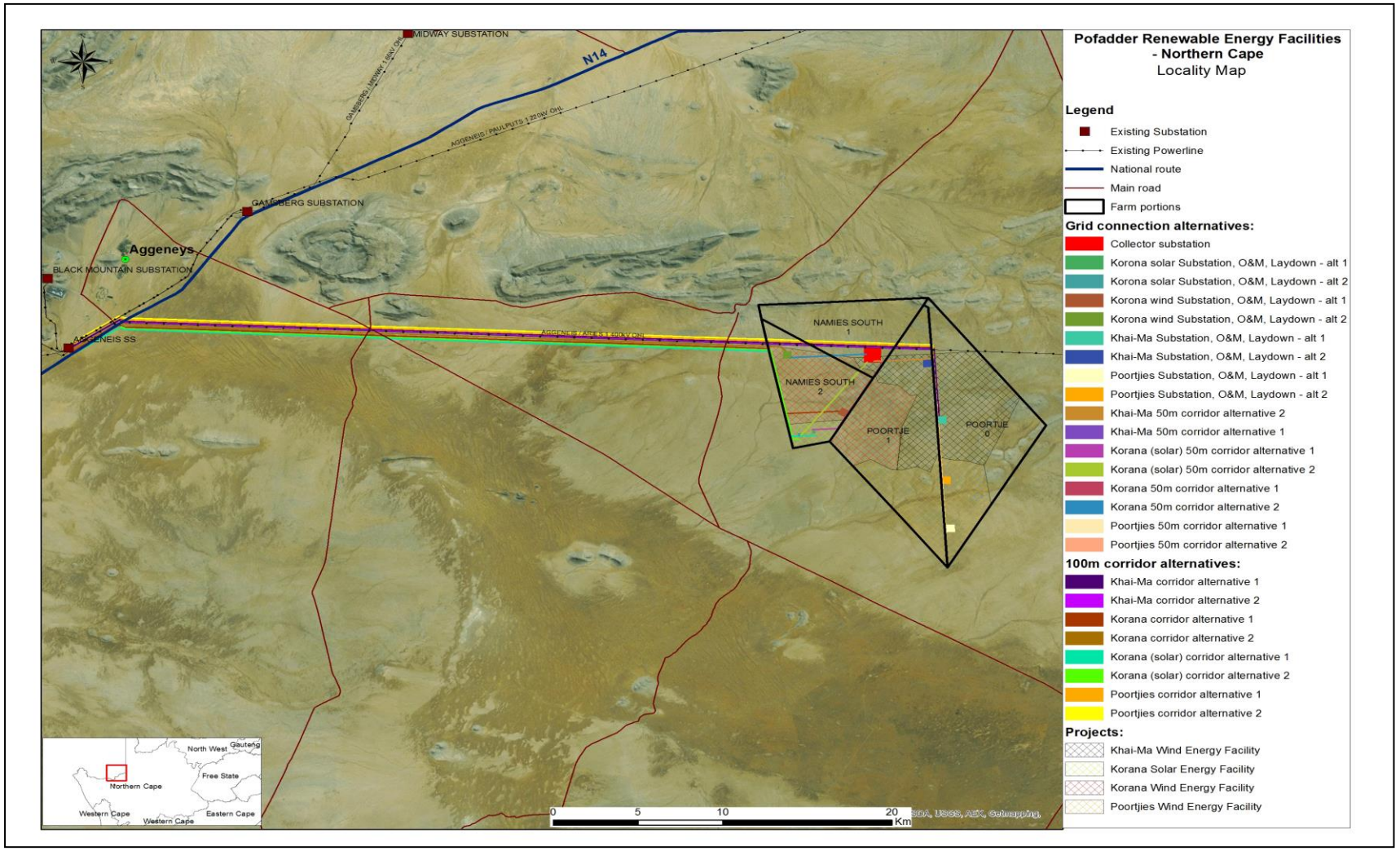


Figure 1.2: Locality map showing the farm portions and study area for the establishment of the Mainstream Renewable Energy Facility near Pofadder, Northern Cape Province (refer to Appendix x for an A3 map)

1.2. Requirement for an Environmental Impact Assessment Process

The proposed wind energy facility and associated infrastructure 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.

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 **14/12/16/3/3/2/681**.

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. Mainstream has appointed Savannah Environmental (Pty) Ltd as the independent environmental consultants 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).

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

The EIA Regulations, 2014, came into effect on the 8 of December 2014. As part of the transitional arrangements as contained in Chapter 8 of the 2014 EIA Regulations as promulgated on 4 December 2014 regarding pending applications with specific reference to Regulation 53(1) which reads as follows:

» 53. (1) An application submitted in terms of the previous NEMA regulations and which is pending when these Regulations take effect, including pending applications for auxiliary activities directly related to-
  * prospecting or exploration of a mineral or petroleum resource; or
  * extraction and primary processing of a mineral or petroleum resource,

must despite the repeal of those Regulations be dispensed with in terms of those previous NEMA regulations as if those previous NEMA regulations were not repealed.

1.3. Objectives of the EIA Process

The Scoping Report dated July 2014 was received by the DEA on 15 July 2014, and accepted by the DEA on 06 October 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) assesses 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 Final EIA Report provides stakeholders with an opportunity to review the information included in the Final 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 Mainstream 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 Mainstream. 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 8 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.
» *John von Mayer*- is a registered Professional Natural Scientist and holds an Honours BSc degree. He has 8 years' experience in the field of environmental consulting. He has extensive experience in the field of renewable energy and has worked on many large-scale EIAs for energy sector projects. He also has experience in auditing and compliance monitoring.
» *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 18 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.

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
Dave McDonald of Bergwind Botanical Surveys & Tours	Ecology
Chris van Rooyen of Chris van Rooyen Consulting	Avifauna
Werner Marias of Animalia Zoological & Ecological Consultation cc	Fauna
Lourens Du Plessis of MetroGIS	Visual impact
Tim Hart of ACO Associates	Heritage
Tony Barbour Environmental Consulting and Research	Socio-economic
Johann Lanz	Agricultural and soil impact
Morné de Jager of Enviro Acoustic Research cc	Noise
John E Almond of Natura Viva cc	Palaeontology
Jennifer Slack of Arcus Consultancy Services	12-month Bat monitoring
Brian Colloty of Scherman Colloty and Associates	Aquatic Assessment

Refer to Appendix A for the curricula vitae for the Savannah Environmental and specialist sub-consultants team.

PROJECT DESCRIPTION, NEED AND DESIRABILITY, SITE SELECTION PROCESS AND ALTERNATIVES CHAPTER 2

The project components and infrastructure presented in this chapter are aimed at enabling the reader to obtain an understanding of the scope of the proposed project, including the need and justification and alternatives considered.

2.1 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, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. This section of the report provides a summary of the findings from the review of relevant policies and guidelines at a national, provincial and local scale regarding the need for renewable energy and the Poortjies Wind Energy Facility, in particular.

2.1.1. Need for the Project at a National Level

Approximately 90% (NDP, 2011) of South African electricity comes from coal-fired power stations, with Eskom being the dominant electricity producing company generating 95% of all electricity in South Africa (SA Yearbook 2009/2010). The demand for electricity in South Africa has grown, on average, at more than 4% over the past few years, with a simultaneous reduction in the surplus generating capacity due to limited commissioning of new generation facilities. Although the electricity demand shows a slight negative trend over the recent past, the maximum demand, together with the greater need for maintenance of existing power plants, has put the available power supply under pressure. In spite of new capacity coming on line in the near future (as a result of the Medupi Power Station near Lephalale which still to be commissioning, and a number of renewable energy projects across the country), the electricity demand within the country is still higher than the available capacity.

The Integrated Resource Plan (IRP) 2010 developed by the Department of Energy projected that an additional capacity of up to 56 539MW of generation capacity will be required to support the country’s economic development and ensure adequate reserves over the next twenty years. The required expansion is more than two times the size of the existing capacity of the system. In order to meet this required

generation capacity, the IRP includes a mix of generation technologies, including a nuclear fleet of 9.6 GW; 6.3 GW of coal; 17.8 GW of renewables; and 8.9 GW of other generation sources.

The need to develop renewable energy developments has been identified by Mainstream in order to meet the requirements of the IRP 2010. In addition, the proposed project is considered desirable in terms of the planning and policy aims and needs of the Province and Municipality, as discussed in the sections which follow.

2.1.2. Need for the Project at a Provincial Level

The Northern Cape Province Spatial Development Framework (NCPSDF) makes reference to the need to ensure the availability of inexpensive energy. The Framework 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.

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. Of specific relevance to the proposed Poortjies wind energy facility, the NCPSDF notes that "Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020. 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 minimising detrimental environmental impacts". IN addition, the NCPSDF aims to "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)."

There is therefore a need for the development of the proposed wind facility at a Provincial Level, and the proposed project will contribute towards the objectives of the Northern Cape SDF.

2.1.3. Need for the Project at a Local Level

The proposed site falls within the Khai-Ma Local Municipality. The Khai-Ma 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 wind projects can contribute indirectly to the Khai-Ma Local Municipality's Integrated Development Plans (IDPs).

The Khai-Ma Local Municipality's Integrated Development Plans (IDPs) also identifies key priorities and their associated objectives and strategies. The targets that are relevant to the proposed Poortjies Wind energy facility include:

- Socio-economic needs, specifically, improve the income levels for the population within the municipality, reduce unemployment from 39% to below 20%, introduce capacity and skills building programs, introduce awareness campaigns around issues relating to healthcare (HIV/AIDS), water and the environment, improve safety and security to vulnerable and marginalized communities.
- Infrastructure development;
- Economic development (including electricity and roads), specifically, provide support for capacity and skills development.

The Poortjies 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.

2.1.4 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. A Fatal Flaw analysis for four potential wind energy sites was conducted by Aurecon, on behalf of Mainstream 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 climate (high wind speeds), environmental suitability, suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical point of view.

Mainstream considers this development site to be highly preferred for wind energy facility development. Monitored wind speeds at the site and in the larger Pofadder 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 higher wind speeds. Average wind speeds are high enough which, combined with suitable wind conditions, will enable a competitive bid into the DoE's REIPPP process in order to deliver cheaper electricity to the grid than new build coal. Wind monitoring has been undertaken using a met mast in order to confirm the wind resource on the site, and ultimately inform the layout of the facility well as the turbine selection process. In terms of the energy yield predicted for the facility calculated from more than 12 months monitored wind data, the developer considers the Poortjies Wind Energy Facility to be financially viable.

Receptiveness of the Site to Wind Farm Development:

Mainstream considers this area, and specifically the demarcated site Portion 1 of the Farm Poortjie 209 and the remainder of the Farm Poortjies 209, to be highly preferred for the development of a wind energy facility. The reasons include:

» Extent of site: Availability of land of sufficient area can be a restraining factor for development of a wind energy facility. The proposed site is approximately 41.17 km^2 in extent which is sufficient for the construction of the facility allowing for avoidance of site sensitivities.
» Power transmission considerations: The Poortjies Wind Energy Facility could be easily connected to the electricity grid via a) the proposed Khai-Ma Collector Substation or alternatively to the existing Aggeneys Substation.
» Site access: the site can be readily accessed off the N14 (from Springbok to the Namies site) via existing gravel roads.
» Loss of current land use: The current land use on the site is livestock farming. The development of the Poortjies Wind Energy Facility will allow current livestock grazing to continue on areas of the farm portions which will not be occupied by wind turbines and associated infrastructure. Therefore the current land-use will be retained on much of the site, while the remainder will be utilised to generate renewable energy. As the landowner will benefit from a portion of the revenue from the facility, the development of the project provides an alternative source of income, contributing towards the sustainability of the current farming operations. This presents a win-win situation for the landowner, the economical use of the site, and the developer.

» 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 proposed project is located in an area of high wind speeds – see section above.
» Topographic conditions: The general topography of the area is flat with a gentle slope of 10% and is potentially suitable for the development of a wind facility, considering the average wind speed measured in the area.

Social considerations: The development of the project would benefit the local, regional and national community by developing a renewable energy project. Surrounding communities would also benefit from the development through job creation and economic 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 be fed 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 Project and Site Description

The proposed project entails the development of the Poortjies Wind Energy Facility on a site near Pofadder. The site falls within the Khai-Ma Local Municipality in the Northern Cape Province. The purpose of the proposed wind energy facility will be to generate electricity to be fed into the National electricity grid.

Table 2.1 below provides details of the proposed project, including the main infrastructure and services. Refer also to the preliminary layout included in (refer to Appendix O for an A3 map).

Table 2.1: Details of the proposed project

Component	Description/ Dimensions
Location of the site	Portion 1 of the farm Poortje 209 and the Remainder of the farm Poortje.
Municipal Jurisdiction	Khai-Ma Local Municipality
SG Codes	C03600000000020900001 C03600000000020900000
Electricity Generating capacity	100MW
Details of turbines	» Up to 50 wind turbines with a generating capacity of up to 4 MW each » Hub height of up to 140m » Rotor diameter of up to 150m

Component	Description/ Dimensions
Extent of site	3197 ha
Internal access	Gravel roads of 32km in length
Site access	Either via Access Alternative 1 (northern road) or Access Alternative 2 (via the south)
Grid connection[7]	» A 132 kV overhead power line connecting the proposed Poortjies Wind Energy Facility to the proposed Khai-Ma Collector Substation or alternatively to the existing 400kV Aggeneys Substation. » Collector substation also required as part of larger facility. The collector substation is proposed on farm portions assessed as part of the Khai-Ma Wind Energy Facility and is not assessed here.
Services required	» 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. .
Temporary infrastructure required during the construction phase	» Construction camps; » Construction yard and offices; » Laydown area and storage areas; and » Temporary access roads.

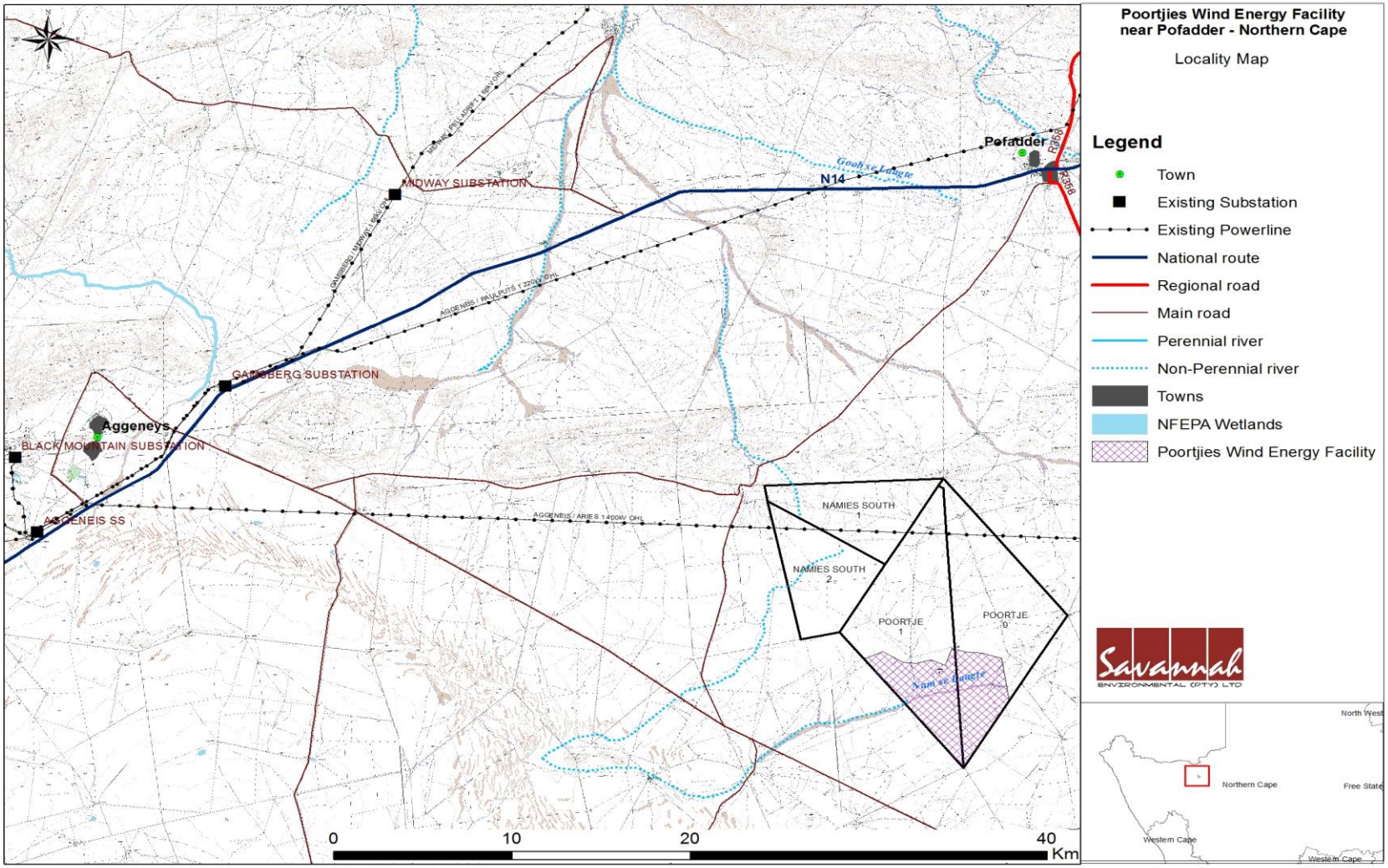


Figure 2.1: Locality map showing the study area for the establishment of the Poortjies Wind Energy Facility in the Northern Cape Province (refer to Appendix O for A 3 Map)

2.3 Site Selection and Pre-Feasibility Analysis

The location of a wind energy facility is highly dependent on technical factors – specifically the available wind resource, site access and the terrain. The technical considerations must, therefore, be weighed against other considerations (including environmental considerations) in the determination of a feasible site for the establishment of a commercially viable wind energy facility. Aurecon undertook an internal site feasibility assessment for various sites identified within the country in order to determine a suitable site for further investigation. A summary of the outcome of this study are presented below.

Alternative site feasibility assessment

Four alternative sites were subjected to a preliminary investigation to identify the environmental suitability of the site (Refer to Figure 2.2), namely:

» The Springbok site
» Kangnas site;
» Pofadder site; and
» Cederberg site.

The Springbok Site: According to the Namakwa District Biodiversity Sector Plan (2008) as well as recent discussions with the Goegap Nature Reserves managers, the nature reserve is planning an extending its borders in an easterly direction, and will include the Kaip Farm (1/130, 3/130 and RE/130). The World Wildlife Fund has initiated negotiations with some of the land owners. The World Wildlife Fund is in the process of developing a position statement on renewable energy initiatives on World Wildlife Fund (WWF) land that will provide a more formalised opinion on the matter. It was also noted that development on old agricultural land and/ or disturbed sites would be preferred by the World Wildlife Fund. It was also confirmed that the reserve's tourism facilities near the border of Kaip are being expanded and the reserve would not support any development that could potentially have a negative impact on the aesthetic value and sense of place of the reserve. This statement is also confirmed in the Namakwa District Sector Plan which notes the important contribution of scenic value on the tourism industry and sense of place. A **high sensitivity** rating was therefore allocated to this site.

The Kangnas Site: It was confirmed by Ms Jonk and Ms Wilson that Portion 3 and the Remainder of Kangnas (Farm 77) was been identified as land that could be formally protected. However at this stage no further action has been taken to

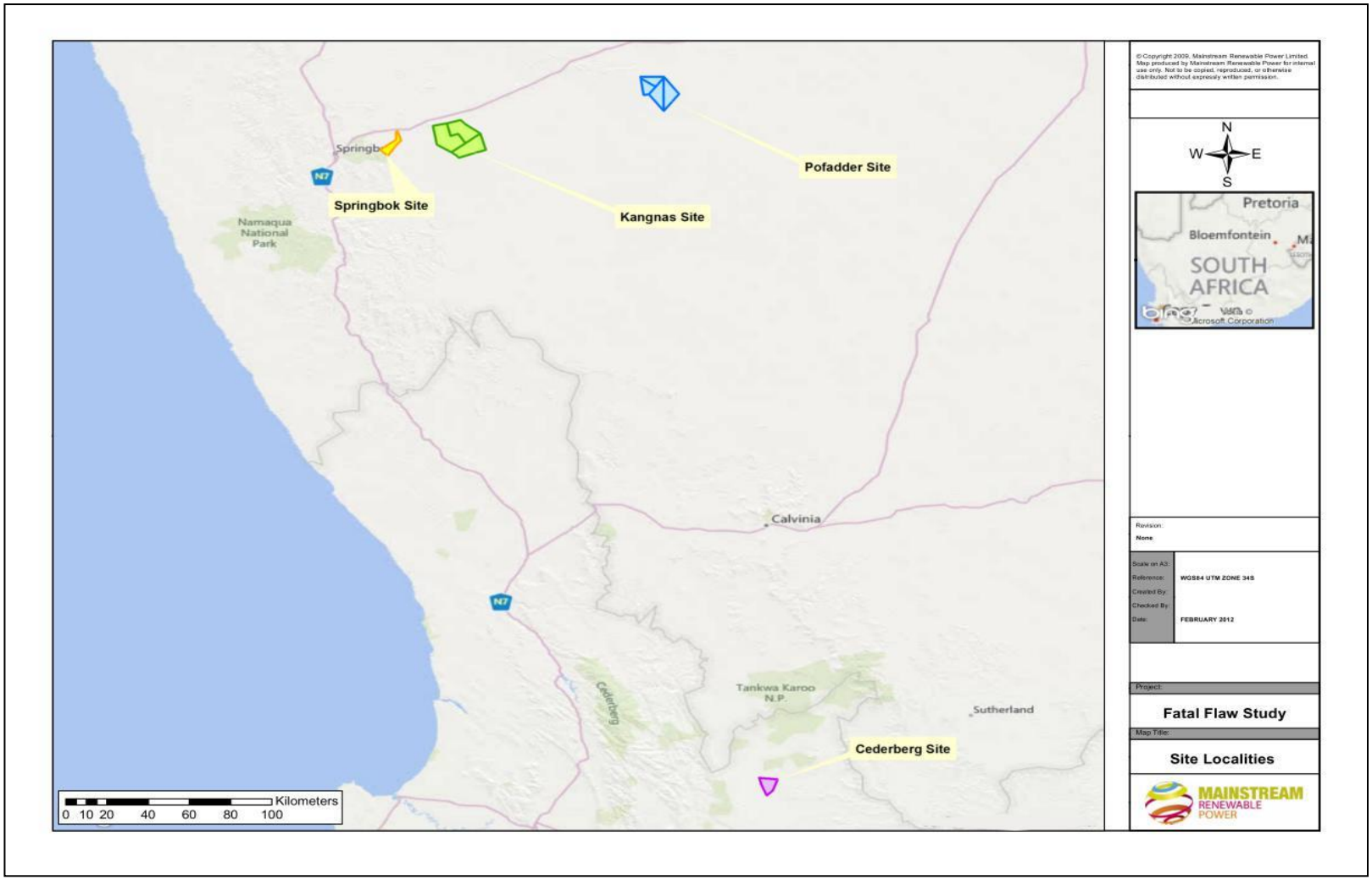


Figure 2.2: Map indicating the four alternative sites that were subjected to a preliminary investigation to identify the environmental suitability of the site

secure these properties by conservation authorities. A **medium sensitivity** was allocated due to the site being identified as a priority area for conservation.

The Pofadder Site (referring to the Farms Poortjies (1/209 and RE/209) and Namies Suid (1/212 and 2/212): No planning related constraints were identified for the site, and therefore a **low sensitivity** rating was allocated.

The Cederberg Site: the site is situated in an area that is predominantly identified as a Critical Biodiversity Area and includes an IBA and numerous protected areas. This area can therefore be considered to be **high sensitivity** in terms of planning and would require careful planning and placement of wind turbines.

Summary of key issues and site rankings

A basic ranking system was used to provide a comparison between the four sites in terms of the findings of the site sensitivities identified by the Fatal Flaw Analysis. It should be noted that the Fatal Flaw Analysis was constrained in the following ways:

» It did not consider any differences in size of potential wind energy facilities under consideration;
» It considered the entire site and not only the buildable areas provided; and
» It did not take into consideration potential mitigation measures that could potentially be implemented to reduce the significance of potential impacts.

A score, as per Table 2.2 below, was assigned to each site for each of the criteria indicated in Table 2.3. Each criterion was considered to have the same weighting.

Table 2.2: Scores assigned to criteria to indicate the various levels of site sensitivity

Site sensitivity rating	Score
Low	1
Medium	2
High	3
Fatal Flow	4

Note: A high score reflects the unsuitability of the site in terms of its sensitivity, whereas a low score indicates that the site is less sensitive and thus more suitable for a wind energy facility.

Table 2.3: The results and a summary of the sensitivity ratings of the various features considered in the FFA are provided in Table 2.2.

Site	Sensitivity rating of key environmental, social and economic features								
	Flora	**Fauna**	**Avifauna**	**Freshwater ecology**	**Heritage**	**Visual landscape**	**Agriculture potential**	**Planning**	**Total Score**
Springbok	Medium (2)	Medium (2)	Medium-high (3)	High (3)	Medium (2)	High (3)	Low (1)	High (3)	**19**
Kangnas	Low (1)	Low (1)	High (3)	Medium (2)	High (3)	High (3)	Low (1)	Medium (2)	**16**
Pofadder	Low (1)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	Low (1)	Low (1)	Low (1)	**12**
Cederberg	Low (1)	High (3)	Medium-High (3)	Medium (2)	High (3)	High (3)	Low (1)	High (3)	**19**

It was concluded from the preliminary assessment conducted that no fatal flaws were identified for the proposed wind energy facilities in the Northern and Western Cape. The Cederberg and Springbok sites appear to be most sensitive, followed by the Kangnas and Pofadder (referring to the Farms Poortje (1/209 and RE/209) and Namies Suid (1/212 and 2/212)).

2.4 Project Alternatives

2.4.1 Activity Alternatives

No activity alternatives were assessed since the site has been identified by Mainstream as being highly desirable for the establishment of a wind energy generating facility. It should also be taken into consideration that the solar energy facility is considered as part of the larger Mainstream Renewable Energy Facility. Therefore, a wind facility is considered by Mainstream to be the only feasible and reasonable activity for consideration on the proposed site.

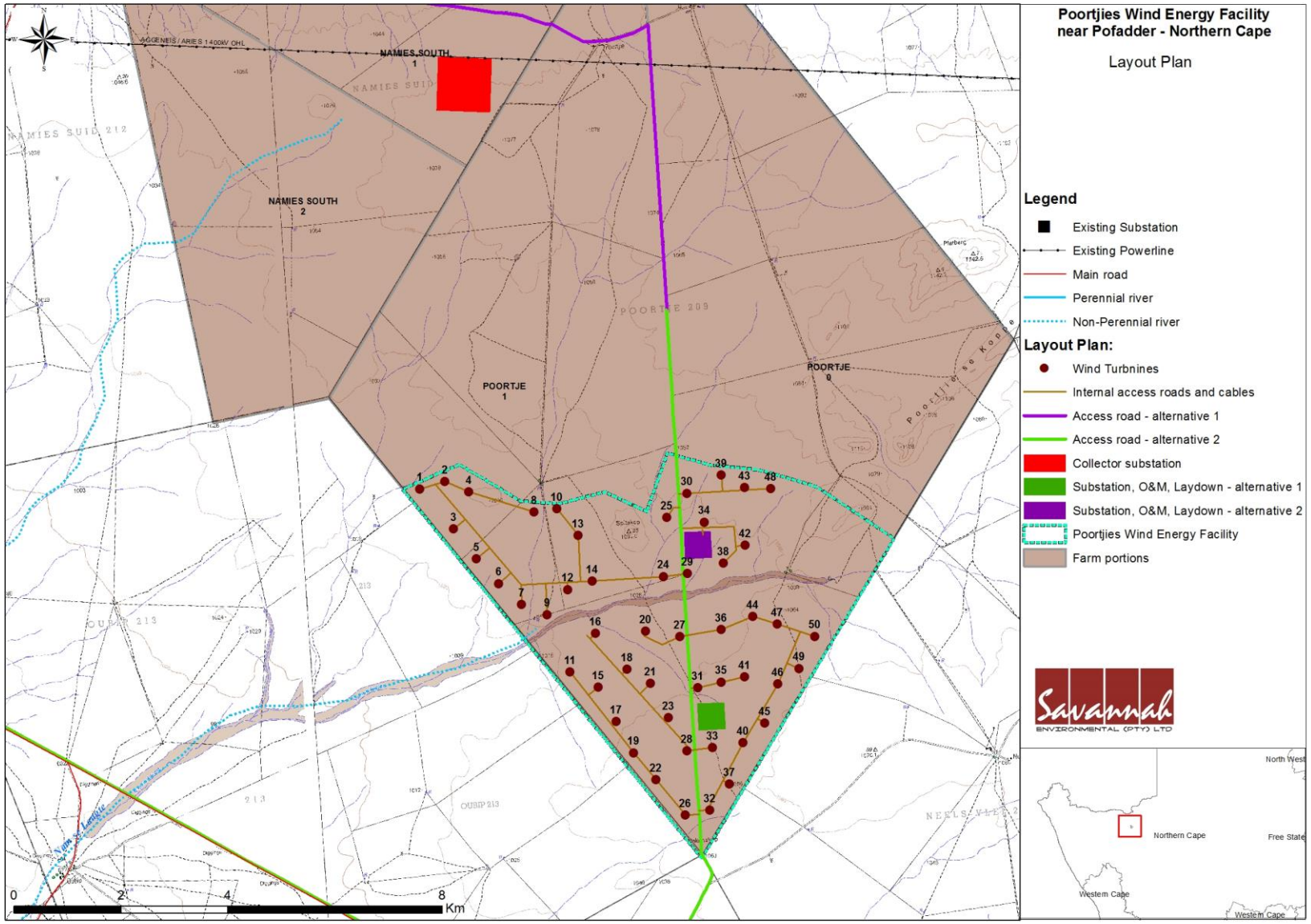
2.4.2 Site-specific or Layout Design Alternatives

A preliminary wind turbine layout has been compiled to effectively 'design' the wind energy facility. Through the process of determining constraining factors and environmentally sensitive areas during the scoping phase, the layout of the wind turbines and infrastructure has been developed by Mainstream, (as shown in **Figure 2.3**). This layout is considered to be highly accurate (80%) but still allows for some adjustment to avoid site-specific environmental and technical constraints, 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 provided by the developer has informed the specialist impact assessments in this EIA phase. The planning process also included the positioning of other ancillary infrastructure, including internal substation site.

Substation Site Alternatives:

Two alternative locations are proposed for the construction of the 132kV Substation, Operations and Maintenance buildings and location of the laydown areas are considered in this report. The alternative infrastructure sites are located as follows (refer to Figure 2.3):

» Alternative 1 is located in the south of the project area (29° 26'15.68"S and 19° 19'32.21"E)- **Preferred Alternative**.
» Alternative 2 is located in the north of the project area (29° 24'30.71"S and 19° 19'31.26 E)



F ce

Province

Access Road Alternatives

There are two main access roads proposed. Both access roads are currently unsurfaced (gravel roads) which will require regular maintenance of the surface during construction (refer to Figure 2.4 and Figure 2.5).

» **Alternative 1- Namies Suid North** - this Access Alternative is an existing gravel road which is approximately 49.5km long with an average width of ~7.5m. For the Namies Suid North access adjustments to the width and vertical alignment will have to be undertaken before safe abnormal load access can be guaranteed. There are also sections through the proposed land parcels of the proposed that may require widening to accommodate abnormal load access. Approximately 5.3km of new road will have to be constructed within the site.

» **Alternative 2- Poortjies South (Preferred route alternative) -** The Poortjies South access road is an existing gravel road that is approximately 63km long with an average width of ~ 10m. This access road is longer but has a more suitable vertical and horizontal alignment for abnormal load access. There is only one corner that may require horizontal re-alignment within the current road reserve.

2.4.3 Technology alternatives

This refers to alternative technologies for use in the establishment of the wind facility. There is a limited range of alternative technologies (turbines) for commercial-scale wind energy facilities. In addition, the technology is constantly evolving. Table 2.3 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.

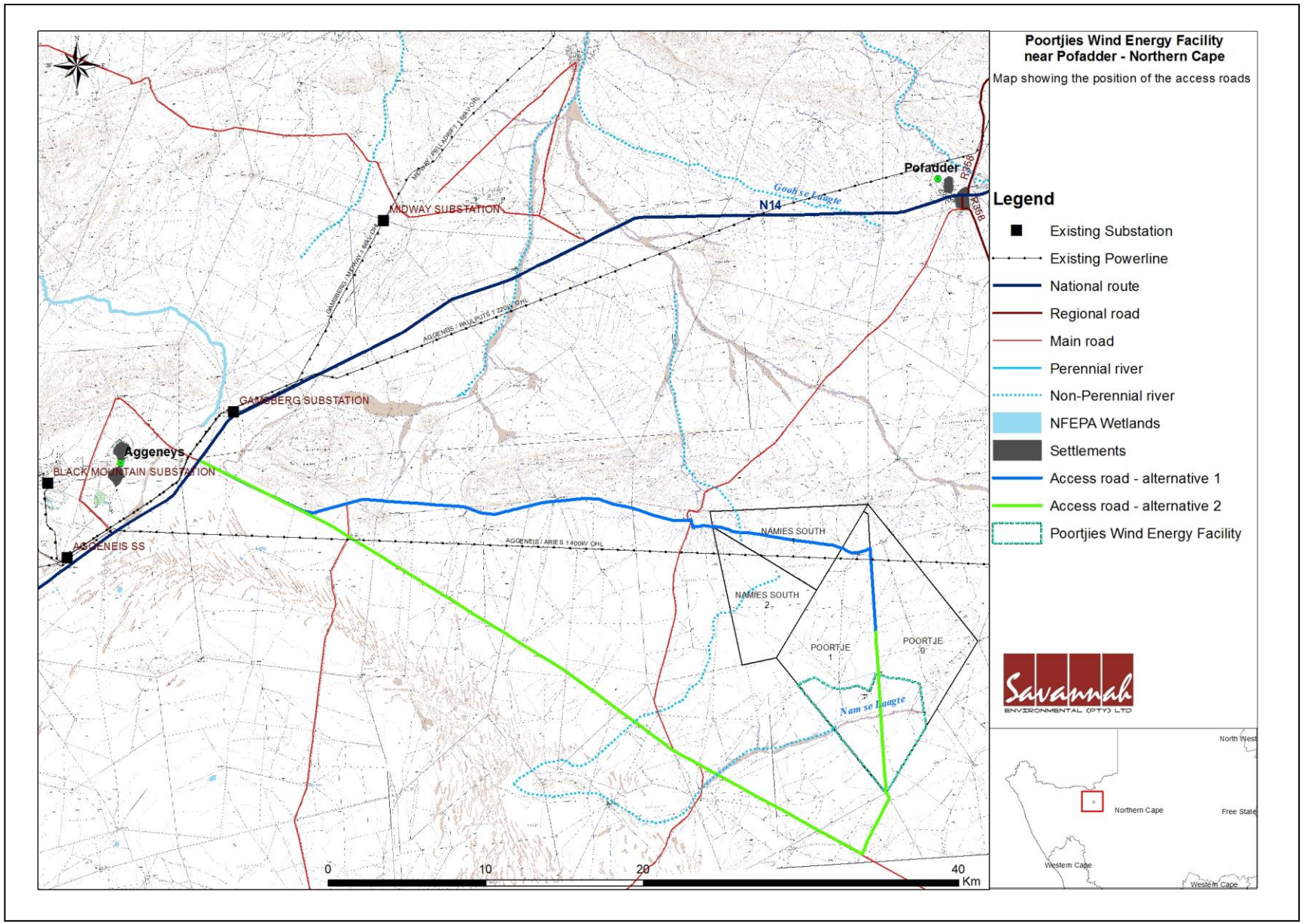


Figure 2.4 Layout of the alternative access roads to the Poortjies Wind Energy Facility (refer to Appendix O for A 3 Map)

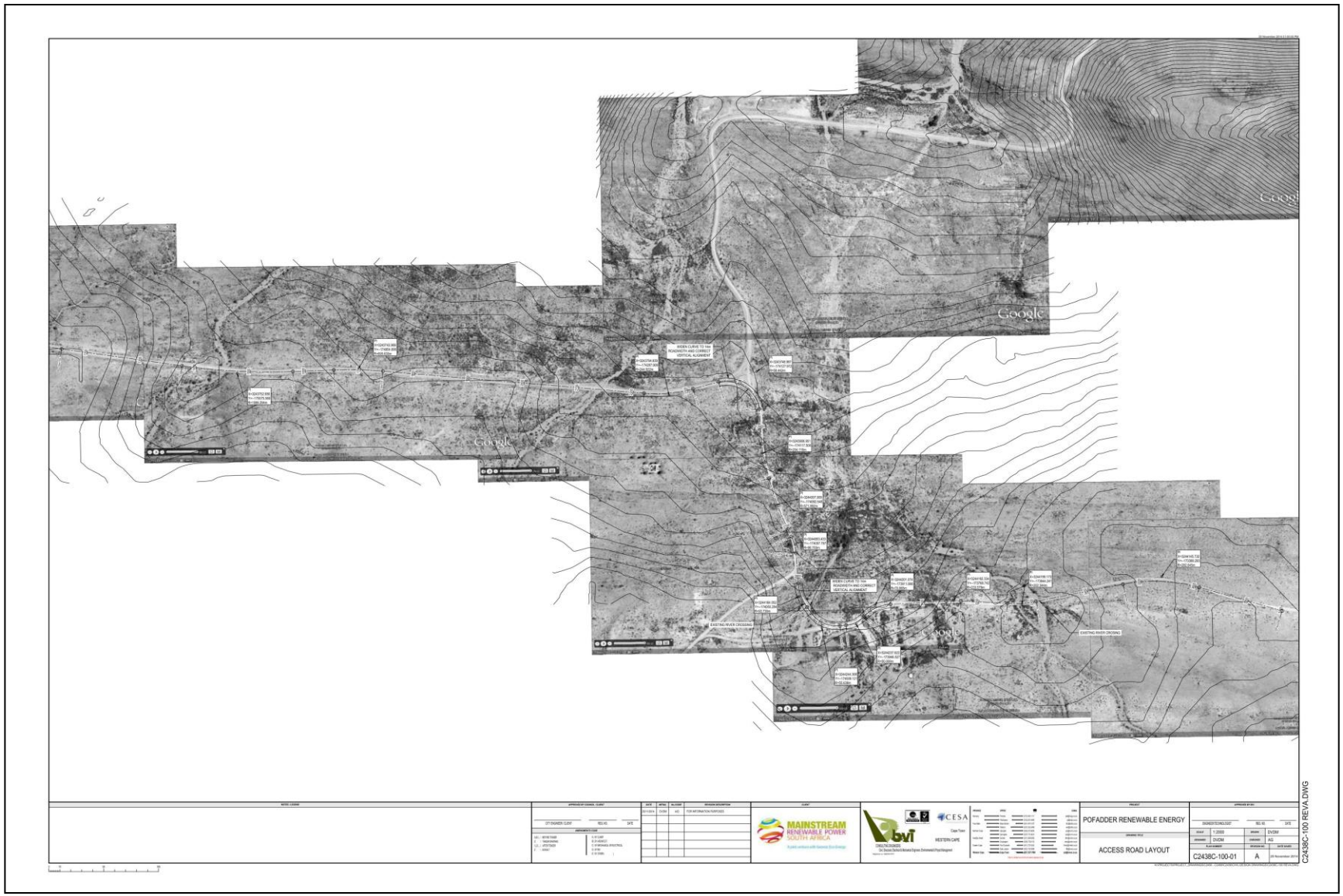


Figure 2.5: Map illustrating the road alignment to the broader Pofadder Renewable Energy Facility (refer to Appendix O for A3 Map)

Table 2.3: 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 4MW 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 120 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.

Compared with other renewable energy sources such as solar and bio-energy, wind turbines generate the highest energy yield while affecting the smallest physical land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be directly used for mechanical needs (e.g. milling or water pumping) or converted to electric power in a generator (i.e. a wind turbine).

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its life cycle. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of low carbon generating technologies technologies) as it meets all international requirements in this regard.

Environmental pollution and the emission of CO_2 from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for ~70% of greenhouse gas emissions worldwide. The climate change challenge needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions and approaches are being developed to reduce emissions. However, it is important to acknowledge that the most cost-effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially and economically sustainable future. The challenge now is ensuring wind energy projects are able to meet all economic, social and environmental sustainability criteria.

3.1 The Importance of the Wind Resource for Energy Generation

The importance of using the wind resource for energy generation has the attractive attribute that the fuel is free. The economics of a wind energy project crucially depend on the wind resource at the site. Detailed and reliable information about the speed, strength, direction, and frequency of the wind resource is vital when considering the installation of a wind energy facility, as the wind resource is a critical factor to the success of the installation.

» **Wind speed** is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. The doubling of wind speed increases the wind power by a factor of 8, so even small changes in wind

speed can produce large changes in the economic performance of a wind farm. Wind turbines can start generating at wind speeds of between ~3 m/s to 4 m/s, with wind speeds greater than 6 m/s currently required for a wind energy facility to be economically viable. Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to the topography. Elevation in the topography influences the flow of air, and results in turbulence within the air stream, and this has to be considered in the placement of turbines.

» **Wind power** is a measure of the energy available in the wind.

» **Wind direction** is reported by the direction from which it originates. Wind direction at a site is important to understand, but it is not typically critical in site selection as wind turbine blades automatically turn to face into the predominant wind direction at any point in time.

A wind resource measurement and analysis programme is being conducted for the site proposed for development, as only measured data will provide a robust prediction of the facilities expected energy production over its lifetime.

The placement of the individual turbines within a wind energy facility must consider the following technical factors:

» Predominant wind direction, wind strength and frequency.
» Topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow).
» Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately 3 to 5 times the rotor diameter apart in order to minimise the induced wake effect the turbines might have on each other. Once a viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria) the spacing requirements will be considered through the process of micro-siting the turbines on the site.

3.2 What is a Wind Turbine and How Does It Work

The kinetic energy of wind is used to turn a wind turbine to generate electricity. A wind turbine typically consists of three rotor blades and a nacelle mounted at the top of a tapered tower. The mechanical power generated by the rotation of

the blades is transmitted to the generator within the nacelle via a gearbox and drive train.

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed Poortjies Wind Farm in the Northern Cape will have a hub height of up to 140 m, and rotor diameter of 140 m. These turbines would be capable of generating in the order of up to 4 MW each (in optimal wind conditions).

3.2.1. Main Components of a Wind Turbine

The turbine consists of the following major components:

» The foundation
» The tower
» The rotor
» The nacelle

The foundation
The foundation is used to secure each wind turbine to the ground. These structures are commonly made of reinforced concrete and are designed to withstand the vertical loads (weight) and lateral loads (wind).

The tower
The tower is a hollow structure allowing access to the nacelle (between 80m and 150m in height). The height of the tower is a key factor in determining the amount of electricity a turbine can generate. Small transformers may occur outside each turbine tower, depending on what make and model of turbine is deemed most suitable for the site. Such a transformer would have its own foundation and housing around it. Alternatively, the transformer could be housed within the tower. The transformers convert the electricity to the correct voltage for transmission into the national energy grid.

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 can reach the stronger winds at higher elevations. 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.

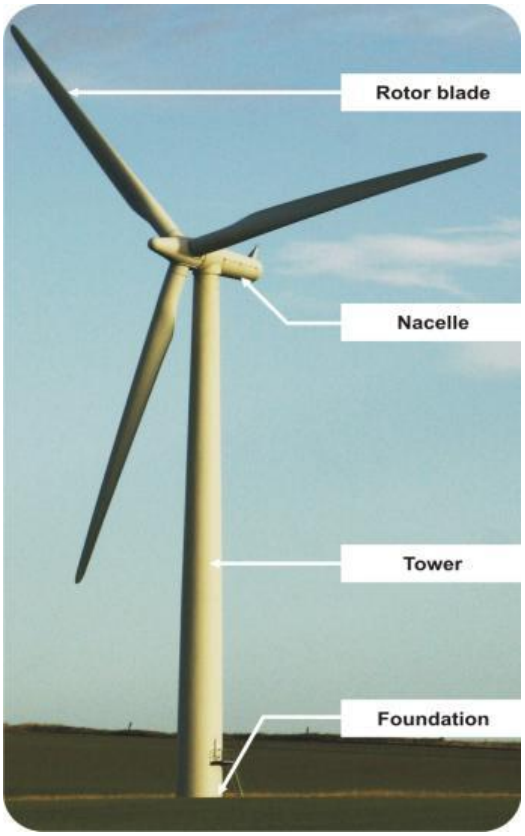


Figure 3.1: Illustration of the main components of a wind turbine

The rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor comprises of three rotor blades (the approximate rotor diameter is in the range of up to 150m, and the length of blade is between 75m – 150m long). The rotor blades use the latest advances in aeronautical engineering materials science to maximise efficiency. The greater the number of turns of the rotor the more electricity is produced. 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). The speed of rotation of the blades is controlled by turning the blades to face into the wind ('yaw control'), and changing the angle of the blades ('pitch control') to make the most use of the available wind.

The rotor blades function in a similar way to the wing of an aircraft, utilising the principles of **lift** (Bernoulli). When air flows past the blade, a wind speed and pressure differential is created between the upper and lower blade surfaces. The pressure at the lower surface is greater and thus acts to "lift" the blade. When blades are attached to a central axis, like a wind turbine rotor, the lift is

translated into rotational motion. Lift-powered wind turbines are well suited for electricity generation.

The rotation of the rotor blades produces a characteristic 'swishing' sound as the blades pass in front of the tower roughly once a second. The other moving parts, the gearbox and generator, cannot be heard unless the observer is physically inside the turbine tower.

The nacelle (geared)

The nacelle at the top of the tower accommodates the gears, the generator, anemometer for monitoring the wind speed and direction, cooling and electronic control devices, and yaw mechanism. Geared nacelles generally have a longer form/ structure than gearless turbines.

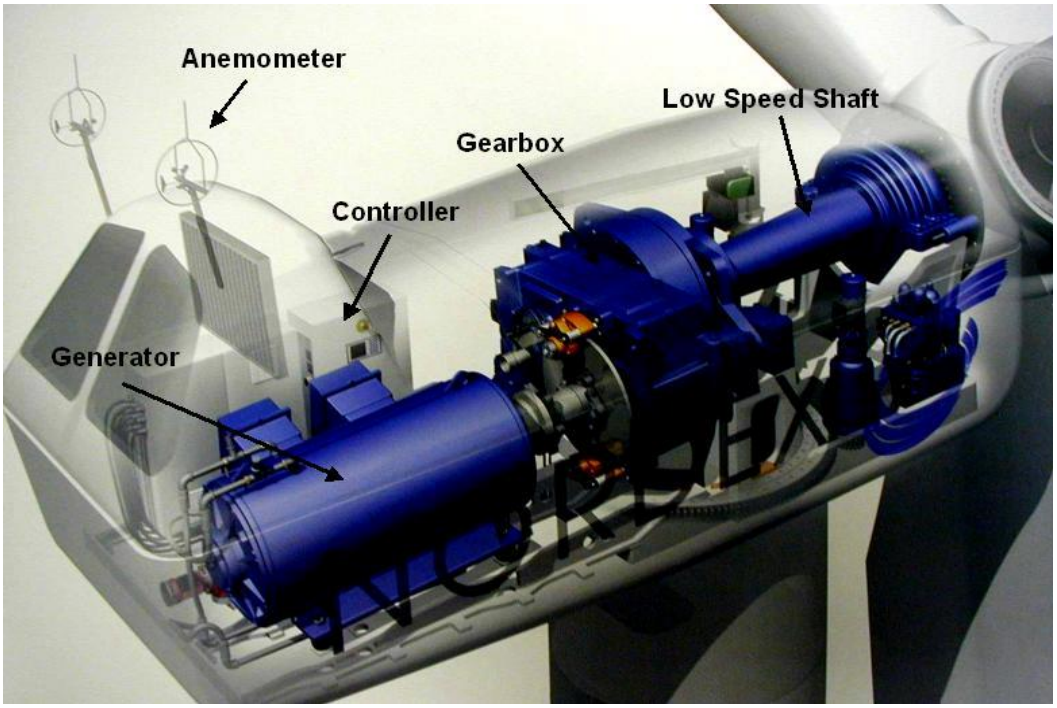


Figure 3.2: Illustration of the main components of a turbine with gears and without gears

3.2.2. Operating Characteristics of a Wind Turbine

A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a Wind Energy Facility can be monitored and controlled remotely, with a mobile team for maintenance, when required.

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 10 and 15 km/hr (~3 m/s and 4 m/s).

At very high wind speeds, typically over 90 km/hr (25 m/s), the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the **cut-out speed**. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

It is the flow of air over the blades and through the rotor area that makes a wind turbine function. 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 the Betz Limit.

However, because the energy in the air is free, describing how efficiently the energy is converted is only useful for system improvement and monitoring purposes. A more useful measurement is the Capacity Factor which is also represented as a percentage. The Capacity Factor percentage is calculated from the actual MWh output of electricity from the entire wind farm over 1 year divided by the nameplate maximum theoretical output for the same period. It therefore also takes wind resource, wind variability and system availability (downtime, maintenance and breakdowns) into account. This figure will be predicted more accurately when more on-site wind data has been recorded.

Wind turbines can be used as stand-alone applications, or they can be connected to a utility power grid. For utility-scale sources of wind energy, a large number of wind turbines are usually built close together to form a **wind energy facility.**

3.3 Project Construction Phase

The construction phase for the Poortjies Wind Energy Facility is anticipated to take between 18 - 24 months. In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. There is likely to be more than one crew operating on the site at any one time during construction, dependant on the phase of construction. Construction crews will constitute unskilled but primarily skilled and semi-skilled workers. No contractors (other than security personnel) will reside on the site at any time during the construction or operational phases.

3.3.1 Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, geotechnical survey, site survey and confirmation of the turbine micro-siting footprint, survey of on-site-substation site/s and survey of power line servitude/s to determine tower locations.

3.3.2 Establishment of Access Roads to the Site

The broader site can be accessed using the N14 via two alternative access roads, namely Namies Suid North and Poortjies South. Access/haul roads to the site as well as internal access roads within the site are required to be established prior to the commencement of construction. As far as possible, existing access roads would be utilised, and upgraded where required. Within the site itself, access will be required between the turbines for construction purposes (and later limited access for maintenance). Special haul roads of up to 8m in width may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines.

These access roads will have to be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and for maintenance purposes. It is proposed that in preparing the access road, a portion of it (up to 8m in width, abnormal trucks will need between 10-12m for sharp corners) will be constructed as a permanent access road and the remainder as a temporary access road that can be de-compacted and returned to its pre-construction condition through rehabilitation.

3.3.3 Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each turbine, the establishment of internal access roads (as discussed in Section 3.3.2 above) and excavations for foundations (refer to Section 3.3.4 below). These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site.

Site preparation will be undertaken in a systematic manner to reduce the risk of the open ground to erosion. In addition, site preparation will include search and rescue of floral species of concern (where required), as well as identification and excavation of any sites of cultural/heritage value (where required).

3.3.4 Construct Foundation

Concrete foundations will be constructed at each turbine location. The dimension of a turbine foundation is approximately 400m^2. Foundation holes will be

mechanically excavated to a depth of approximately 4 m, depending on the local geology. Concrete may to be brought to site as ready-mix or batched on site if no suitable concrete suppliers are available in the vicinity. The reinforced concrete foundation will be poured and will support a mounting ring. The foundation will then be left up to a week to cure.

Figure 3.2: Photograph illustrating the construction of the foundation for a wind turbine (photo sourced from www.blm.gov)

Figure 3.3: Photograph illustrating a completed foundation for a wind turbine (photo sourced from www.blm.gov)

3.3.5 Transport of Components and Equipment to Site

The wind turbine, including the tower, will be brought to the site by the turbine supplier in sections on flatbed trucks. Turbine units which must be transported to site consist of: the tower (in segments), hub, nacelle, and three rotor blades. The individual components are defined as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989)[8] by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). In addition, components of various specialised construction and lifting equipment are required on site to erect the wind turbines and need to be transported to site. In addition to the specialised lifting equipment/cranes, the normal civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, site offices etc.).

The components required for the establishment of the substation/s (including transformers) as well as the associated infrastructures will also be transported to site as required.

The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (e.g. widening on corners), accommodation of street furniture (e.g. street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (i.e. bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading.

A Preliminary Traffic Management investigation showed (refer to Appendix O of the EMPR) that it will be possible to transport the imported wind turbine and solar array components by road to Namies. The proposed route will include the following sections of road:

- R399 (Saldanha Town to Piketberg) - Approximately 98km.
- N7 (Piketberg to Vredendal) - Approximately 151 km.
- R363 (Vredendal to N7) - Approximately 100km.
- N7 to Springbok - Approximately 200km.
- N14 (Springbok to Namies Site) – Approximately 142km

3.3.6 Establishment of Laydown Areas on Site

[8] A permit will be required for the transportation of these abnormal loads on public roads.

Laydown areas, including crane hardstand areas, will need to be established at each turbine position for the storage and assembly of wind turbine components (an area approximately 150m X 450m = 67500m^2). The laydown area will need to accommodate the cranes required in tower/turbine assembly. Laydown and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site.

In addition a number of construction compound areas will need to be established around the site. These will be temporary structures for site offices, storage and safe refuelling areas.

Figure 3.6: Photograph illustrating the laydown areas required during the erection of a turbine (photo courtesy of Eskom)

3.3.7 Construction of Turbines

A large lifting crane and an assisting small crane will be brought onto site (refer to Figure 3.6 above), these will be used to lift the various turbine components. These two cranes will lift the tower sections into place, before the nacelle, which contains the gearbox, generator and yawing mechanism, are placed on the top of

the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground which will then be lifted to the nacelle and bolted into place.

3.3.8 Construction of Substation/s

One or more on-site substations and a 400kV Collector Substation (referred to as the Khai-Ma Collector Substation) will be constructed within the site. The turbines will be connected to the substation via underground cabling wherever possible. The position of the substation/s will be informed by the final micro-siting/positioning of the wind turbines. The layout of the turbines will determine the optimum position for the construction of a substation.

The construction of the substation would require a survey of the site; site clearing and levelling and construction of access road/s to the substation site (where required); construction of substation terrace and foundations; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

3.3.9 Establishment of Ancillary Infrastructure

A workshop as well as a contractor's equipment camp will also be required to be constructed. Temporary storage areas and a construction compound (sizes and numbers to be confirmed later in process) will also be established. Service building(s) (number, size and location to be confirmed later in process) are also required.

The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

3.3.10 Connection of Wind Turbines to the Substation

Each wind turbine will be connected to an optimally positioned on-site substation by underground electrical cables wherever possible. The installation of these cables will require the excavation of trenches, approximately 1-2 m in depth within which these cables can then be laid. The underground cables will be planned to follow the internal access roads, where possible.

3.3.11 Commissioning

Prior to the start-up of a wind turbine, a series of checks and tests will be carried out. This will include both static and dynamic tests to make sure the turbine is working within appropriate limits. Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades. The schedule for this activity will be subject to site and weather conditions.

3.3.12 Undertaking of Site Rehabilitation

As construction is completed in an area, and as all construction equipment is removed from the site, the site will be rehabilitated where practical and reasonable. On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

3.4 Project Operation Phase

It is not known at this stage exactly how many people will be responsible for monitoring and maintenance of the facility. It is anticipated that there could be security and maintenance staff required on site, though this will be evaluated as the need arises.

Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions or maintenance activities.

3.4.1 Maintenance

The wind turbine will be subject to periodic maintenance and inspection. Periodic oil changes will be required. Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.

3.5 Decommissioning

The turbine infrastructure which will be utilised for the proposed wind energy facility is expected to have a lifespan of approximately 20 - 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is possible that refurbishment of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.

The following decommissioning activities have been considered to form part of the project scope of the proposed wind energy facility.

3.5.1 Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required equipment and lifting cranes, preparation of the site (e.g. laydown areas, construction platform) and the mobilisation of decommissioning equipment.

3.5.2 Disassemble Existing Turbines

A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. A majority of the components will be removed from the site. It must be noted that only the top 1m or more of the foundation will be removed. The

area will be filled with suitable topsoil, it will be levelled and returned to its original state. These components will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbine would be considered reusable or recyclable except for the blades.

STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 4

4.1. National Policy and Planning Context

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 4.1. 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.

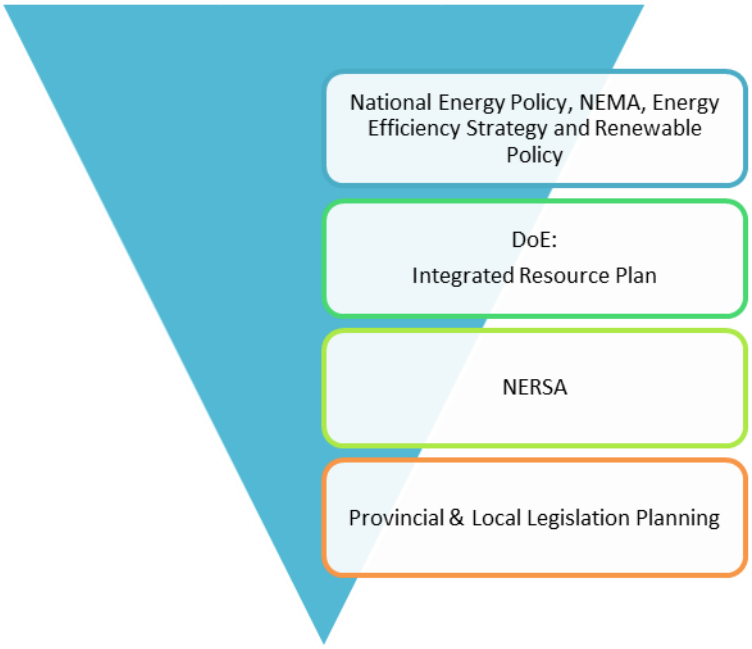


Figure 4.1: Hierarchy of electricity policy and planning documents

4.1.1 The Kyoto Protocol, 1997

South Africa's electricity is currently 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 their 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.

4.1.2. The National Energy Act (2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors. The Act provides the legal framework which supports the development of power generation facilities.

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

The White Paper on Energy Policy states the need to improve the energy security in the country by means of expanding the energy supply options. This implies the increase in the use of renewable energy and encouraging new entries into the generation market. 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; more so when social and environmental costs are taken into account. Government policy on renewable energy is thus concerned with meeting the following challenges:

- » Ensuring that economically feasible technologies and applications are implemented;
- » Ensuring that an equitable level of national resources are 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 policy states the advantages of renewable energy which include minimal environmental impacts in operation in comparison with traditional supply technologies; generally lower running costs; and high labour intensities. Disadvantages include: higher capital costs in some cases; lower energy densities; and lower levels of availability, depending on specific conditions, especially with sun and wind based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future. Therefore the policy supports the

advancement of renewable energy sources at ensuring energy security through the diversification of supply, which is in line with the proposed Solar Energy Facility.

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

4.1.5 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 Final Draft Integrated Energy Planning Report (November 2013)[4] for public comment. The Final 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.

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

[4] Please note that the final draft IRP 2010 Update was submitted to Cabinet for final approval by March 2014. The updated IRP has however not been promulgated or published in the Government Gazette.

In order to meet the long-term goal of 17,8GW of renewables by 2030, the Department of Energy (DoE) has determined that 3 725 megawatts (MW) to be generated from Renewable Energy sources is required to ensure the continued uninterrupted supply of electricity. This 3 725 MW is broadly in accordance with the capacity allocated to Renewable Energy generation in IRP 2010-2030. This capacity is to be secured from Independent Power Producers (IPPs) through the Renewable Energy IPP Procurement (REIPPP) Programme. This Procurement Programme has been designed so as to contribute towards the target of 3 725 megawatts and towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa.

In terms of this programme, IPPs (such as Mainstream) will undergo a competitive bidding process in which the Department of Energy will determine preferred bidders. A Preferred Bidder will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as enter into a power purchase agreement from Eskom or other relevant parties (i.e. typically for a period of 20 - 25 years). The developer will be held to compliance with the price and economic development proposals in its bid, with regular reporting to demonstrate compliance during the life of the project. As part of the agreement, the IPP will be remunerated per kWh by Eskom or a 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 DoE REIPPP Programme is currently underway, with four bidding rounds already completed. A total of 22 wind energy facility projects and 33 solar projects have been awarded preferred bidder status to date. A number of these projects are in the Northern Cape Province, which makes the province a hub for wind and solar projects. Mainstream intends bidding the proposed project to the DoE for the Round 5 bid submission, which is likely to be in August 2015.

4.2 Provincial and Local Level Developmental Policy

4.2.1 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 PGDS 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.

4.2.2. Northern Cape Climate Change Response Strategy

The key aspects of the Northern Cape Climate Change Response Strategy (NCCCRS) Report are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the 3 key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as 3 remaining key Sectors to ensure proactive long term responses to the frequency and intensity of extreme weather events such as flooding and wild fire, with heightened requirements for effective disaster management".

Key points from the MEC address include the NCPG's commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the Northern Cape Province's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is indented as an important provincial intervention in addressing climate change. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy.

4.2.3 Khai-Ma Local Municipality Integrated Development Plan (2011/12)

The Integrated Development Plan (IDP) enables Local Municipalities like the Khai-Ma Municipality to manage and measure their progress in terms of meeting their

development goals. The major developmental challenges facing the Khai-Ma Local Municipality identified in the IDP are:

» Low storage capacity of water which leads to water shortages;
» Unequal access to electricity;
» Waste removal;
» High levels of HIV/AIDS infection;
» Poor roads, electricity, communications, stormwater and sanitation infrastructure;
» Shortage of agricultural land; and
» Poor moral values.

The Khai-Ma Local Municipality IDP identified 5 Key Priorities to address the municipality's development objectives:

» Priority 1: Institutional (Local Governance and Administration);
» Priority 2: Spatial Development and Land Reform;
» Priority 3: Socio-economic Needs;
» Priority 4: Infrastructure Development; and
» Priority 5: Economic Development.

These priorities address the outcome of an analysis of the status quo across numerous sectors within the Municipality and, in turn, inform the 5 key priorities and their associated objectives and strategies. In terms of these priorities, the IDP sets out a number of critical targets. The targets that are relevant to the proposed renewable energy facility include:

» Socio-economic needs, specifically, improve the income levels for the population within the municipality, reduce unemployment from 39% to below 20%, introduce capacity and skills building programs, introduce awareness campaigns around issues relating to healthcare (HIV/AIDS), water and the environment, improve safety and security to vulnerable and marginalized communities.
» Infrastructure development;
» Economic development (including electricity and roads), specifically, provide support for capacity and skills development.

The proposed wind energy facility will aid the municipality is addressing these targets as a result of job opportunities and economic upliftment associated with the project.

4.3 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.

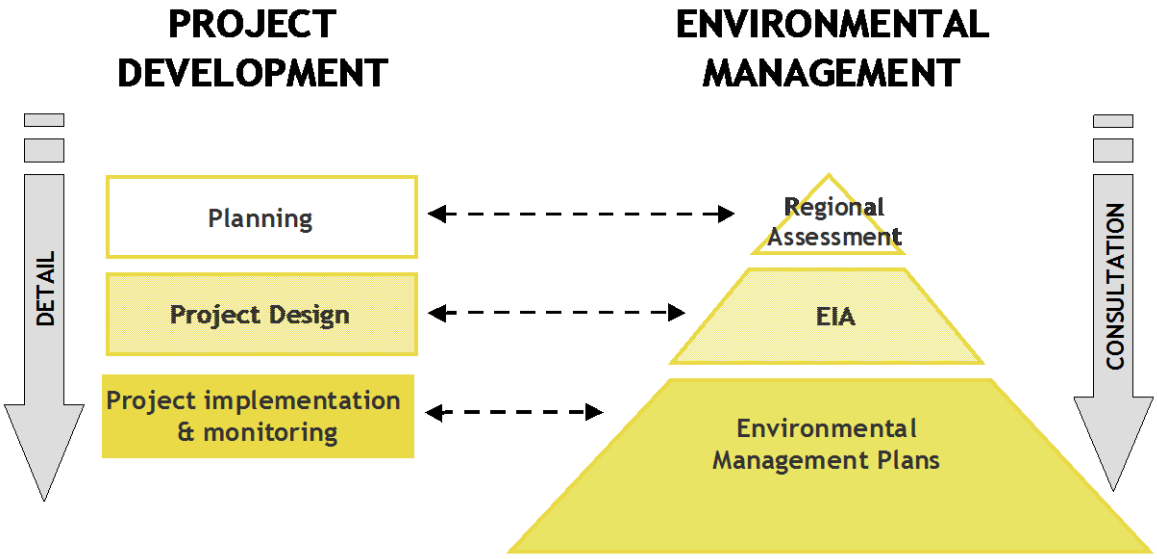


Figure 4.2: Diagram depicting the relationship between project development and environmental management

The project planning phase for the Poortjies Wind Energy Facility included a detailed site selection process, and the environmental suitability of the site was confirmed through an environmental fatal flaw analysis undertaken by Aurecon. This site selection process is detailed further in Chapter 2 and attached as Appendix N of this Final 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 Final Environmental Impact Assessment Report to determine any environmental sensitivity and/or fatal flaws and to inform the layout of the wind energy facility.

APPROACH TO UNDERTAKING THE EIA PROCESS CHAPTER 5

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two Phases: a **Scoping Phase** and an **EIA Phase**. The Scoping Phase culminates in the submission of a Scoping Report to the Department of Environmental Affairs, as the competent authority, for review and acceptance before proceeding onto the EIA Phase of the process. The EIA Phase culminates in the submission of an Environmental Impact Report (EIR), including an Environmental Management Programme (EMPr), to the competent authority for review and decision-making.

The phases of the EIA process are as follows:

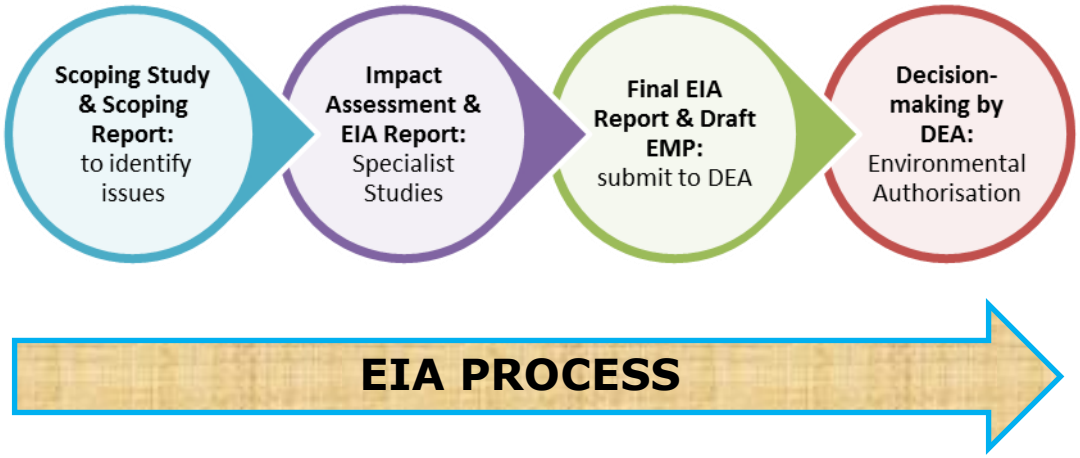


Figure 5.1: The four phases of the EIA process

The EIA Phase for the proposed Poortjies 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). This chapter serves to outline the EIA process that was followed.

5.1. Phase 1: Scoping Study

The Scoping Study, which was concluded in October 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 Poortjies 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 Pofadder Public Library for I&AP review and comment from **28 May 2014** to **09 July 2014**. 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) in July 2014. The Final Scoping Report was accepted by the DEA on 06 October 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 EIR, and that the EIR is to contain a construction and operational phase Environmental Management Programme (EMPr).

5.2. 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.

5.3. Overview of the EIA Phase

The EIA Phase is 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.

5.3.1. 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 Draft Scoping Report (July 2014) 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
  * Department of Energy
  * Department of Water and Sanitation
  * Department of Agriculture, Forestry and Fisheries
  * South African Heritage Resources Agency
  * Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
  * South African National Roads Agency Limited (SANRAL)
  * Department of Mineral Resources
  * Department of Science and Technology
  * Department of Rural Development and Land Reform
  * Northern Cape Department of Environment and Nature Conservation (NC DENC)
  * Northern Cape Department of Roads and Public Works
  * Northern Cape Department of Agriculture, Land Reform and Rural Development Civil Aviation Authority (SACAA)
  * Khai-Ma Local Municipality
  * Namakwa District Municipality
  * South African Airforce (SAAF)
  * South African National Parks (SANParks)
  * Eskom
  * National Energy Regulator South Africa (NERSA)
  * 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 EIR. A record of the authority consultation in the EIA process is included within **Appendix B**

5.3.2 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 Gemsbok and the Volksblad on the 23 April 2014.

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 district and local 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 as detailed in 5.3.1 above.

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.

5.3.3. Public Involvement and Consultation: Scoping Phase

Table 5.1: Summary of Public Involvement Process undertaken to date

	Activity	Date
	Placement of newspaper advert in local newspapers notifying the public and interested parties of the project.	23 April 2014
	Placement of site notices on-site & in public places	28 April 2014
	Distribution of a stakeholder letter, background information document to authorities, ward councillors, landowners within the study area, neighbouring landowners and stakeholder groups	17 April 2014

	Activity	Date
Scoping Phase	Placement of newspaper advert in local newspapers informing interested and affected parties of the availability of the Draft Scoping Report and Public Meeting date.	28 – 30 May 2014
	40-day public review period for the Draft Scoping Report for public comment.	28 May 2014 – 09 July 2014
	Focus group meetings	18 June 2014
	Notification to registered I&APs of submission of Final Scoping Report to DEA	06 July 2014

5.3.4. 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.
» Comments received from organs of and I&APs were recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping and EIA phases for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of interested and affected parties (refer to **Appendix C1** 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.

Below is a summary of the key public participation activities conducted during the EIA process.

» **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 5.2).

Table 5.2: Key stakeholder groups identified during the EIA Phase

Stakeholder Group	Department
National Government Departments	» National Department of Environmental Affairs » Department of Energy » Department of Water and Sanitation » Department of Agriculture, Forestry and Fisheries » Department of Communications » Department of Mineral Resources » Department of Science and Technology » Department of Rural Development and Land Reform » The South African Airforce (SAAF) » South African National Parks (SANParks)
Government Bodies and Institutions	» Eskom » National Energy Regulator of South Africa (NERSA) » Sentech » South African Civil Aviation Authority (SACAA) » Square Kilometre Array: Southern Africa » South African Heritage Resources Agency (SAHRA) » Telkom
Provincial Government Departments	» Northern Cape Department of Environment and Nature Conservation (DENC) » 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 Roads and Public Works
Local Government Departments	» Khai-Ma Local Municipality » Namakwa District Municipality
Conservation Authorities	» BirdLife South Africa » Endangered Wildlife Trust (EWT) » South African Bat Assessment Advisory Panel (SABAAP) » Wildlife and Environment Society of South Africa (WESSA)
Public stakeholders	» Affected landowners and tenants » Neighbouring landowners and tenants

» **Newspaper Advertisements**

As part of the EIA phase newspaper adverts were placed in English and Afrikaans in the Gemsbok and the Volksblad on **05 January 2015** 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; and
- publicise the date of the public meeting.

» **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)
- **Public feedback meeting** (public invited to attend)
- 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.**

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

5.3.5 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 a 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.

Table 5.3: Main concerns raised during the Public participation process and the responses provided

Main concerns raised during the public participation process	Responses Provided
» Concern about ground water usage;	» Mainstream is considering the following

» Concern about the supply of accommodation services; » Concern about wildlife in the area; » Concern about erosion in the area; » Concern about the degradation of existing gravel roads; and » Security issues.	options: use of existing boreholes; drilling of new boreholes on the proposed site; alternatively connecting to the neighbouring farmer's borehole system or connecting to the municipal supply, the fresh water resources will be taken into consideration and the impacts will be assessed during the Environmental Impact Assessment (EIA) Phase. » It is anticipated that the Soil erosion due to alteration of the land surface run-off characteristics, construction related land surface disturbance, vegetation removal, and the establishment of hard standing areas, surfaces and roads may occur. A detailed field investigation will be undertaken to assess visual assessment of erosion and erosion potential on site, taking into account the proposed development layout. This assessment will inform the EIA Phase and soil erosion mitigation measures will be incorporated into the Environmental Management Program. » Construction camps will not be located on site, the construction workers will be accommodated in the nearest towns, e.g. Pofadder. Issues and mitigation around safety security have been addressed in the EIA Phase.

5.3.6 Public Review of Draft Environmental Impact Assessment Report

The Draft EIA Report was available for a 40 day public review period from **05 January 2015 – 13 February 2015** at the following locations:

» Pofadder Public Library;
» Aggeneys Library; and
» www.savannahSA.com

In order to facilitate comments on the Draft Environmental Impact Assessment Report, all registered I&APs have been notified of the availability of the report by letter. An advert has been placed in the Gemsbok and the Volksblad, to inform the public and I&APs of the availability of the Draft EIAR for review. A public meeting was held on **21 January 2015 at the Pofadder Community Hall at 17h00** in order to provide an overview of the findings of the EIA studies.

5.3.7. Final Environmental Impact Assessment (EIA) Report

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

5.4. 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 Table 5.4.

Table 5.4: Specialists involved in the assessment of impacts

Specialist	Area of Expertise	Refer Appendix
Dave McDonald of Bergwind Botanical Surveys & Tours	Flora	Appendix F
Werner Marias of Animalia Zoological & Ecological Consultation cc	Fauna	Appendix G
Chris van Rooyen of Chris van Rooyen Consulting	Avifauna (including long-term monitoring)	Appendix H
Jonathan Aronson and Jennifer Slack of Arcus Consultancy Services	Bats (including long-term monitoring)	Appendix I
Johann Lanz	Soil, erosion and agricultural potential	Appendix J
Morne de Jager of Enviro Acoustic Research	Noise	Appendix K
Lourens du Plessis of MetroGIS and Mandy van der Westhuizen of NuLeaf Planning & Environmental	Visual	Appendix L
Tony Barbour (Environmental Consultant and Researcher)	Social	Appendix M
Tim Hart of ACO Associates	Archaeology and Heritage	Appendix N
Brian Colloty	Surface water Assessment	Appendix O

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 O**.

5.5. 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 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 renewable energy facility project and the related statutory environmental assessment process.

5.5.1. 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).
- Sentech Square Kilometer Array Office (SKA).
- *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*: According to Section 53 of the Minerals and Petroleum Resources Development Act (Act No. 28 of 2002) an application is required by the DMR. 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 (Khai-Ma Local Municipality and Namakwa 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.

5.5.2. 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.

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. Listing summary of relevant legislation and associated requirements identified at this stage of the process is provided in Table 5.5.

Table 5.4: 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. » The Transitional Arrangements as contained in Chapter 8 of the 2014 EIA Regulations as promulgated on 4	» 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
	December 2014 regarding pending applications with specific reference to Regulation 53(1) which reads as follows: » 53. (1) An application submitted in terms of the previous NEMA regulations and which is pending when these Regulations take effect, including pending applications for auxiliary activities directly related to- * prospecting or exploration of a mineral or petroleum resource; or * extraction and primary processing of a mineral or petroleum resource, must despite the repeal of those Regulations be dispensed with in terms of those previous NEMA regulations as if those previous NEMA regulations were not repealed. » 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 with granting of the relevant environmental authorisation. » In terms of GNR 543 of 18 June 2010,		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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 EMPr and will continue to apply throughout the life cycle of the project.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically	» DEA » DENC	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
	endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). » This Act also regulates alien and invader species.		
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	» DEA » NC DENC	» As no waste disposal site is to be associated with the proposed project, no permit is

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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 harm to health are prevented.		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).
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"	» DEA » NC DENC	» While no permitting or licensing requirements arise from this legislation, this Act

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» 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.		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 and/ or stored for use at the facility (either during construction or operation), this may also require a water use licence

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			(Section 21a and b).
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 (refer to the Noise Impact Assessment Report in AppendixM).
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	» Department of Mineral Resources	» 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
	Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of 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	» 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
	of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Standalone HIAs are not required 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". » The list of protected tree species was published in GN 877 of 22 November 2013.	» 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	» Department of Agriculture, Forestry and	» While no permitting or licensing requirements arise

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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 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.	Fisheries	from this legislation, this act will find application during the operational phase of the project in terms of fire prevention and management.
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.	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

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).		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.
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	» 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 power

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	effect on road pavements, bridges and culverts. » 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.		station components may not meet specified dimensional limitations (height and width).
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	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
	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 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.		
Astronomy Geographic Advantage Act (Act 21 of	» Preservation and protection of areas within South Africa that are uniquely	Department of Science and Technology	No permitting or licensing requirements. This act may find

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
2007)	suited for optical and radio astronomy. » Regulations promulgated in terms of AGA in 2009 require all developments in the Sutherland area that entail external night lighting, to be fully cut-off, with no light emitted in the upward direction. This is aimed at protecting the observational integrity of SALT (Southern African Large Telescope), the largest telescope in the Southern Hemisphere, located approximately 20 km east of Sutherland.		application during through the project EIA.
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	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
	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 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.		

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the Final EIA Report provides a description of the environment that may be affected by the proposed Poortjies Wind Energy Facility near Pofadder. The greater study area for the Mainstream Pofadder Renewable Energy Facility is the main focus of this chapter, however, where applicable, specific environmental features relating only to the Poortjies Wind Energy Facility are highlighted. 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 have been described. This information has been sourced from both existing information available for the area as well as collected data from specialists who have a working knowledge of the area, and 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 D to M**.

6.1 Regional Setting and the Study Area

6.1.1 Regional Setting

The site of the proposed Poortjies Wind Energy Facility (Portion 1 of the farm Poortje 209 and the Remainder of the farm Poortje) is located approximately 22km south-west of Pofadder in the heart of the Northern Cape (refer to **Figure 6.1**). The town of Pofadder is located on the N14, which links Springbok in south-west with Upington in the north east. The site falls within the Khai-Ma Local Municipality.

6.1.2 Land-Use Character of the Region

The land use on the site and in the broader development area is mostly sheep farming, with some game and cattle also present. The entire area is divided into fenced off grazing camps, with several boreholes with associated water reservoirs, drinking troughs and a few trees. The small town of Pofadder is the only major settlement in the area which services the surrounding farming communities. There are no large urban or industrial structures in the area and the only major forms of infrastructure are the N14 highway and the Eskom Aggeneys–Aries 400kV power line which traverses the site.

View of the Remainder of the Farm Poortje 209	View of Portion 1 of Farm Poortje 209
	

Figure 6.1: Photographs of the study area

6.2 Climatic Conditions

In general, the study area falls within the spring and autumn rainfall zone of the Northern Cape Province. It experiences highly unpredictable rainfall that can vary between 50 to 200 mm per annum. Rain normally falls as scattered thunder showers when tropical thunderstorm activity extends southwards over the Kalahari. It is not uncommon for heavy showers to occur in one place and for a nearby area to remaining completely dry.

Summer daytime temperatures can reach above 40ºC (range 20 – 40+ ºC) whereas the dry winters are mild to cold. Winter daytime temperatures can reach 25 ºC but at night frost can occur and temperatures can average below 0 ºC (-3.3ºC). The upland areas of the site in the north and east are characterised by Bushmanland Inselberg Shrubland and have lower rainfall than the plains in the study area but slightly less mean annual potential evaporation. Mean annual temperatures are also marginally lower. These areas will not be affected by the proposed wind energy infrastructure.

6.3 Biophysical Characteristics of the Study Site and Surrounds

6.3.1. Geology

The geology underlying the flatter areas of the site is dominated by late Cainozoic to Recent age superficial sediments consisting of sands and gravels of fluvial and/or sheet wash origin, overlain by coarse to medium grained sands of aeolian origin. Small calcrete concretions are evident in most areas and these constitute the gravelly texture of the soil cover. Calcrete "dorbank" lenses are expected over most of the site below the superficial unconsolidated soil cover. Thicker deposits of red fine sand are located along dry river channels. The surrounding hills and slightly elevated areas on the farms consist of outcrops of metamorphic basement rock. Basement formations occurring within the site area include the Wortel Formation (quartzite and pelitic schist), Brulkolk Formation (gneiss and amphibolites), Koeipoort Formation (Gneiss), and Namies Suid Formation (biotite gneiss). Copper and nickel deposits are known to occur on the eastern side of the site near the Platberg.

6.3.2. Hydrology, Drainage Lines, Rivers & Wetlands

There are no perennial rivers or wetlands on the site. The drainage lines that do occur on the site are characterised by loose sandy soil or exposed bedrock and boulders in the 'washes' with the banks lined with grasses, shrubs and small trees (as shown in **Figure 6.2 and 6.3**). The drainage lines on the Poortjies site are wide and well-defined and drain north-westerly towards the Orange River. All the

drainage lines have similar vegetation; variation depends on availability and length of duration of flowing water.

In an arid ecosystem such as in the study area, the drainage lines are prone to flash flooding. They are also the 'ecological linking corridors'. Although not having a high diversity of plant species they should be observed as ecologically sensitive. The landscape is prone to sheet-wash at times of heavy rain and there are seasonal drainage lines which in some cases are poorly defined whereas in others they are quite distinct. The vegetation of the drainage lines does not differ greatly from that found on site. This is attributed to the drainage lines being mainly dry and only having water-flow for very short periods.

Figure 6.2: A typical drainage line in the study area with white grasses and low to mid-high shrubs on the banks

Figure 6.3: Some drainage lines have mid-high shrubs and trees along their banks together with white grasses

6.3.3. Soils, Land Use and Agricultural Potential

The underlying geology is Gneissic granite of the Namaqualand Metamorphic Complex. The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The Poortjies site is located on two land type, i.e. Ag61 and Ag25. Both land types are dominated by very shallow, very sandy soils on underlying rock or hard-pan carbonate. The ridges (Ib131) are dominated by rock outcrops (refer to **Figure 6.4**). The soils would fall into the Lithic and Calcic soil groups according to the classification of Fey (2010).

The study area is located within a sheep farming agricultural region. There is no cultivation on the farms.

Land capability is the combination of soil suitability and climate factors. The area has a land capability classification, on the 8 category scale, of predominantly Class 7 - non-arable, low potential grazing land, with small sections of class 8 – non utilisable wilderness land. The limitations to agriculture are aridity and lack of access to water together with the very shallow soil depth and rockiness on the site. Because of these constraints, agricultural land use is restricted to low intensity grazing only. The natural grazing capacity is low, at mostly 31-40 hectares per animal unit, with the ridges even lower at 41-60 hectares per animal unit.

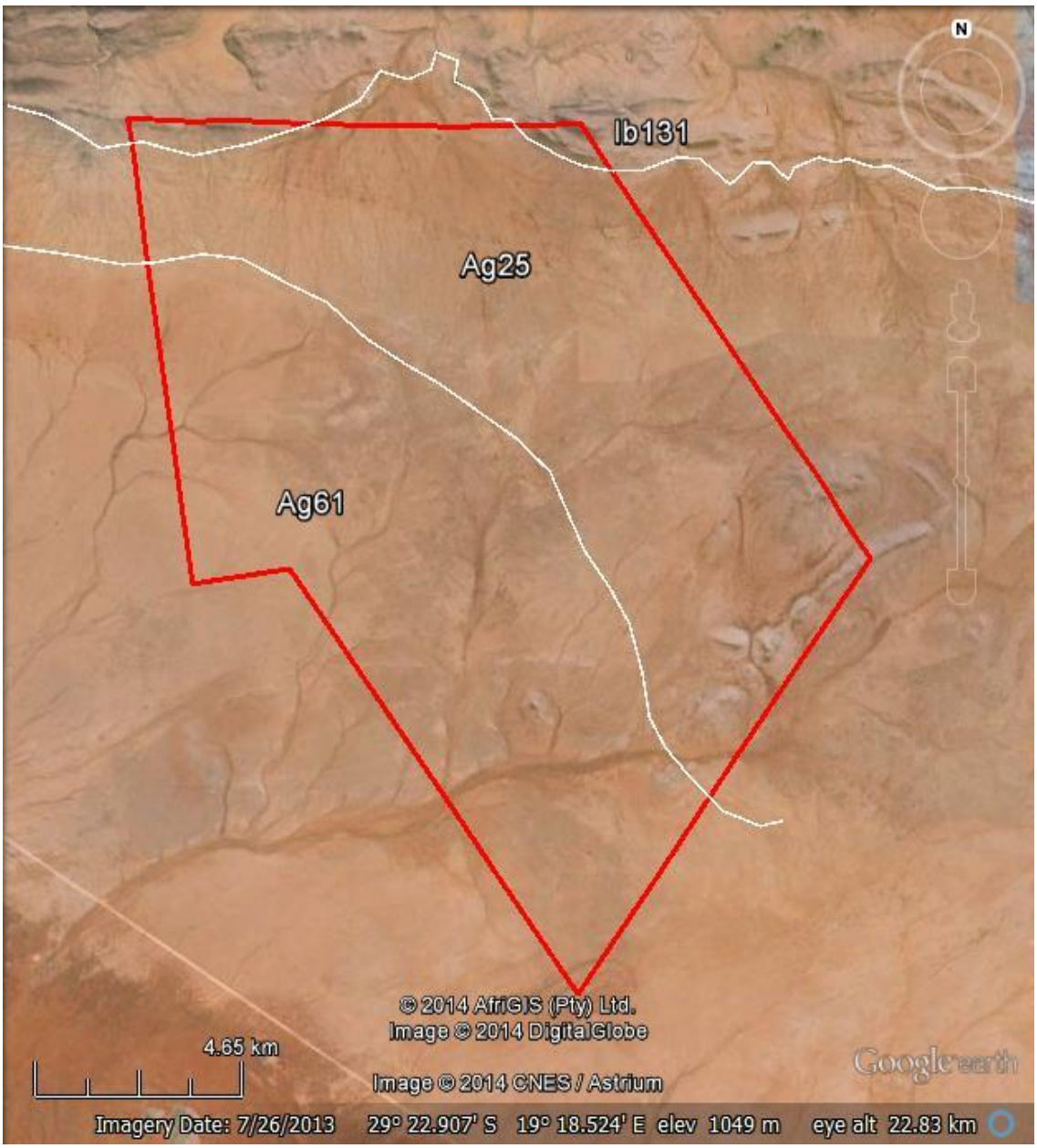


Figure 6.4: Satellite image of the greater study area showing land type distribution. Land type labels and boundaries in white and site with red boundary.

6.3.4. Ecological Profile of the Study Area

a. <u>Vegetation</u>

The site occurs in the Bushmanland Bioregion. The Bushmanland Bioregion is separated from the other bioregions within the Nama Karoo Biome by having low mean precipitation and high mean annual temperatures. It is dominated by arid shrublands and grasslands (Mucina *et al.* 2006). The vegetation of the study area is principally Bushmanland Arid Shrubland (as shown in **Figure 6.5**). Bushmanland Arid Grassland occurs over a wide expanse in the Northern Cape Province from the

Bushmanland Basin in the south to the vicinity of the Orange River in the north and from Prieska in the east to Aggeneys in the west (Mucina *et al.* 2006). It is used mainly as rangeland for sheep-farming and no crops are cultivated.

b. <u>Plant Communities</u>

Five plant communities or associations are recognised in the study area including:

» Open plains grassland;
» Low to mid-high shrubland;
» Drainage line vegetation;
» Aggeneys Gravel Vygieveld; and
» Bushmanland Inselberg Shrubland.

Neither Aggeneys Gravel Vygieveld nor Bushmanland Inselberg Shrubland are likely to be affected by the proposed renewable energy infrastructure, since it was recommended in the botanical constraints analysis (McDonald, 2012) that the areas where these vegetation types occur should be avoided. These two vegetation types are therefore not described below.

» ***Open plains grassland***
The open plains grassland has a highly distinctive appearance due to the dominance of 'white grasses' (*Stipagrostis* spp.) and is described as semi-desert 'steppe' (Mucina *et al.* 2006). This vegetation occurs on moderately-deep to deep red sandy soils and is found extensively in the central and southern parts of the study area.

» ***Low to mid-high Shrubland***
The low to mid-high shrubby association is found on relatively shallow soils with stones and small boulders on the surface and often over calcrete hardpan. This vegetation is encountered in the northern part of the study area[5]. One species of note occurring on the site is *Aloe claviflora* (kraalaalwyn). Occasionally stands of vegetation dominated by the mid-high shrub *Rhigozum trichotomum* (granaatbos) are encountered in the study area. This species is described by Van Rooyen (2001) as '*widespread throughout the Northern Cape in sandy and calcareous soils on plains, dune valleys and near pans and dry rivers. Often forming dense thickets in overgrazed veld'.*

[5]It was extremely dry at the time of the site visit and most plants were not in a fit state for identification. This was a severe limitation and hence species-lists were not compiled.

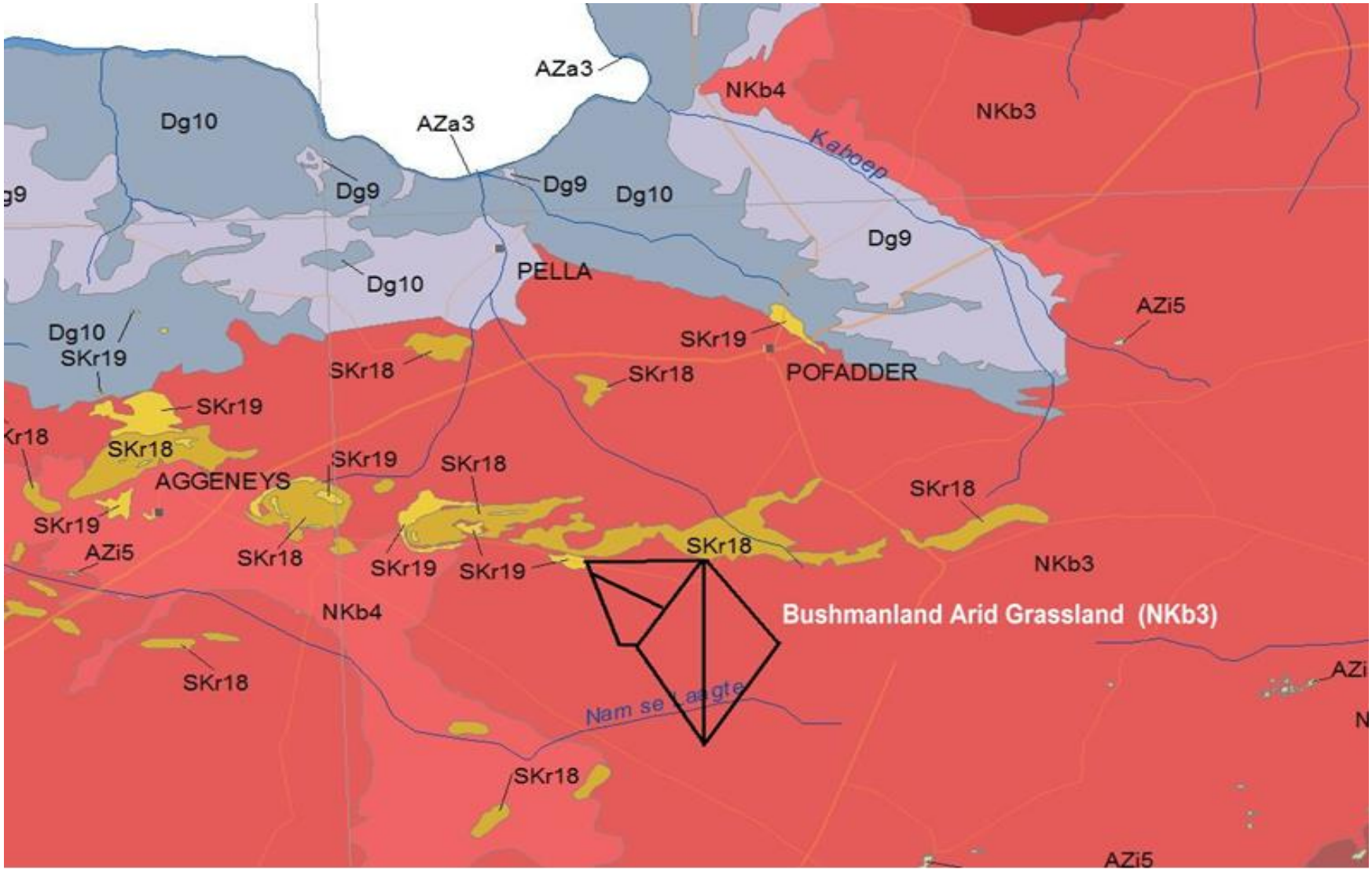


Figure 6.5: Portion of the national vegetation map (Mucina et al. 2005) showing the position of the greater study area

» ***Drainage Line Vegetation***

The drainage lines on the site are characterised by loose sandy soil or exposed bedrock and boulders in the 'washes' with the banks lined with grasses, shrubs and small trees (refer to Figure 6.4). All the drainage lines have similar vegetation with variation dependent on availability and length of duration of flowing water. In the arid ecosystems such as in the study area the drainage lines are prone to flash flooding. They are also the 'ecological linking corridors', although the drainage lines do not have a high diversity of plant species.

c. Critical Biodiversity Areas and Conservation Planning

Aggeneys Gravel Vygieveld and Bushmanland Inselberg Shrubland, although not listed as threatened, are range-restricted and harbour endemic plant taxa. They are geographically separate from the main distribution range of the Succulent Karoo Biome lying well east of the main Richtersveld Bioregion. For these reasons Aggeneys Gravel Vygieveld and Bushmanland Inselberg Shrubland have special characteristics and high conservation value.

Desmet & Marsh (2008) mapped the Critical Biodiversity Areas (CBAs) within the Namaqualand District Municipality (NDM). They mapped three levels of sensitivity: ecological corridors (Ecological Support Areas: ESAs) and two levels of Critical Biodiversity Areas (CBAs i.e. T1 & T2). The northern-eastern parts of Namies Suid 212/1 and Namies 212/2 and the extreme north corners of Poortje 209/1 and Poortje 209/RE lie within ecologically sensitive (CBA – T2) areas according to the classification of Desmet & Marsh. In addition a small localised area of Bushmanland Inselberg Shrubland is located in the south-central area of Poortje 209/1 which is also classified as a CBA-T2 area.

d. Protected Tree Species

A protected tree species, *Boscia albitrunca* (Shepherd's Tree) is one of the few tree species which occur within the study area (**see Figure 6.5**). The trees recorded on site are old. The Shepherd's Tree is easily identified with its pale white-coloured trunk and small leaves. These trees are slow growing and not suited to relocation.

Figure 6.5: *Boscia albitrunca* (Shepherd's Tree) trees are found scattered though the landscape in the study area.

e. <u>Terrestrial Fauna Species</u>

The following vegetation types provide habitat for faunal species:

» ***Bushmanland Sandy Grassland*** is found to the west of the study area. This vegetation unit is covered by sparse open grassland with scattered, drought resistant dwarf shrubs.

» ***Bushmanland Basin Shrubland*** is south-west of the study area. The vegetation is a dwarf shrubland dominated by a combination of low shrubs and white grasses.

» ***The Eastern Gariep Plains Desert*** is north of the study area. The vegetation conforms to typical wash vegetation in the breaks between the mountains. Grasslands are dominated by white grasses (*Stipagrostis*) on much of the flats with additional shrubs and herbs in the drainage lines. The vegetation unit consists of flat plains (sheet wash plains) with interspersed rocky hills and outcrops belonging to other habitat types. These rocky hills and outcrops provide faunal roosting sites.

» ***Eastern Gariep Rocky Desert*** is also found north of the study area. This area comprises hills and mountains, mostly with bare rock outcrops and covered with very sparse shrubby vegetation and low growing trees. This vegetation type may prove important as bat roosting areas.

The specialist fauna study contained in Appendix E provides a list of faunal species that may occur on the site. The faunal species on conservation importance that may occur on the site include:

» *Felis nigripes (*Small spotted cat)

» *Petromus typicus* (Dassie rat)

» *Family Theraposidae* (Baboon spiders)
» *Stasimopus spp* (Trapdoor spiders)
» *Psammobates spp (*Tent tortoises)
» *Cordylus spp* (Girdled lizards)

f. Bats

Three factors are required for most South African bats to be prevalent in an area: a) availability of roosting space, b) food (insects/arthropods or fruit), and c) accessibility to open water. However, the dependence of a bat on each of these factors depends on the species and its biology, for example different species of bats utilise different types of roosting spaces. Nevertheless if all three of these factors are common in an area the bat activity and abundance will also most likely be high.

Concerning species of bats that may be impacted by wind turbines, the site was evaluated by comparing the amount of surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces), climate (can influence insect numbers and availability of fruit), and presence of surface water (influences insects and acts as a drinking source for bats). Species probability of occurrence, based on above mentioned factors, and distribution maps were also estimated for the broader study area.

The site is relatively flat barring the mountainous elevations on the northern and south-western perimeter of the site. These outcrops and inselbergs will provide suitable roosting space for bats. The vegetation present on the site is sparse and consists of small succulent plants which will not provide roosting sites but has the potential to create an area of foraging for insectivorous bats. The farmhouse and buildings provide bat roosting sites. The fruit trees around the landowner's house can technically provide some food for *Eidolon helvum* fruit bats. This bat is a rare occurrence of a non-breeding migrant in South Africa, with a low probability of venturing onto the site.

The study area has a low mean annual precipitation. However, there are drainage channels across the majority of the site. These channels drain in a southerly direction to collect into a larger stream within the site boundary. The channels will provide limited surface water and soil moisture on a seasonal basis during the rainy season for this site, and therefore will make insect prey available to bat fauna.

According to the Pre-construction Bat Monitoring and Assessment report dated February 2014, to date, four bat species and a total of 12,695 bat passes have been recorded on site. Activity was dominated by two species, the Cape Serotine

and the Egyptian free-tailed bat which have a medium-high and high likelihood of impact from wind turbines respectively. Bat activity was similar across each of the monitoring locations and bat activity does not appear to be strongly associated with any specific parts of the proposed site. Higher bat activity was recorded at low height than at rotor swept height.

g. Avifauna

While the distribution and abundance of the bird species in the broader development area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine external modifications to the environment that may have relevance for birds. The following avifaunal-relevant habitat modifications were identified within the broader development area:

- **Water points:** The land use in the broader development area is mostly sheep farming, with some game and cattle also present. The entire area is divided into fenced off grazing camps, with several boreholes and associated water reservoirs, drinking troughs and a few trees. These troughs, reservoirs and trees are a big draw card for several bird species.
- **Transmission lines and telephone lines:** The broader development area is bisected by the Aggeneys – Aries 400kV transmission line. The transmission line towers are used by raptors for perching and roosting, and potentially also for breeding. An inactive eagle nest, most likely belonging to a Martial Eagle, was recorded on tower 147. Prey remains and droppings below the nest and other towers indicate recent activity. There is also a telephone line running along the road to the two farm houses, which is used extensively by several species for perching.
- **Farm yards:** The site contains two farm yards, with associated buildings, trees and patches of lawn. Certain species may be attracted to trees at farm yards.

Three Important Bird Areas (IBAs) which are broadly similar in habitat and vegetation to the broader development area are situated within a 40km radius from the site, namely the Mattheus Gat Conservation Area (SA034), Haramoep and Black Mountain Mine Nature Reserve (SA035) and Bitterputs Conservation Area (SA 036) (Barnes 1998).

A total of 83 species were recorded within the study area (i.e. the turbine area, control areas and immediate surroundings) from all data sources (drive transects, walk transects, VP watches, focal point counts and incidental sightings) during the pre-construction monitoring, of which 11 are priority species (refer to Appendix B of the Avifauna Study for full list).

According to the winter 2013 and summer 2013/2014 bird monitoring progress report, of the transect recorded species in the study area 5 species (38.5% of recorded species) were priority species (Greater Kestrel *Falco*, Karoo Korhaan, Ludwig's Bustard, Red Lark and Southern Pale Chanting Goshawk). One species (10% of recorded species) was a priority species at the control site (Karoo Korhaan).

A Martial Eagle nest and three Southern Pale Chanting Goshawk nests were recorded during the monitoring (see Figure 1). All nests were monitored once every season to establish the status of the nests.

6.4 Social Characteristics of the Study Area and Surrounds

The proposed wind energy facility is located in the Northern Cape Province, which is the largest province in South Africa and covers an area of 361,830 km^2, constituting approximately 30% of South Africa. The province is divided into five district municipalities (DM) (namely, Frances Baard, Pixley ka Seme, Namakwa, Siyanda, and John Taolo Gaetsewe DM), twenty-six Category B municipalities and five district management areas. The site itself is located in the Khai-Ma Local Municipality (KMLM), which is a Category B Municipality, and one of seven constituent B-Municipalities that make up the Namakwa District Municipality (NDM).

The administrative seat of the Khai-Ma Local Municipality is located in Pofadder, while Springbok is the administrative seat for the NDM. The rural/agricultural municipality is approximately 8 332 km² in size (~7.7% of the NDM) and is bordered to the north by the Orange River (the border with the Republic of South Africa and Namibia), by a District Management Area (NCDMA08, part of the Siyanda District Municipality) to the east, District Management Area (NCDMA06) to the south and the Nama Khoi Local Municipality to the west. The largest town in the Khai-Ma Local Municipality is Pofadder, while other smaller towns include Aggeneys, Pella and Onseepkans. The KMLM is divided into 4 administrative wards. The study area is located within Ward 4 (Aggeneys).

6.4.1. Economic Development

The Human Development Index (HDI) for the Northern Cape Province is 0.58, which covers four indexed factors – life expectancy, adult literacy, GDP per capita (adjusted for real income) and education attainment, which is substantially below the South African figure of 0.72. Over the past 8 years there has been little to no variance in the HDI figures, indicating no increase or decrease in the overall

standard of living. In contrast, the Kimberley and Springbok areas have the highest HDI of 0.63 to 0.62 respectively, primarily due to the broader economic opportunities and access to services such as infrastructure, schools, and health facilities. Similarly, there has been no significant change over the past 8 years.

The above trend is unlikely to change in the foreseeable future, mainly due to the marginal economic base of the poorer areas, and the consolidation of the economic base in the relatively better off areas. In terms of per capita income, the Northern Cape Province has the third highest per capita income of all nine Provinces. However, income distribution is skewed, with a high percentage of the population living in extreme poverty. The measure used in the PGDS document to measure poverty is the percentage of people living below the poverty line or breadline is used. The poverty line indicates a lack of economic resources to meet basic food needs. The percentage of household income below the poverty breadline of R800 in the Northern Cape Province, with the highest being Karoo at 48% and the lowest being Namakwa at 36%.

6.4.2. Economy

In terms of economic importance, the Northern Cape's share of the country's Gross Domestic Product (GDP) in 2002 was 2%, the lowest contribution of the nine provinces. However, although the Northern Cape Province has the smallest economy of the nine provinces, Gross Domestic Product of the Region (GDPR) per capita is higher than the national average. In terms of economic activities, the economy of Northern Cape is heavily dependent on the primary sectors of the economy, which in 2002 made up 31.0% of GDPR. The largest sector is mining which has declined in contribution to the GDPR from 25.8% in 1996 to 23.7% in 2002. Agriculture, on the other hand, increased in its contribution from 6.2% to 7.3%.

All the industries in the secondary sector have decreased in their contribution to the GDPR, with electricity and water sector showing the greatest decrease of 0.7% and the construction industry making the lowest contribution of 1.9% to the GDPR of the Northern Cape. At the same time the contribution to regional GDPR by industries in the tertiary sector increased, with the exception of the wholesale and retail industry, which decreased by 1.1%.

6.4.3. Population

The population the Khai-Ma Local Municipality (KMLM) is estimated at 12 465 (Census 2011) and makes up approximately 11% of the total population of the greater Namakwa District Municipality (NDM) (115 842). The main towns of Pofadder and Aggeneys account for approximately 64% of the total population

(Khai-Ma IDP, 2011/12). The remainder of the population in the Khai-Ma Local Municipality is made up of small farming communities.

The majority of the population is Coloured (75.1%), followed by Black Africans (17.6%) and Whites (6%). The dominant language within the Municipality is Afrikaans (81.3%) with the remainder made up of Setswana (10.7%), isiXhosa (2.2%) and English (1.2%).

6.4.4. Education

The education levels in both the NDM and KMLM improved for the period 2001 t0 2011, with the percentage of the population over 20 years of age with no schooling in the NDM decreasing from 11.7% to 6.6%. For the KMLM the decrease was from 6.7 % to 3.9 %. The percentage of the population over the age of 20 with matric also increased in both the NDM and KMLM, from 15.7% to 18.8% in the NDM and 14.8% to 18.1% in the KMLM. Despite these increases the figures are significantly lower than the provincial (27.7%) and national (28.4%) averages. Low education levels, specifically higher education, therefore remains a challenge in both the NDM and KMLM.

6.4.5. Employment levels

Based on the data collected, the official unemployment rate in the NDM and KMLM decreased for the ten year period between 2001 and 2011. In the NDM the rate fell from 28.5% to 20.1%, a decrease of 8.4%. However, the unemployment rate in the KMLM increased from a low 15.3% to 22.1%, an increase of 6.8%. Youth unemployment in the KMLM also increased over the same period. The increase in the unemployment rate in the KMLM reflects the limited employment opportunities in the area. However, the unemployment and youth unemployment levels in the NDM and KMLM are lower than the provincial and national averages.

Based on the data from the 2011 Census, 8.4% of the population have no formal income, 2.6% earn between 1 and R 4 800, 5% earn between R4 801 and R9 600 per annum (Census 2011). Sixteen % of the population therefore earn less than R 800 per month (This is the figure used by the South African Government as the official breadline figure). The majority of households (40%) earn between R19 601 and R38 200 per annum. The low-income levels reflect the limited formal employment opportunities in the KMLM. According the DTI NDM Profile (2008), 65% of households in the KMLM were registered as indigent (impoverished) households in 2005. The 2011/2012 Khai-Ma Local Municipality IDP indicates that 77% of households in the municipality are indigent and reliant on the state for subsidies and grants.

6.5 Noise and Visual receptors

The site is located in a remote area due to its considerable distance from any major metropolitan centres or populated areas. The study area is sparsely populated (less than 1 person per km^2), with the highest concentration of people living in the town of Pofadder, located approximately 22km north-east of the site.

Very few homesteads and settlements are present within the study area. Those present include *Lekdam, Samoep, Namies, Onder Namies, Neelsvlei, Dubip and Luttigshoop* within a 10km radius of the proposed site. It is uncertain whether all of the potentially affected farmsteads are inhabited or not.

The N14 national road is located to the north of the study area, just less than 20km from the proposed site, and the R358 bypasses the site some 10-15km to the east. Other than these main roads, a number of secondary roads cross the study area, mainly extending to the west and east.

The only other built infrastructure in the study area is a 400kV power line which traverses the study area (and the site) from west to east.

There are no formally protected or conservation areas present within the study area, but the greater environment has a vast, undeveloped and rugged character. Where settlements occur, these are very limited in extent and domestic in scale.

The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

This area itself is not known as a tourist destination, but the N14 and R358 are recognised tourist access routes within the region, giving access to visitors to the Green Kalahari, Namaqualand and Namibia (via Onseepkans).

An assessment of the area was done using the DEA's Environmental Potential Atlas, with available topographical maps used to identify potential Noise-sensitive developments (NSD) in the area (within the area proposed, as well as potential NSD's up to 2 km from boundary of facilities). The data was imported into GoogleEarth® to allow a more visual view of the areas where Noise-sensitive developments were identified. The presence of these Noise-sensitive developments was also confirmed during a site visit. These noise-sensitive developments are highlighted in **Figure 6.6** and are both located just less than 2km from the closest turbines.

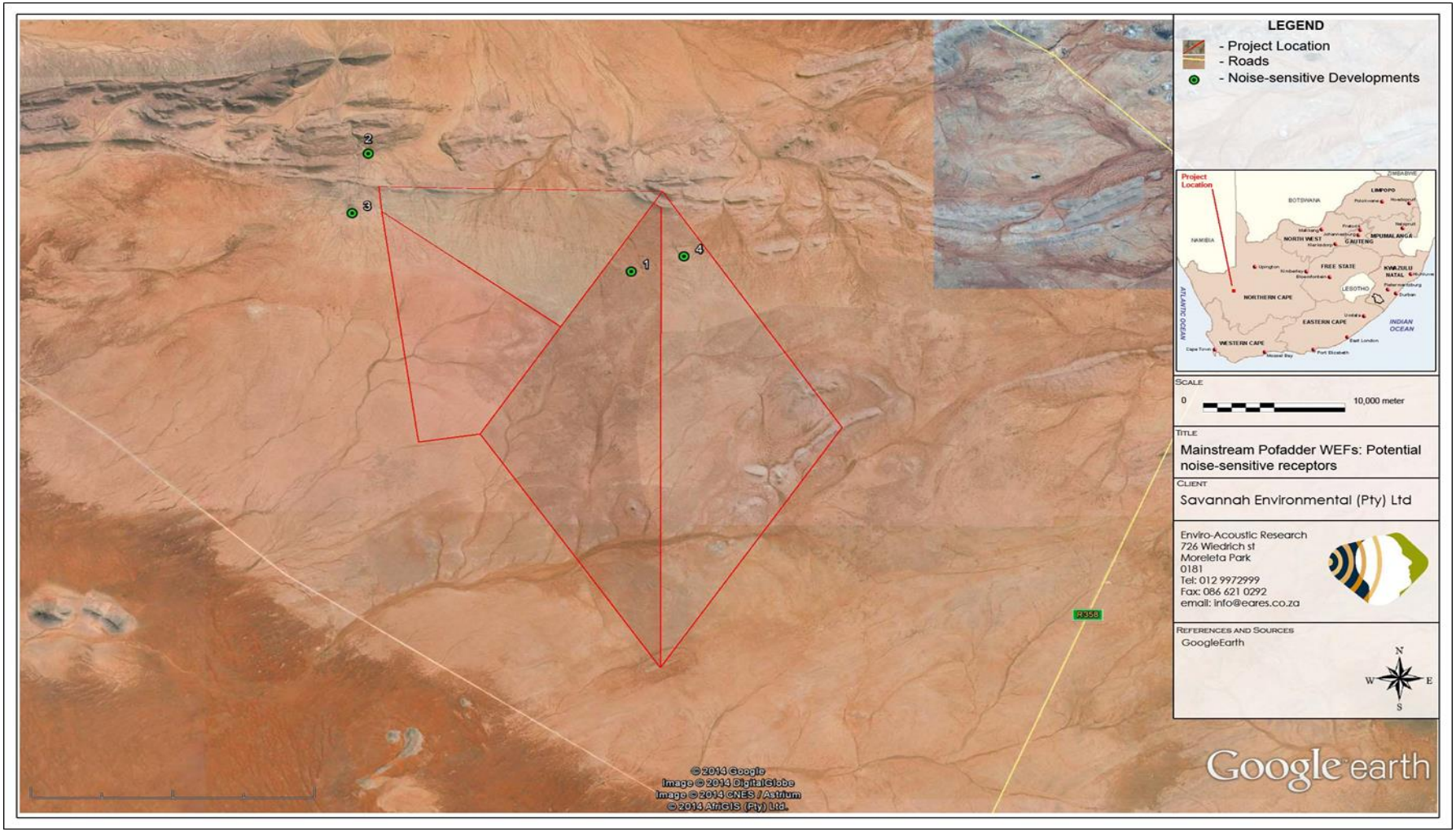


Figure 6.6 Potential Noise Sensitive Developments (green dots) in and around the greater study area

6.6 Heritage and Palaeontological Profile

6.6.1. Palaeontology

The study area for the proposed wind energy facilities is underlain at depth by one to two billion year old Precambrian basement rocks of the Namaqua-Natal Province that are highly metamorphosed and entirely unfossiliferous. Apart from the rugged slopes of the Namiesberge – Die Poort se Berge range of Inselberge on the northern margin of the area and occasional rocky outliers further south, these ancient basement rocks are largely mantled by a variety of Late Caenozoic superficial deposits such as stream alluvium, sheetwash sediments, surface gravels and wind-blown sands that are usually of low palaeontological sensitivity. In general, the various Late Caenozoic superficial sediments represented within the Mainstream study area are either largely unfossiliferous (*e.g.* scree, surface gravels) or only very sparsely fossiliferous (*e.g.* aeolian sands, younger alluvium). In the latter case the fossils concerned are probably of widespread occurrence elsewhere.

Important Miocene vertebrate faunas, including 15 to 16 million year old mammal and reptile remains, are recorded from ancient fluvial sediments of the Koa River Valley (*e.g.* at Bosluis Pan, *c*. 50 km SSW of the study site). This defunct drainage system, a former major tributary of the Orange River, runs from south to north across the Pofadder 1: 250 000 sheet area and is marked by relict pans, fluvial sediments and wind-blown sands. The study area lies just northeast of the potentially fossiliferous Koa River Valley region. However, fossiliferous older (Tertiary / Quaternary) fluvial sediments have not yet been recorded from this northern sector of the Koa River Valley and, if present, they are likely to be deeply buried beneath superficial sediments (*e.g.* younger alluvium, aeolian sands). Likewise the chances of buried fossiliferous crater lake sediments, such as have yielded Cretaceous dinosaur remains at Kangnas *c*. 100 km to the northwest, are considered to be remote within the present study site.

6.6.2. Archaeology

The following heritage indicators were identified in the study area:

» The survey revealed that there is a thin background scatter of Stone Age artefacts over the area which is of very low significance; there are however few concentrations or definable archaeological sites. The material is entirely attributable to the Middle Stone Age.
» The abandoned Namies village ruins lie on either side of the current access route from the N14.

There are no particular areas that need conservation in terms of archaeology/heritage on or near the site proposed for the Poortjies Wind Energy Facility.

ASSESSMENT OF IMPACTS: WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE CHAPTER 7

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

The construction of a WEF project includes land clearing for site preparation and access/haul roads; transportation of supply materials and fuels; construction of foundations involving excavations and concrete pouring; compaction of laydown areas and roadways, manoeuvring and operating cranes for unloading and installation of equipment; building of substations, inverters and power lines, 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 WEF include visual impacts; noise produced by the spinning of rotor blades; avian and 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.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed wind turbines and associated infrastructure (substation, power line, access road/s to the site, internal access roads between turbines, underground electrical cabling between turbines, 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 Environmental Management Programme (refer to **Appendix O**).

In order to assess the impacts associated with the proposed Poortjies Wind Energy Facility, it is necessary to understand the extent of the affected area. The permanently affected area primarily includes the turbines, substation and associated access roads. A WEF is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. The study area for the Poortjies site is being considered as a larger study area for the construction of the proposed WEF. The area to be occupied by turbines and associated infrastructure is illustrated in **Figure 7.1** below, and includes the area covered by the following farm portions:

- Portion 1 of the farm Poortjie 209; and
- Remainder of the farm Poortjie 209.

Further details of the project are found in Table 7.1 below.

Table 7.1: Details of the proposed project

Component	Description/ Dimensions
Municipal Jurisdiction	Khai-Ma Local Municipality
Electricity Generating capacity	100MW
Details of turbines	» Up to 50 wind turbines with a generating capacity of between 1.5 - 4 MW each » Hub height of up to 140m » Rotor diameter of up to 150m
Extent of broader site	~32 km^2 in extent
Internal access	Gravel roads of up to 8m in width
Site access	Via the DR2961, which feeds off the TR8401 and N14
Grid connection[6]	» A 132 kV overhead power line connecting the proposed Poortjies Wind Energy Facility to the proposed Khai-Ma Collector Substation or alternatively to the existing 400kV Aggeneys Substation.
Services required	» 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

[6] 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 Poortjies Wind Energy Facility to the proposed Khai-Ma Connector Substation or alternatively to the existing 400kV Aggeneys 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.

Component	Description/ Dimensions
	waste disposal site. This service will be arranged with the municipality when required. » Water– Water will either be abstracted from local boreholes (subject to relevant approvals if required), or piped or trucked in from Pofadder or Aggeneys.

The assessment presented within this chapter of the report has been compiled on the basis of a facility layout provided by Mainstream. This layout indicates up to **50 wind turbines** as well as associated infrastructure. The assessment of issues presented within this chapter (and within the specialist studies and addendums to these studies attached within **Appendices D – M**) considers the worst-case scenario in terms of potential impacts (i.e. maximum number of turbines which could be implemented on the site).

Potential impacts and associated listed activities applicable to the project are also listed in table 7.2 below.

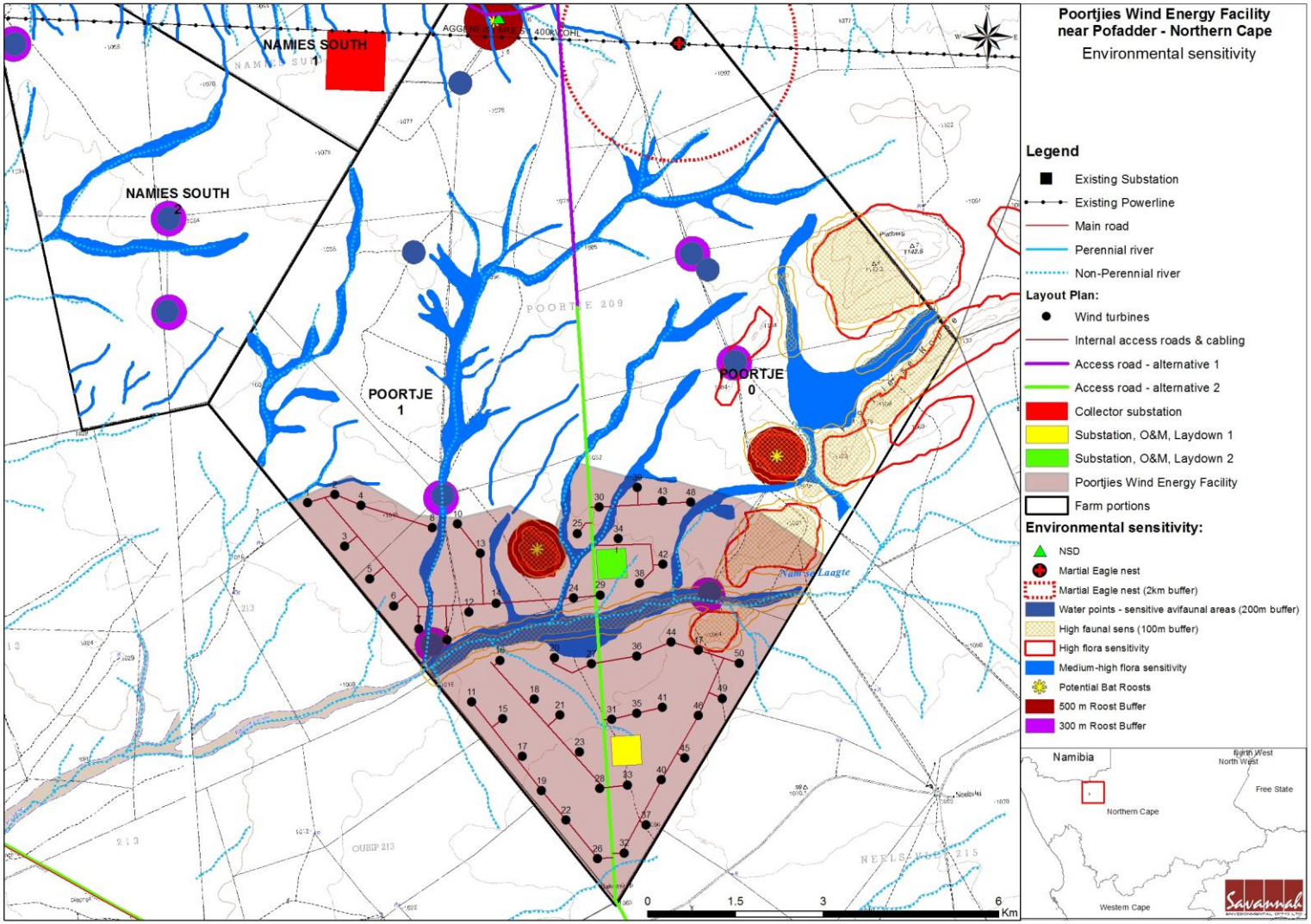


Figure 7.1: Map showing the preliminary layout of the Poortjies Wind Energy Facility

Table 7.2: Potential impacts associated with the Construction/ Decommissioning Phase with the proposed Poortjies Wind Energy Facility

Construction / Decommissioning Impacts	Extent	Applicable listed activities (GN 544, 545 &546 of 18 June 2010)
Impacts on vegetation, listed plant species and critical biodiversity areas	R	GN 544, 26; GN 545, 1; GN 545, 8; GN 545, 15; GN 546, 4 (ii)(ee); GN 546 10 (ii)(ee); GN R546, 14(a)(i); GN 546, 19(ii)(ee) and GN 546, 24(d)(ii)(ee)
Ecological Degradation	L	GN 544, 26; GN 545, 1; GN 545, 8; GN 545, 15; GN 546, 4 (ii)(ee); GN 546 10 (ii)(ee); GN 546, 12(b); GN R546, 14(a)(i); GN 546, 19(ii)(ee) and GN 546, 24(d)(ii)(ee)
Ground Water obstruction	L-R	GN 545, 1, GN 545, 8 and GN 545, 15
Direct Faunal Impacts	L	GN 545, 1; GN 545, 8; GN 545, 15; GN 546 10 (ii)(ee); GN 546, 12(b); GN R546, 14(a)(i)
Disturbance of Birds, particularly breeding species	L	GN 544, 11(iii)(iv)(x)(xi); GN 544, 18(i);GN 544, 39(iii); GN 545, 1; GN 545, 8;GN 545, 15; GN 546, 12(b); GN R546, 14(a)(i) and GN 546, 24(ii)(ee)
Habitat destruction	L	GN 544, 11(iii)(iv)(x)(xi); GN 544, 18(i);GN 544, 39(iii); GN 545, 15; GN 546, 4 (ii)(ee); GN 546 10 (ii)(ee); GN 546, 12(b); GN R546, 14(a)(i) and GN 546, 24(d)(ii)(ee)
Impacts on bats	L	GN 544, 11(iii)(iv)(x)(xi); GN 544, 18(i);GN 544, 39(iii); GN 545, 1; GN 545, 8;GN 545, 15; GN 546, 12(b); GN R546, 14(a)(i) and GN 546, 24(ii)(ee)
Impacts on Avifauna	L	GN 544, 11(iii)(iv)(x)(xi); GN 544, 18(i);GN 544, 39(iii); GN 545, 1; GN 545, 8;GN 545, 15; GN 546, 12(b); GN R546, 14(a)(i) and GN 546, 24(ii)(ee)
Loss of agricultural land	L	GN 545, 1, GN 545, 8 and GN 545, 15
Land surface disturbance and alteration	L	GN 546, 12(b); GN R546, 14(a)(i) and GN 546, 24(ii)(ee)
Loss of topsoil	L	GN 545, 1; GN 545, 8; GN 546, 12(b); GN R546, 14(a)(i); GN 546, 19(ii)(ee) and GN 546, 24(d)(ii)(ee)

7.1 Assessment of Potential Impacts on Flora and Fauna

Impacts on the vegetation are assessed for one wind turbine layout alternative and two substation alternatives. Direct impacts are those that would occur directly on the vegetation as a result of construction of internal access roads and wind turbines and other infrastructure at the proposed Poortjies Wind Energy Facility.

The impacts are considered with respect to:

» Loss of vegetation and habitat, including plant species, due to construction and operational activities.
» Loss of ecological processes due to construction and operational activities.

The vegetation of the WEF study area was sampled during a survey of Poortjies 209/1 and 209/RE and Namies South 212/1 & 212/2 in November 2014 when 43 sample waypoints were recorded. It was found that the vegetation is similar over extensive areas and has low botanical sensitivity. The only areas that require special attention are the seasonal drainage lines which should be treated as ecologically sensitive and should be avoided (refer to Figure 7.2).

The site displays a low level of Red List species occurring on site with regards to the fauna assessed in this report. Of these species the Black-footed cat, Aardvark, Bat-eared fox, Cape fox, Shortridge's Rat, Fisk's house snake, Ludwig's Bustard, Martial Eagle, Baboon spiders, Trapdoor spiders, Girdled lizards and Tent tortoises are likely to occur on site or have been found on site. The Tent tortoises are at most risk to be impacted by vehicles and the Black-footed cat, Aarvark, Bat-eared fox and Cape fox are most at risk to be impacted upon during the construction phase by digging and earthworks.

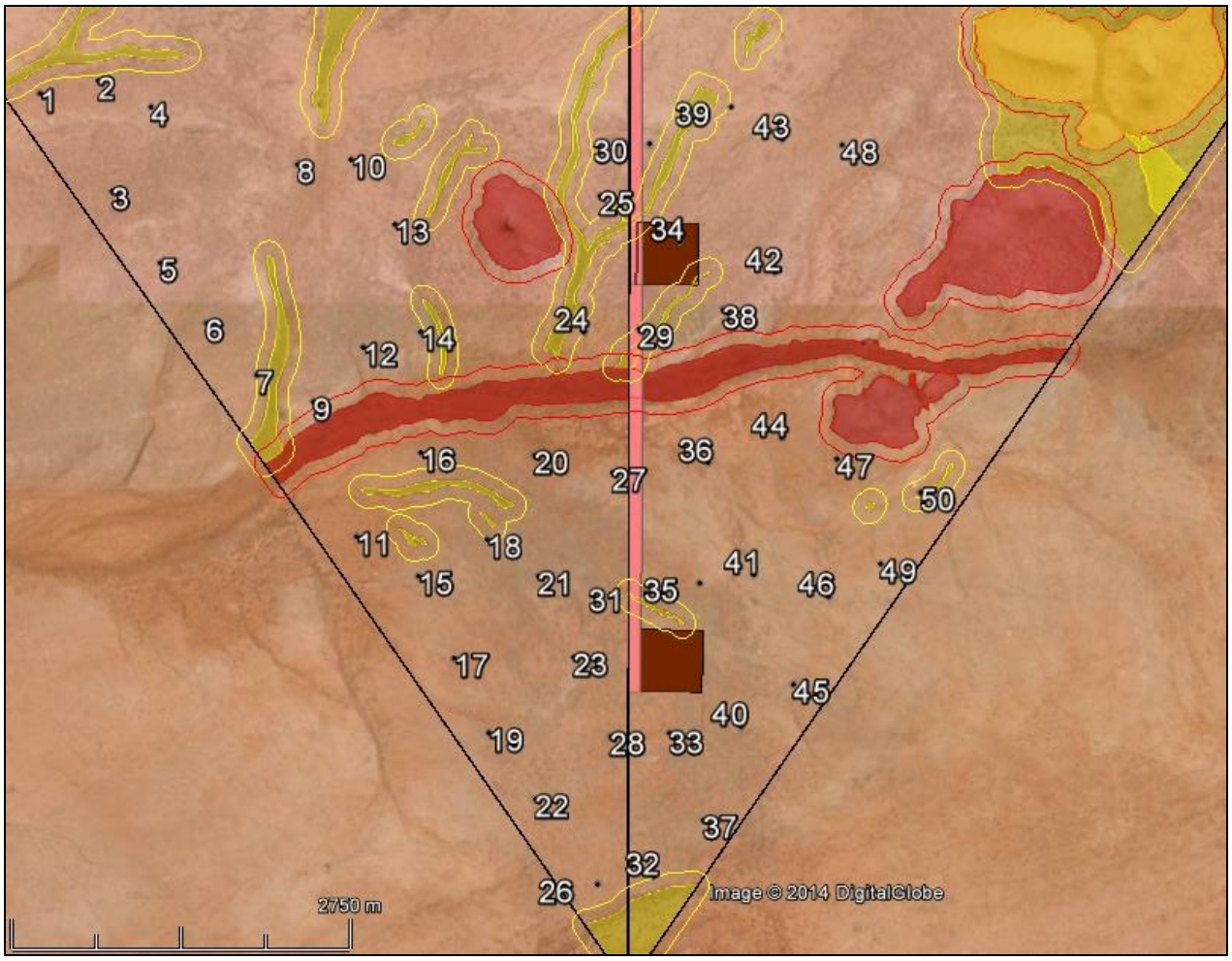


Figure 7.2: Fauna sensitivity map of Poortjies wind energy facility development and associated infrastructure, showing both alternatives for grid connections.

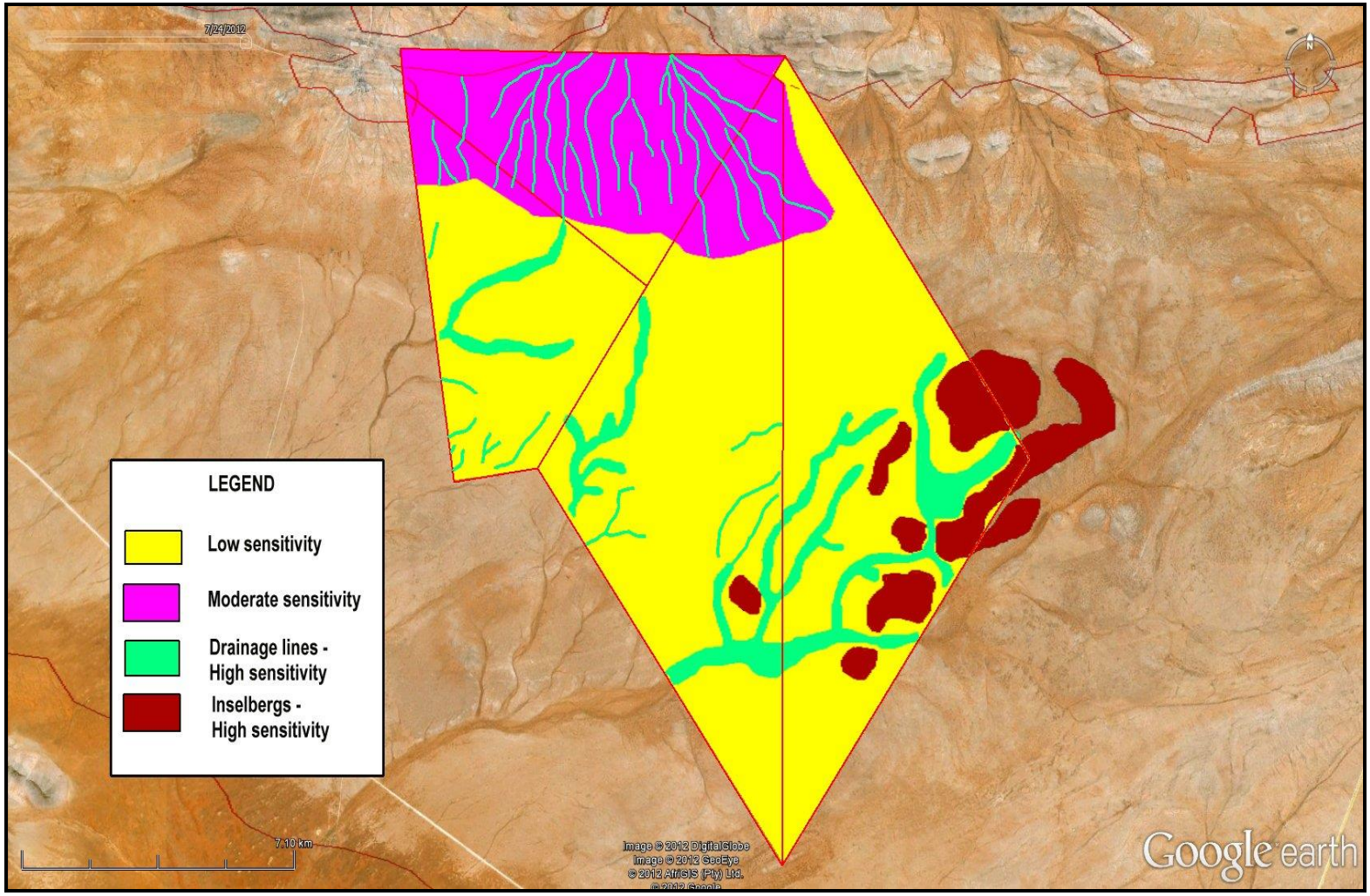


Figure 7.3: Botanical sensitivity map for the greater wind energy facility site

7.1.1 Impacts on vegetation

The vegetation found in the proposed Poortjies Wind Energy Facility area is uniform over large areas. Apart from the seasonal drainage lines (washes) or 'laagtes' which are considered sensitive due to their ecological-linkage value, the open plains have no special plant communities or plant species of conservation concern. The terrain also has low relief. Taken together these factors result in the receiving environment having a high 'absorption capacity'. In other words there is a low probability of impacts being such that they negatively compromise the vegetation, local plants communities and habitats or ecological processes.

Nature: Loss of vegetation and habitat including plant species due to construction and operation of the WEF (access roads, substation and wind turbines).w		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (16)**	**Low (16)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes	

Mitigation:

» The principle mitigation should be avoidance of identified sensitive areas, i.e. seasonal drainage lines and any quartzite koppies.
» No protected trees were found in the study area so no permits would be required for removal of such trees. However, a permit would be required from Northern Cape Province, Department of Environment & Nature Conservation to clear natural vegetation.
» Access roads must be clearly demarcated and strictly observed. There should be no indiscriminate driving of vehicles 'in the veld', i.e. off designated roads and access routes.
» Construction and laydown areas must be clearly marked and no activity should occur outside these areas apart from access.
» Toilet facilities must be provided during the construction phase. The veld should not be used for ablutions.
» Lay-down areas must be levelled and scarified after construction to encourage growth of grasses which would be the first cover species, followed by shrubs.
» No alien invasive species such as *Prosopis* spp. (mesquite) should be introduced.
» Any sensitive plants listed in the flora report must be avoided. If necessary the turbine locations must be reviewed or roads re-aligned to avoid these plants. Appropriate mitigation should be applied if sensitive plants cannot be avoided.
» The Environmental Control Officer (ECO) must oversee pre-construction site cleaning.
» Re-seeding of disturbed sites is not recommended. The veld should be allowed to regenerate unaided.

Cumulative Impacts: There are other wind energy facilities proposed in the area, but the potential for cumulative impacts on ecology would be low if the sensitive areas can be avoided.
Residual Impacts: If the sensitive parts of the site can be avoided, there will be very little residual impacts on the terrestrial environment.

7.1.2 Loss of ecological processes

It is predicted that there would be some negative effect on ecological processes due to the construction of the proposed roads, substation, connector substation and wind turbines in the Poortjies wind energy facility. However, due to the scale of the project in relation to the extent of Bushmanland Arid Grassland, the effects are likely to be small since the receiving environment, apart from the areas identified as botanically sensitive (which equates to ecological sensitivity), is not perceived to be generally ecologically sensitive.

Nature: Loss of ecological processes		
	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (16)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » The principle mitigation should be avoidance of identified sensitive areas, i.e. seasonal drainage lines and any quartzite koppies.		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on riparian habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.		

7.1.3 Impacts on threatened fauna and associated habitat

Nature: Direct and indirect impacts on the local faunal community may occur due to habitat destruction, alteration and disturbance during the construction and operational phase.

	Without mitigation	With mitigation
Extent	Local (2)	Local (1)
Duration	Medium term (3)	Medium -term (3)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Medium (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?		Yes

Mitigation:

- » Any fauna directly vulnerable to the construction activities must be removed to a safe location by a suitably qualified person, the process overseen by the ECO
- » Where possible, vegetation should be rehabilitated to restore faunal biodiversity on site
- » The collection, hunting or harvesting of any fauna on site should be strictly forbidden
- » All staff on site should receive environmental education so as to ensure that no hunting,
    - o indiscriminate killing or harvesting of animals occurs
- » Fires should be limited to within fire-safe demarcated areas
- » No dogs should be allowed on site
- » All hazardous materials must be stored in the necessary containers and in demarcated areas to prevent a spill or contamination of the site. Any accidental chemical, fuel and oil spills should be cleaned up as soon as possible with the appropriate methods
- » No unauthorized persons should be allowed onto the site
- » All vehicles on site need to adhere to a low speed limit to prevent collision with any animals
- » Access and connecting roads should be strictly adhered to during construction as well as during operation
- » Areas of Moderate sensitivity and their buffers should preferably be avoided with turbine placement, laydown areas and other associated infrastructure. Only access and connecting roads may intrude on Moderate sensitivity buffers if no other alternative exists.

Cumulative impacts: Faunal populations will become reduced and may disappear completely from the local area.

Residual impacts: Provided that the development remains out of the demarcated sensitive areas, residual impacts should be minimal.

Nature: The site contains several burrow systems that could potentially be impacted, leading to direct mortality as well as habitat loss if these are dug up. These burrows are utilised by a number of fauna including the Vulnerable and Specially Protected Black Footed cat. Leveling these areas or digging foundations in these areas can have negative

impacts such as direct mortality on animals inhabiting underground burrows.

	Without mitigation	With mitigation
Extent	Local (2)	Local (1)
Duration	Short term (2)	Short -term (2)
Magnitude	High (8)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?		Yes

Mitigation:

The main species of fauna that are of concern, and that may utilise burrows, as well as the months of birth and protection period for young are listed below. Protection period refers to the time needed before young may possibly move out of a burrow by itself during disturbance. Risk period indicates the period when helpless young may be in a burrow, unable to move away from disturbances caused by construction (Skinner & Chimimba, 2005). Data for Aardvark and Pangolins are very limited.

Species	**Birth months**	**Protection period for young**	**Risk period**
Aardvark	June - July	Unknown	June - Unknown
Black-footed cat	Mid Sept – mid Nov	8 weeks	Mid Sept – mid Jan
Pangolin	Mar – mid Sept	5 weeks	Mar - late Oct
Aardwolf	Oct - Dec	8 – 10 weeks	Oct – mid Mar

According to the periods above, the preferred period for construction in affected areas is start of January to end of May. This is limited to actions that will close up, compact, excavate, seal off or damage burrows in any way.

If an area with burrows is to be used, it is recommended that they are investigated first to determine the presence and identity of inhabitants during a **preconstruction survey**. And if inhabited they need to be carefully dug up and the inhabitants evicted and relocated (less than 2km away) in an ethical manner by a suitably qualified and experienced person. Such an exercise is not recommended unless completely necessary.

Cumulative impacts: Impacted faunal populations will become reduced and may disappear completely from the local area.

Residual impacts: As the impact is of a short duration, the residual impacts are low.

Nature: Shy animals would move away from the area particularly during the construction phase as a result of the noise and human activities present

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

Duration	Short -term (1)	Short -term (1)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Low (30)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?		Yes
Mitigation: All traffic, noise and light pollution should be kept to a minimum such that the shy animals return to site soon after the construction phase		
Cumulative impacts: None		
Residual impacts: Shy animals are expected to move back into the areas after construction is completed, thus residual impacts should be minimal.		

Nature: It is possible that tortoises on site may be killed by heavy vehicles and moving machinery during the construction phase, especially when such vehicles are driving through untracked terrain. During the operational phase they may also be killed on access and connecting roads due to an increase of traffic in the area.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?		Yes

Mitigation: Driving should be kept to the already existing and pre-designated access/construction roads only, and drivers be made alert of the possibility of tortoise mortalities. When vehicles/machinery is driven through untracked terrain for the first time, it is recommended that the route to be walked out or slowly driven with an observer assigned to check for tortoises.
During the operational phase, measures (for example speed bumps) should be taken to prevent excessive driving speeds on access and connecting roads.

Cumulative impacts: Significant negative impact on tortoise population may occur from which they may not recover.

Residual impacts: Reduced tortoise population, genetic bottlenecks of populations.

Nature: Disruption of landscape connectivity for fauna could result if the site is fenced off in a manner which prevents the movement of larger and middle-sized mammals. Furthermore, since most such mammals have home ranges which exceed the extent of the site, any mammals trapped within the site would probably not have sustainable resources present.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (6)	Minor (2)
Probability	Probable (3)	Improbable (1)
Significance	**Medium (33)**	**Low (7)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?		Yes
Mitigation: Fencing should only be used where absolutely necessary. Fencing should be constructed in a way that it allows for the passage of small and medium sized fauna. Steel palisade fencing with gaps between bars may be useful to allow most small animals to pass through. If electrified fencing is to be used, the fencing should not be electrified within 50 cm of the ground to prevent mortality of any small fauna, specifically tortoises and snakes. Staff on site need to be vigilant to prevent larger fauna from entering and becoming trapped within any fenced off areas.		
Cumulative impacts: Disruption of landscape connectivity on a large-scale shall interfere with all biological processes of fauna such as foraging, reproduction and migrations.		
Residual impacts: Reduced faunal populations		

7.1.4 Comparative Assessment of Substation Positions and Access Road Alternatives

Both alternative substation positions acceptable. There is no preference in terms of ecological impacts as sensitive areas are avoided.

In terms of access, there is no preferred alternative.

7.1.5 Conclusions and Recommendations

The construction of the proposed Poortjies Wind Energy Facility is considered to be ecologically acceptable as long as the areas identified as sensitive are avoided. Proposed turbines in areas of ecological sensitivity should be relocated in a micro-siting exercise during final design to lower sensitivity locations prior to any construction commencing.

Faunal disturbance during the construction phase of the project is inevitable, this impact will however be temporary and most fauna are likely to return to the area once construction has been completed. Areas of high faunal sensitivity and their buffers must be avoided by turbine placement, laydown areas and other associated infrastructure. Only access and connecting roads may intrude on high sensitivity buffers if no other alternatives exist. Areas of moderate faunal sensitivity and their buffers should preferably be avoided by the infrastructure footprint. However in the case of infrastructure inevitably intruding on moderate faunal sensitivity and its buffers, the proposed mitigation measures must be intensified as needed.

Provided that the mitigation measures as described are implemented, the development of the site should not lead to a significant environmental impact or degradation of the receiving environment. However it is crucial that the EMPr considers the impacts mentioned and make all efforts for the implementation of the proposed mitigation measures where practical, and any other mitigation measures recommended by the suitably qualified person implementing such mitigations.

7.2. Assessment of Potential Impacts on Surface Hydrology

The study area is characterised by several non-perennial water courses that are not always connected to any other main stem systems and typically only carry flows during high rainfall periods for short distances (200m – 10 km1). Surface flow then dissipates within the alluvial areas, finally infiltrating groundwater systems. None of these systems are directly connected to the Gariep River (Previously named the Orange River) (D82C Quaternary catchment).

The Present Ecological State of a natural waterbody represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habitat and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores are currently being revised for the country. This revision is based on new models that will incorporate aspects of functional importance as well as direct and indirect impacts (DWS, 2014). The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in

the old model. The new model is still heavily centered on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators.

The PES scores for the respective catchments as per the recent 2014 DWS data was B or largely Natural for the D82B, D82C and D81 catchments. Based then on this latest model and information collected during the site visit, these ratings remained unchanged for all the systems within the study area.

The Ecological Importance and Ecological Sensitivity (EI & ES) for these systems was rated as Moderate. The overall EI & ES scores for all the systems within the site could have been higher, but scores were reduced due to the presence of erosion, sedimentation and road networks.

Nature: ***Loss of riparian systems***

The physical removal of the narrow strips of riparian zones within the project area and transmission line alignments is possible should any new roads or turbines be located in these areas. This biological impact would be limited by locating all infrastructure outside of the delineated areas and the 32m buffer.

One of the existing roads (S29.303329°: E 19.208749°) will be widened as well as raised from natural ground. This would result in the loss of riparian vegetation.

	▪ **Without mitigation**	**With mitigation**
Extent	Site (2)	▪ Local (1)
▪ **Duration**	Short-term (2)	▪ Long-term (4)
▪ **Magnitude**	Moderate (6)	▪ Low (2)
▪ **Probability**	Probable (3)	▪ Improbable (1)
▪ **Significance**	**30 (medium)**	▪ **Low (7)**
▪ **Status (positive or negative)**	Negative	▪ Negative
▪ **Reversibility**	▪ Yes (high)	▪ High
▪ **Irreplaceable loss of resources**	▪ Yes (medium)	▪ No
▪ **Can impacts be mitigated**	▪ Yes (high)	Yes (High)

▪ **Mitigation:**

» All wind turbines, towers and infrastructure is placed outside of the demarcated water course and alluvial rivers.

» No new structures must be placed within the active channels (lowest part of the water course, where water has flowed in the recent past).

» Vehicles should be limited from crossing the broader alluvial systems to either existing routes or access these areas from the opposite ends where suitable.

» Where existing road crossings need to be upgraded the following mitigation is proposed:

» Additional energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but would support the maintenance of natural base flows within

these systems, i.e. hydrological regime (water quantity and quality) is maintained.

» Any crossings must be designed in such a manner so as not to impede or divert any baseflows or increase upstream flood inundation. The use portal culverts spanning up to 2m are suggested for the large crossings and pipe culverts for the smaller crossings. It is however recommended that box culverts be selected over pipe culverts as they are less restrictive in terms of flow and also aid in reducing habitat fragmentation.

- **Cumulative impacts:**

Three additional projects are proposed within the study area (same farm portions) and this could have an impact on run-off and riparian systems should a large number of new roads with crossings are required.

- **Residual impacts:**

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site was considered but is unlikely.

Nature: ***Increase in sedimentation and erosion***		
	▪ **Without mitigation**	**With mitigation**
Extent	▪ Local (1)	▪ Local (1)
▪ **Duration**	▪ Long-term (4)	▪ Long-term (4)
▪ **Magnitude**	▪ Low (1)	▪ Low (1)
▪ **Probability**	▪ Probable (3)	▪ improbable (1)
▪ **Significance**	▪ **Low (18)**	▪ **Low (6)**
▪ **Status (positive or negative)**	▪ Negative	▪ Negative
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	

- **Mitigation:**

Clearing of vegetation should be kept to a minimum and any areas that were used as laydown or construction camps areas must be rehabilitated.

- **Cumulative impacts:**

Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) will form. However due to type of water courses within the region this is not anticipated.

- **Residual impacts:**

During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) will form. However due to type of water courses within the region this is not anticipated and furthermore the nature of the development together with the proposed layout does not lend itself to such impacts.

Nature: ***Impact on localized surface water quality***

During both preconstruction, construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement

powder, wet cement, shutter-oil, etc.) associated with construction camp clearing machinery and construction activities could be washed downslope via the ephemeral systems. Along with this could be contamination from human waste if not properly managed.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (1)	Improbable (1)
Significance	**5 (low)**	**5 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	

Mitigation:

» Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.
» Strict use and management of all hazardous materials used on site.
» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).
» Containment of all contaminated water by means of careful run-off management on the development site.
» Strict control over the behaviour of construction workers.
» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.

Cumulative impacts:
None.

Residual impacts:
Residual impacts will be negligible after appropriate mitigation.

7.2.1. Comparative Assessment of Substation Position and Access Road Alternatives

There is therefore no preference between the two positions or access routes when considering hydrology.

7.2.2. Conclusions and Recommendations

The proposed layout of the project area and transmission line alignments would seem to have a negligible impact on the aquatic environment. This is based on the assumption that no infrastructure and transmission towers will be placed directly within any active channels. Furthermore, during the site visit, no protected or species of special concern (fauna & flora) were observed within the aquatic areas. Therefore based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be LOW.

It is however recommended that the proponent does apply for the appropriate Section 21 c & I Water Use licenses from the Department of Water and Sanitation should any activities occur within a water course, e.g. access roads and/ or road crossings if unavoidable. However no activities will occur near or within 500m of any wetland boundary, thus any application to the Department should only require a General Authorisation not a Water Use License with regard the road crossing upgrades.

7.3 Assessment of Potential Impacts on Avifauna

The pre-construction bird monitoring programme for the site was conducted over four seasons. The purpose of the bird pre-construction monitoring programme was to inform the findings of the avifauna impact assessment in line with the Best Practice Guidelines for bird monitoring, and to ensure that appropriate mitigation measures are recommended. This approach also aimed to ensure that the DEA has sufficient information on which to make a decision. The monitoring programme was initiated in order to collect data to characterise the bird community (baseline) at the Wind Energy Facility site and a control site. The monitoring programme was designed to include a minimum of 6 surveys across all four seasons to record data across all seasons. The baseline data from the bird monitoring programme has been considered in the avifaunal assessment to support the EIA field survey (refer to Appendix G).

A total of 83 species were recorded at the study area (i.e. the turbine area, control areas and immediate surroundings) from all data sources (drive transects, walk transects, VP watches, focal point counts and incidental sightings), of which 11 are priority species.

Table 7.2 below lists all the priority species that could potentially occur at the site and the potential impact on the respective species by the development infrastructure.

Table 7.2: Target / priority species for the study area relative to their conservation status and established risk of mortality due to collision with wind energy facility structures (see text below for explanation).

Name	Regional threatened status (Taylor 2014)	Global threatened status (IUCN 2014)	BLSA/EWT Priority rating (on scale of 170 – 395)	Likelihood of occurrence	Potential impact
Secretarybird	VU	VU	320	Medium. Recorded as an incidental sighting on neighbouring farm.	Ct, Cp, Dd,
Kori Bustard	NT	Least concern	280	Low. The species is generally associated with dry riverbeds with trees, but also occur in open dune veld. May occur sporadically.	Ct, Cp, Dd,
Lanner Falcon	VU	Least concern	280	High. Recorded as an incidental sighting on neighbouring farm. Most likely to perch on the transmission and telephone lines running through the site, but may also be attracted to the water points where it hunts small birds.	Ct
Red Lark	SAE, VU	VU	260	Confirmed. Recorded sparsely, mostly in drainage lines. Most of the site is probably not optimal for the species, as it is most often associated with red sand dunes and sandy plains with large-seeded grasses e.g. the Koa Valley south of the site. However, the drainage lines do contain some suitable habitat.	Dd, Dh
Sclater's Lark	SAE, NT	NT	240	Confirmed. The species was recorded incidentally during monitoring, but large sections of the habitat seem suitable, i.e. stony arid to semi-arid plains with scattered shrubs, grasses and extensive bare patches. The species is nomadic and may occur sporadically.	Dd Dh

VU Vulnerable
NT Near threatened
EN Endangered
SAE Southern African endemic or near endemic

Ct Collisions with turbines
Cp Collisions with power line
Dd Displacement through disturbance
Dh Displacement habitat transformation

Wind energy facilities have three forms of impact on birds – habitat destruction, population displacement, and, in particular, mortality through collisions. These potential impacts are assessed below.

7.3.1. Displacement of Birds due to Disturbance

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance in effect can amount to habitat loss. Displacement may occur during both the construction and operational phases of wind farms, and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or as a result of vehicle and personnel movements related to site maintenance. The scale and degree of disturbance will vary according to site- and species-specific factors and must be assessed on a site-by-site basis (Drewitt & Langston 2006).

For the proposed Poortjies Wind Energy Facility, none of the recorded priority raptor species are expected to be permanently displaced from a foraging perspective, although temporary displacement during the construction phase is possible. Unless mitigated with appropriate buffer zones around nests, both Martial Eagle and Southern Pale Chanting Goshawk could potentially be displaced as a breeding species, but they would most likely continue to use the site for foraging.

Of the large terrestrial priority species that occur or are likely to occur on the site, Ludwig's Bustard are most likely to be affected by displacement. Bustards are very sensitive to disturbance, and will readily vacate an area due to the presence of human activity. It is possible that a percentage of birds may return once the construction activity is finished, but it is unlikely that the numbers will recover to pre-development levels. No evidence of any bustard display sites (leks) was found during any of the surveys.

Temporary displacement of Karoo Korhaan and Northern Black Korhaan are likely during the construction phase, but numbers will most likely recover substantially during the operational phase. However, due to the lack of precedents, this will only be confirmed once post - construction monitoring is implemented and such re-colonisation may only happen after a few years.

If displacement of Red Lark happens due to the construction and operation of the wind farm, the cumulative impact of several wind farms may constitute a significant impact as the species is a Red Data range restricted endemic. However, the species was not recorded in large numbers on the site, and based on the existing information on the displacement of passerines by wind farms, it is unlikely that the species will be displaced. Furthermore, the distribution records for this bird indicate a preference for drainage lines, where no turbines will be constructed.

Based on the data currently available, none of the priority species recorded at the site are likely to be permanently displaced by the operations of the wind farm. This will have to be confirmed through the post- construction monitoring, especially for Ludwig's Bustard and Red Lark.

Nature: Movement and noise during the construction process is likely to impact all birds in the immediate area. Larger species will be the most affected.		
	Without mitigation	***With mitigation***
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (27)**
Status	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Partially	

Mitigation:

» A 200m no-go buffer is proposed around water points to prevent disturbance and displacement of breeding Southern Pale Chanting Goshawks.

» A 50m no-turbine buffer is proposed around drainage lines (optimal Red Lark habitat). A total exclusion zone will not be feasible, as the internal road network will have to cross drainage lines at some point. However, the construction of infrastructure in drainage lines should be kept to an absolute minimum, and avoided where possible.

» Formal monitoring should be resumed once the turbines have been constructed, as per the most recent edition of the best practice guidelines (Jenkins et al. 2011). The purpose of this would be to establish if displacement of priority species has occurred and to what extent. The exact time when post-construction monitoring should commence will depend on the construction schedule, and will be agreed upon with the site operator once these timelines have been finalised.

» As an absolute minimum, post-construction monitoring should be undertaken for the first two (preferably three) years of operation, and then repeated again in year 5, and again every five years thereafter. The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the results of the monitoring through a process of adaptive management.

» Construction activity should be restricted to the immediate footprint of the infrastructure, and in particular to the proposed road network. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.

Cumulative impacts:

There are currently 4 applications for wind energy facilities within a 100km radius around Pofadder, which will result in the construction of approximately 370 wind turbines. It is difficult to gauge at this stage how severe the cumulative displacement impact of all these proposed wind developments will be on priority species in the Karoo bioregion, firstly because for many species (e.g. Red Lark) inadequate baseline population data

exists, and secondly because the extent of actual impacts will only become known if the wind farms are actually developed and post-construction monitoring is implemented. It is therefore imperative that post-construction monitoring is implemented at all the proposed sites, in accordance with best practice. This will provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species, especially for future developments in the region. Within the context of the previous statement and without detracting from it in any way, it could be speculated that because the priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (possible exceptions are Red Lark and Sclater's Lark which are more range restricted), the cumulative impacts would be locally significant, rather than regional or national. The potential significance of those local impacts will only become known once the number of wind farms to be developed in the Karoo bioregion is known, and the results of current studies become known.
Residual impacts: Strict access control and implementation of buffer zones during the construction phase will limit the impact of disturbance to some extent, but the construction activities will have some temporary displacement impact. It is possible that a percentage of birds may return once the construction activity is finished, but it is unlikely that the numbers will recover to pre-development levels, especially the larger terrestrial species.

7.3.2. Bird Mortalities due to collisions with wind turbines

The crucial issue of concern is mortality of birds through collision with the turbine rotor blades and the degree to which such mortality is acceptable for particular groups or species of birds. The risk of collision mortality varies in several general ways and these affect the manner in which collision mortality can be mitigated.

In general, little flight activity of priority species was recorded during the vantage point (VP) watches, with an overall passage rate for priority species over the VP observation area (all flight heights) of 1.15 birds/hour. Based on the amount of time spent at turbine height, flight characteristics and morphology, Ludwig's Bustard emerged as the species with the highest potential collision risk score, i.e. with a risk rating 44.57 times higher than the median risk rating for priority species. The recorded flight patterns of Ludwig's Bustards at the site are predominantly east – west in orientation, with most flights occurring in autumn. This correlates with recorded migration patterns for the species. However, based on international data, bustards as a family are not known to be particularly susceptible to turbine collisions.

Southern Pale Chanting Goshawk emerged as the species with the second highest collision risk with a risk rating 6.75 times higher than the median risk rating for priority species. Flight activity of Southern Pale Chanting Goshawk was mostly concentrated around nests near water points. Northern Black Korhaan emerged with a collision risk slightly lower than Southern Pale Chanting Goshawk with a risk rating 6.69 times higher than the median risk rating for priority species. Most flight

activity took place in summer, when display activity is at a peak. None of the recorded priority passerines species, namely Red Lark and Sclater's Lark, were recorded at rotor height, although flight activity of Sclater's Lark below turbine height was substantial. The potential for collisions with the wind turbines at night due to the presence of lights is not envisaged to be a major contributing factor at the Pofadder site, primarily because the phenomenon of mass nocturnal passerine migrations is not a feature of the study area. It may however heighten the risk of collisions for Spotted Eagle-Owl, if insects are attracted to the lights which in turn attract the birds.

From a statistical perspective, it would seem that the survey effort was sufficient to produce a reasonably reliable set of data to draw conclusions from.

From a potential collision perspective no relocation of turbine positions is required based on the results of the pre-construction monitoring.

Nature: Collision of birds with wind turbines		
	Without mitigation	***With mitigation***
Extent	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes

Mitigation:

» From a potential collision perspective no relocation of turbine positions is currently required.

» A 1.5km no-go buffer is proposed around the Martial Eagle nest situated at 29°19'49.65"S 19°20'34.87"E.

» Should the Martial Eagle nest become occupied before construction commences, it is recommended that the flight activity of the juvenile Martial Eagle be monitored through monthly direct observations from October – March, i.e. after fledging until it leaves its natal territory. Such monitoring will be to assess the flight patterns of the juvenile eagle during this period when it will be most vulnerable to potential collision. This should give an indication of the extent of the potential curtailment (if any) that would be required to minimise the risk of collisions, i.e. which turbines and for what period. This monitoring should be conducted pro-actively, i.e. before the first turbines are constructed in order to have baseline information available on flight behaviour before the turbines become operational. This will help in the pro-active identification of high risk areas which could form the focus of subsequent monitoring.

» A 200m no-go buffer is proposed around water points as they serve as focal points for raptor activity.

- » Formal monitoring should be resumed once the turbines have been constructed, as per the most recent edition of the best practice guidelines (Jenkins et al. 2011). The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of adaptive management. The purpose of this would be (a) to establish if and to what extent displacement of priority species has occurred through the altering of flight patterns post-construction, and (b) to search for carcasses at turbines.
- » As an absolute minimum, post-construction monitoring should be undertaken for the first two (preferably three) years of operation, and then repeated again in year 5, and again every five years thereafter. The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of adaptive management.
- » The environmental management plan should provide for the on-going inputs of a suitable experienced ornithological consultant to oversee the post-construction monitoring and assist with the on-going management of bird impacts that may emerge as the post-construction monitoring programme progresses.
- » Depending on the results of the carcass searches during operational monitoring, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, including selective curtailment of problem turbines during high risk periods.
- » If turbines are to be lit at night, lighting should be kept to a minimum and should preferably not be white light. Flashing strobe-like lights should be used where possible (provided this complies with Civil Aviation Authority regulations).
- » Lighting of the wind farm (for example security lights) should be kept to a minimum. Lights should be directed downwards (provided this complies with Civil Aviation Authority regulations).

Cumulative impacts:

There are currently 4 applications for wind energy facilities within a 100km radius around Pofadder, which will result in the construction of approximately 370 wind turbines. It is difficult to guess at this stage how severe the cumulative collision mortality impact of all these proposed wind developments will be on priority species in the Karoo bioregion, firstly because for many species no or inaccurate baseline population data exists, and secondly because the extent of actual impacts will only become known if the wind farms are actually developed and post-construction monitoring is implemented. It is therefore imperative that post-construction monitoring is implemented at all the proposed sites, in accordance with best practice. This will provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species, especially for future developments in the region. Within the context of the previous statement and without detracting from it in any way, it could be speculated that because the priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (possible exceptions are Red Lark and Sclater's Lark which are more range restricted), the cumulative impacts would be locally significant, rather than regional or national. The potential significance of those local impacts will only become known once the number of wind farms to be developed in the Karoo bioregion is known, and the results of current studies become known. It should also be borne in mind that power lines kill many bustards in the Karoo (Shaw 2013), therefore any additional mortality may well have a more significant impact than what is evident at first glance. For some large raptors, e.g. Martial Eagle,

this would also be true.
Residual impacts: Some mortalities will occur regardless of mitigation.

7.3.3. Comparative Assessment of Substation Positions and Access Road Alternatives

Some bird habitat loss will occur at the substation footprints and access road regardless of the positions or routes selected. Neither substation position falls into an area deemed sensitive in terms of avifauna. There is therefore no preference between the two positions or access routes when considering avifauna.

7.3.4. Conclusions and Recommendations – Avifauna

The proposed Poortjies Wind Energy Facility will have a moderate impact on avifauna which could be reduced to low through appropriate mitigation. There will however be residual impacts which cannot be entirely eliminated by the proposed mitigation.

The significance of the potential mortality due to collisions with the wind turbines is rated as medium which can be reduced to low with appropriate mitigation.

The significance of the potential displacement due to the habitat transformation associated with the wind turbines and associated infrastructure is rated as medium which can be reduced to low with appropriate mitigation.

The priority species that could potentially be most affected by displacement due to habitat change and loss is the Ludwig's Bustard, Karoo Korhaan and to a lesser extent the Red Lark. However, due to the small footprint, displacement linked directly to habitat loss is not likely to be a major impact.

7.4 Assessment of Impacts on Bats

A bat monitoring strategy for the proposed development was created in accordance with best practice guidelines. The survey approach focused on the use of passive acoustic monitoring to record bats across the development. Vegetation types, landscape features important for bats (e.g. potential roosts and water), road access and the size of the site were assessed to determine the number and locations of bat detectors.

7.4.1. Bat Communities

Bat species composition was the same at all seven detector locations and activity was dominated by three species: the Long-tailed serotine, the Cape

serotine and the Egyptian free-tailed bat According to the Guidelines, these species (all classified as Least Concern) have the potential to be at risk from WEFs because they display foraging behaviour that may bring them within the rotor-swept zone. The Long-tailed serotine and Cape serotine forage at a range of heights including near to the ground, on the edge of vegetation and in open air several meters above the ground. This may bring these species into the range of the lower sweep of the turbine blades. The Egyptian free-tailed bat is a high flying species which forages in open areas and is therefore at risk of encountering wind turbine blades across most of the rotor-swept zone. Egyptian free-tailed bats are therefore identified by the Guidelines as being at High risk. Monitoring at operational WEFs in South Africa has confirmed that Cape serotine and Egyptian Free-tailed bats have suffered mortality (Aronson et al. 2013; Doty & Martin 2012).

Natal long-fingered bats were also recorded at the site but in low numbers. This species also forages across a range of heights and habitats (Jacobs 1999) which may bring them into the range of the rotor-swept zone. This species has the highest conservation status of the four species recorded being listed as Near-threatened and having a Medium-high fatality risk with WEFs (Table 3.1). This is a migratory species (Miller-Butterworth et al. 2003; Monadjem et al. 2010) and is protected under the Convention on the Conservation of Migratory Species of Wild Animals. The majority of bat mortalities at wind energy facilities in North America are migratory species (Baerwald et al. 2014; Cryan 2011; Kunz et al. 2007b) while in Europe both resident and migratory species are impacted (Lehnert et al. 2014; Voigt et al. 2012). It is therefore assumed that the Natal long-fingered bat is at risk from wind turbines in South Africa. This species migrates during autumn (April and May) and spring (September and October) between summer maternity roosts and winter hibernating sites, and is reported to migrate distances from approximately 150 km to 560 km (Miller-Butterworth et al. 2003; Monadjem et al. 2010). However, the monitoring data suggest that this species does not migrate through the site, at least in 2014, but multi-year monitoring is needed to confirm this assumption.

7.4.2. Habitat for Bats on the Site

The proposed development is located in the Nama Karoo Biome and the landscape is dominated by open, relatively flat sandy plains. The Development has low mountains to the north, several koppies bordering to the east and encroaching across its boundary and low inselbergs in some areas. These geological features have rocky crevices which could be used as roosts by some bats. Seasonal drainage lines run from northeast to south-west across the development. The vegetation is dominated by low growing shrubs, bunch grasses and short woody shrubs. The density of the vegetation is predominantly low. The

principal land use is sheep farming and no crops are cultivated. There are very few trees but some are associated with farmsteads in the north of the development and with several livestock kraals. Farm dams and drinking troughs are also located at these kraals and at the farmsteads. Bats could roost in cavities in these trees, among foliage on the trees or in farm buildings.

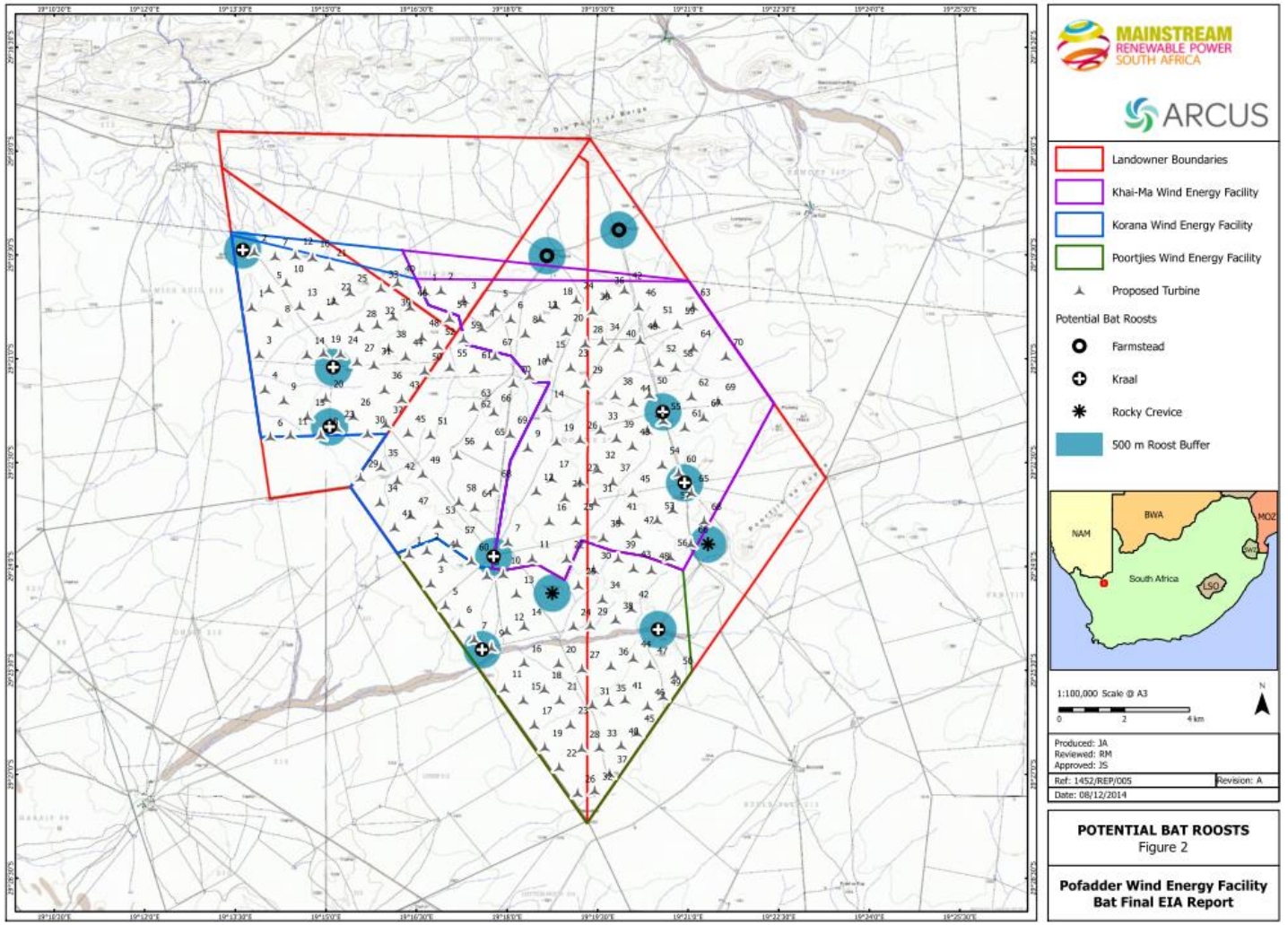


Figure 7.4: Possible bat roosts identified through the pre-construction monitoring undertaken within the greater study area

7.4.3. Disturbance and/or destruction of bat roosts due to construction activities

Wind Energy Facilities have the potential to impact bats directly through the physical destruction of roosts. Roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. Reducing roosting opportunities for bats is likely to have negative impacts. However there are few roosting opportunities for bats in the proposed WEF so this impact should be low.

Nature of impact: **Destruction of bat roosts due to earthworks and blasting**		
	Without mitigation	**With mitigation**
Extent	High (3)	Low (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (4)	Unlikely (2)
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 . » 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: Foraging habitat loss		
	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.
» 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: Large-scale foraging habitat clearence due to the development of other renewable projects in the area will 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.

	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: Large-scale foraging habitat clearence will 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.

7.4.4. Mortality of bat species through collision with turbines or barotrauma caused by turbines operation

The most significant potential impacts on bat communities can occur during the operation phase. These impacts are mostly related with bat mortality due to collision with turbine blades or barotrauma. The potential collision risk is not the

same for all bat species and it varies according to the species' habits and ecology. Certain bat habits, such as migration, high flight, clutter-edge foraging or open air foraging, contribute to species susceptibility to collision (EUROBATS, 2013). On the other hand the barotrauma phenomenon is caused by the change of pressure on the back side of the blade, so the specimens do not contact directly with the blades. Once more, the species that fly at blade height are susceptible to suffer barotrauma. In South Africa the information regarding bat behaviour is still scarce so the measurement of collision risk can be difficult to predict.

Nature of the impact: Bat mortalities due to direct blade impact or barotrauma during foraging activities (no migration)		
	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: » Apply mitigation measures to any further layout revisions. » Avoid areas of High bat sensitivity and their buffers as well as preferably avoid areas of Moderate bat sensitivity and their buffers.		
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.		

7.4.5. Comparative Assessment of Substation Positions and Access Road Alternatives

There is no evidence to suggest that bats which are common to the area are affected by the substations in any way. For this reason, there is no preference between the two substation positions when considering the bat community.

There is no preference in terms of access route alternatives for bats as either option will result in similar impacts on bats.

7.4.6. Conclusions and Recommendations

Based on over 12 months of pre-construction monitoring, bat activity is moderate relative to other sites based on the experience of the Specialist. Four species were recorded, the most active three of which are of "Least Concern" and the other of which is "Near Threatened". Activity varies across the proposed development with higher activity near the tubular met mast, considered likely to be because of proximity to potential roost sites. Lower activity was recorded at height at this mast. Activity is highest in summer at all the monitoring locations and very little activity was recorded in autumn, winter and spring, except for at the met mast where activity persisted throughout the monitoring period. On average across a night bat activity was low and concentrated in the early evening for up to two hours. On the basis of these results, it is considered that design and mitigation measures would allow a wind energy facility can be developed on the development without an unacceptable risk to bats.

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

The following are identified as potential impacts of the development on agricultural resources and productivity, and assessed in the table formats below. There are two important factors that influence the significance of agricultural impacts. The first is the fact that the proposed site is on land of very limited agricultural potential, which is classified as non-arable, low potential grazing land. The second is that the actual footprint of disturbance of the wind farm is very small in relation to the available grazing land on the affected farm portions.

From an agricultural impact perspective, land on this site is ideally suited to renewable energy development because of its very limited production potential. It is agriculturally strategic to steer as much of the country's renewable energy development as possible to such land. It does not therefore make sense on this site to impose any agricultural limitations to renewable energy. Instead of

preserving the viability of farm portions, this limitation can prevent marginal farm portions from achieving economic viability through rental to renewable energy development.

7.5.1. Impact on the project on Land-use & Agricultural Potential

Nature of Impact: Loss of land with high agricultural potential and land capability due to the development of the wind energy facility		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	N/A
Duration	Long term (4)	N/A
Magnitude	Small (1)	N/A
Probability	Definite (5)	N/A
Significance*	**Medium (30)**	N/A
Status (positive or negative)	Negative	
Reversibility	Medium	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: None.		
Cumulative impacts: There will be an overall greater loss of agricultural land in the region due to other developments, of which several are proposed. The significance is low due to the extremely limited agricultural potential of the land in the area.		
Residual Impacts: N/A		

7.5.2. Soil Erosion / Degradation during Construction

Activities / infrastructure that may have an impact on soils include:

- Wind turbines (i.e. construction and positioning of the concrete foundations of the wind turbines, positioning and construction of underground cabling between the wind turbines, laydown areas and crane pads);
- Construction and positioning of an on-site substation;
- Construction and positioning of a workshop, office, maintenance and storage area;
- Construction and positioning of internal access roads; and
- Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment).

Nature: Soil erosion on construction sites during and after the construction phase due to decreased vegetation cover and increased water run-off. Caused by: alteration of run-off characteristics due to hard surfaces and access roads, and disturbance of surface cover and consequent exposure to wind erosion;

And having the effect of: loss and deterioration of soil resources.		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (3)
Probability	Probable (3)	Very improbable (1)
Significance	**Low (27)**	**Low (8)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Implement an effective system of run-off control, where it is required, that collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development.		
Cumulative Impacts: A number of construction sites in the area would have a cumulative impact in terms of erosion.		
Residual Impacts: Minor – Localised movement of sediment. Slow regeneration of soil processes.		

7.5.3. Loss of Topsoil During Construction

There is likely to be some loss of topsoil in disturbed areas during construction, causing a decline in soil fertility in those areas.

Nature: Topsoil loss is caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.). The effect is one of: loss of soil fertility on disturbed areas after rehabilitation		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (3)	Minor (2)
Probability	Probable (3)	Very improbable (1)
Significance	**Low (18)**	**Low (5)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Strip and stockpile topsoil from all areas where soil will be disturbed. » After cessation of disturbance, re-spread topsoil over the surface.		

» Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land (for example use as road surfacing), or where they can be effectively covered with topsoil.
Cumulative impacts: » A number of construction sites in the area would have a cumulative impact
Residual impacts: » Minor negative – slow regeneration of soil processes in and under topsoil

7.5.4. Degradation of Veld Vegetation during Construction

Destruction of vegetation by vehicles will cause degradation of veld during the construction phase of the wind energy facility. This may impact on grazing potential.

Nature: Degradation of veld vegetation caused vehicles and deposition of dust		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)
Significance	**Low (15)**	**Low (8)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Minimize road footprint and control vehicle access on roads only. » Control dust as per standard construction site practice.		
Cumulative impacts: » None.		
Residual impacts: » Minor negative		

7.5.5. Soil Contamination / Soil Erosion during the Operation

During the maintenance activities (operations) of the site, the possibility for soil contamination exists in the event of spillage of oils, fuels or hydrocarbons used for maintenance of the wind turbines, substation or power line. In addition, spillage of fuels from vehicles may occur. These impacts on soil can be mitigated to a low significance.

Nature: Increased pollution of soil by contaminants (e.g. fuel, oil, chemicals, cement).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)

Duration	Medium term (2)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation: » Control storage, use and disposal of potential contaminants or hazardous materials – refer to EMPr Appendix for further details. » Remove contaminants and contaminated topsoil and replace topsoil in affected areas. » Implement measures to avoid /reduce chemical spillages during the operation of the facility (such as spill kits).		
Cumulative impacts: » The cumulative impact of soil pollution is considered low due to the undeveloped nature of the study area.		
Residual impacts: » Minor negative – slow regeneration of soil processes in and under tops.l		

7.5.6. Comparative Assessment of Substation Positions and Access Road

There are no significant differences in terms of agricultural impact between any of the proposed alternatives.

7.5.7. Conclusions and Recommendations

The development of the wind energy facility will have low to low negative impacts on agricultural and soil resources and productivity. The significance of all agricultural impacts is influenced by two important factors. Firstly the site has extremely limited agricultural potential, with a land capability of class 7, non-arable, low potential grazing land. The site is used only for low intensity grazing. The grazing capacity is 38 hectares per large stock unit. Secondly the actual footprint of disturbance of the wind farm is very small in relation to available grazing land on the affected farm portions.

No agriculturally sensitive areas occur within the proposed development footprint. Soils are predominantly extremely shallow, sandy soils of the Coega soil form with an underlying hard pan carbonate horizon, but also include Plooysburg, Mispah, Glenrosa and Knersvlakte soil forms. The major limitations to cultivation are the aridity and lack of access to water, as well as the extremely shallow, sandy soils.

The conclusion of this assessment is that from an agricultural impact perspective the development can proceed as proposed, subject to the recommended mitigation measures provided. From an agricultural impact perspective, land on this site is ideally suited to renewable energy development because of its very limited production potential. It is agriculturally strategic to steer as much of the country's renewable energy development as possible to sites such as this one.

7.6. Assessment of Potential Visual Impacts

The VIA 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.

Anticipated issues related to the potential visual impact of the proposed Poortjies Wind Energy Facility, which is part of the greater Mainstream Renewable Energy Facility, include the following:

» The visibility of the facility from, and potential visual impact on observers travelling along main roads (i.e. the N14 and TR8401) and secondary roads in close proximity to the proposed facility and within the region.
» The visibility of the facility from, and potential visual impact on residents of homesteads and settlements in close proximity to the proposed facility and within the region.
» The potential visual impact of ancillary infrastructure (i.e. the substations, power lines, internal access roads, workshop and office) on observers in close proximity to the proposed facility.
» Potential visual impacts associated with the construction phase on observers in close proximity to the proposed facility.
» The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the facility.
» The potential visual impact of the proposed facility on tourist access routes (i.e. the N14 and TR8401) within the region.
» The potential visual impact of the proposed facility on the visual quality of the landscape and sense of place region.
» The potential cumulative visual impact of the proposed facility in relation to the other three proposed components of the Mainstream Renewable Energy facility, other approved renewable energy facilities and other infrastructure and built forms within the region.
» Potential residual visual impacts after the decommissioning of the proposed facility.
» The potential to mitigate visual impacts and inform the design process.

7.6.1 Visual Exposure

Figure 7.5 indicates areas from which any number of turbines, with a minimum of one turbine (shaded in lighter yellow) to a maximum of 50 turbines (shaded in a darker red), could potentially be visible as well as proximity offsets from the proposed development area. The following is an overview of the findings of the viewshed, based on the concept layout illustrated on the map provided:

The proposed facility will have a large core area of potential visual exposure on the project site itself, and within a 5km radius thereof. The low mountains to the north and north west of the site offer some visual screening to the areas beyond.

Potential sensitive visual receptors within this visually exposed zone include residents of homesteads. Potential visual exposure remains high in the medium distance (i.e. between 5 and 10km), with visually screened areas in the north west (beyond the low mountains). Sensitive visual receptors comprise users of secondary roads to the west, north-west and south-west of the site as well as residents of homesteads and settlements.

In the longer distance (i.e. beyond the 10km offset), the extent of potential visual exposure is slightly reduced, especially in the north west of the study area, and to a lesser extent in the north east and south west. Visually exposed areas tend to be concentrated in the south and south east and to the far west and north east. Sensitive visual receptors include users of stretches of the N14 in the north west, and of the TR8401 in the east. In addition, users of secondary roads within the study area and residents of homesteads and settlements, particularly in the south, may be visually exposed.

The town of Pofadder lies more than 20km from the proposed site, and is thus not likely to be visually exposed to the proposed facility. Other receptor sites at this distance, despite lying within the viewshed, are also not likely to visually perceive the facility.

Typically, structures of this height (i.e. 200m) may be visible up to 20km away. In this respect, the anticipated Zone of Visual Influence for this facility as calculated from the development footprint (i.e. determined from the edge of the outer most turbines) and has been indicated at 20km. The extent of visual exposure within this zone is very high.

In general, despite the low population density in the study area, the Poortjies WEF may constitute a high visual prominence, potentially resulting in a high visual impact.

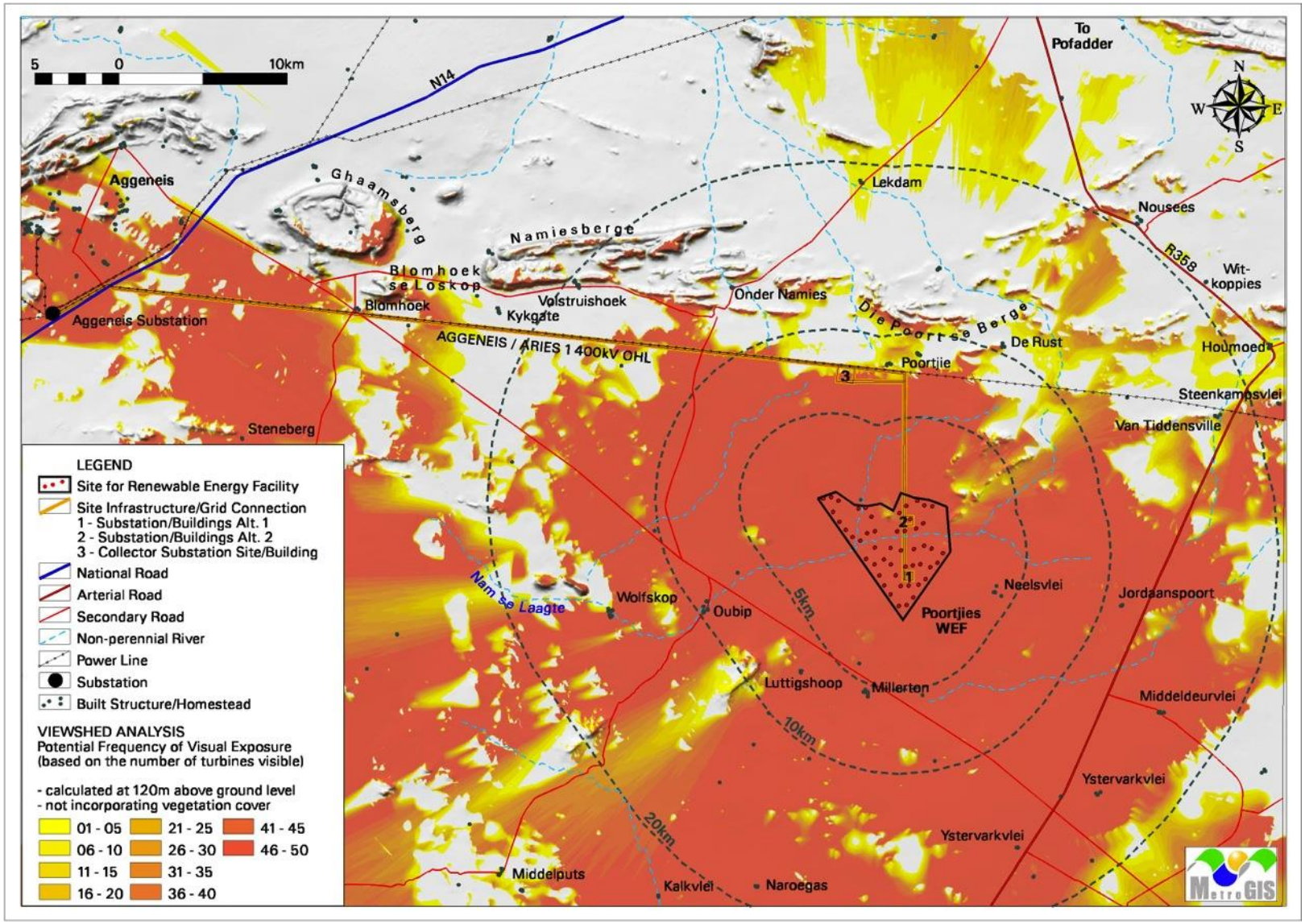


Figure 7.5: Visual exposure for the Poortjies Wind Energy Facility

7.6.2 Visual Impact

The combined results of visual exposure, viewer incidence / perception and visual distance of the proposed facility are displayed on Figure 7.6. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index. An area with short distance, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map indicates a core zone of high visual impact **within 5 km of the proposed facility**. Small patches of land located on the northern outskirts of this zone will be screened from any visual impact occurring. These are areas where screening is as a result of high lying topography and low mountains.

Sensitive visual receptors within this zone comprise mainly of residents of homesteads. The following homesteads are likely to be affected:

» Neelsvlei to the east of the site

These receptors are likely to experience high visual impact.

Visual impact is low **between 5 km and 10 km** of the proposed facility. Screened areas within this zone are located mainly to the north and north west of the site. Sensitive visual receptors within this zone comprise mainly of users of the secondary roads surrounding the site and residents of homesteads. The following homesteads are likely to be affected:

» Poortjie to the north of the site;
» Millerton to the south of the site; and
» Oubip and Luttigshoop to the south west of the site.

These receptors are likely to experience moderate visual impact.

Between 10 km and 20 km of the proposed facility, the extent of potential visual impact is somewhat reduced, and the magnitude is very low, with screened areas expected mostly in the north west and north east. Sensitive visual receptors at this distance include users of the TR8401, secondary roads as well as residents of homesteads. The following homesteads are likely to be affected:

» Lekdam to the north of the site;
» Van Tiddensville to the north east of the site;

- » Jordaanspoort, Middeldeurvlei and Ystervarkvlei to the south east of the site;
- » Naroegas to the south west of the site; and
- » Wolfskop to the west of the site.

Visual impacts on these sensitive receptors are likely to be low.

Remaining impacts **beyond 20 km** of the proposed facility are expected to negligible on the whole, with very low impacts along roads and at homesteads.

7.6.3 Photo Simulations

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Poortjies WEF within the receiving environment.

The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions. The photo simulations indicate the anticipated visual alteration of the landscape from various points located at different distances from the infrastructure.

The photograph positions are indicated on the reference map provided and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken. These photographs can therefore be seen as an ideal operational scenario (from a visual impact point of view) that should be aspired to. Additional infrastructure (e.g. access roads, etc.) associated with the facility are not included in the photo simulations.

Each photographic simulation is preceded by a panoramic overview of the landscape from the specified viewpoint being discussed.

The simulated infrastructure, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the infrastructure.

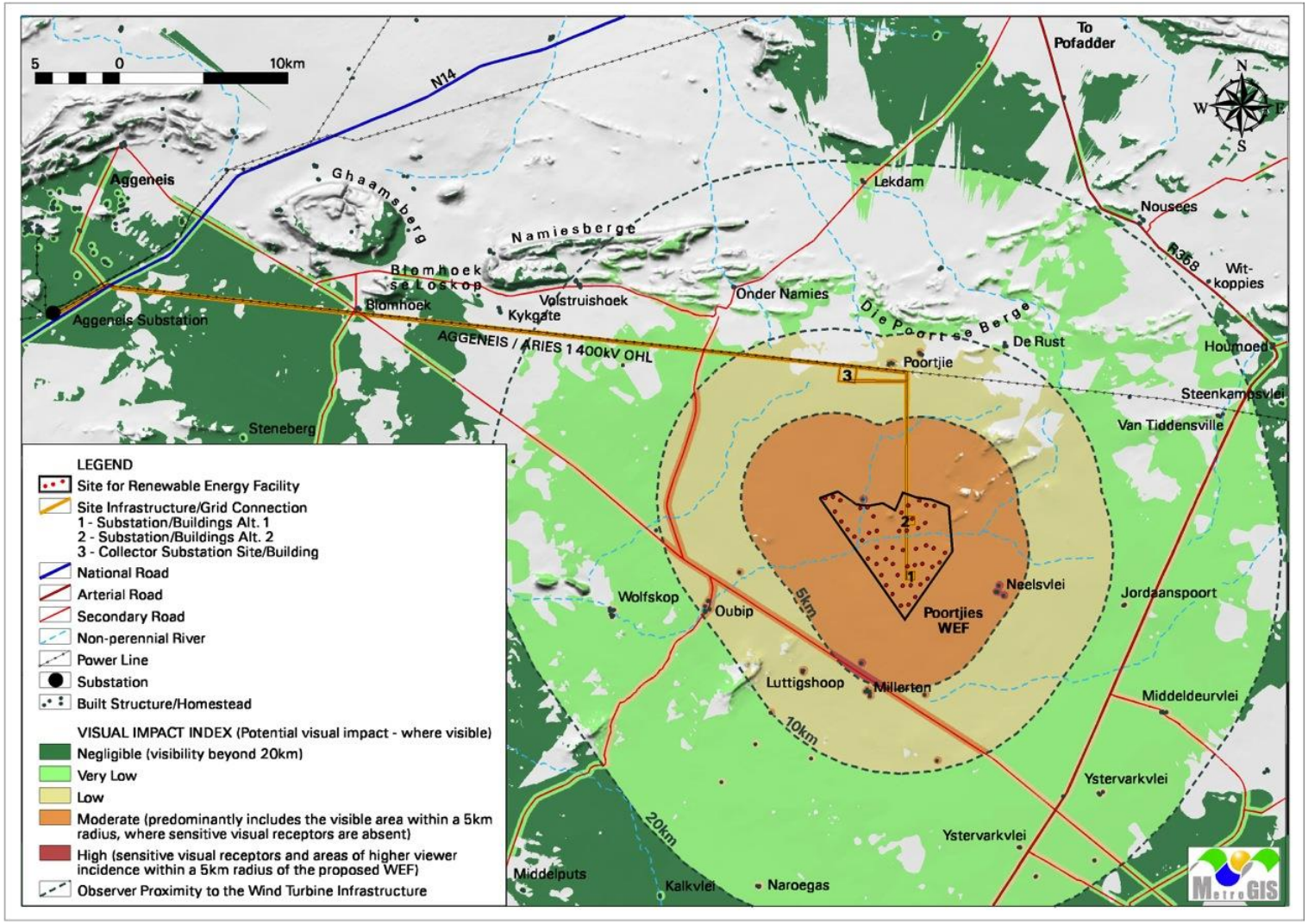


Figure 7.6: Visual Impact Index

Figure 7.7.: Photo simulation A – enlarged panoramic view (Photo Simulation A has been generated from a viewpoint situated south west of Poortjies WEF, looking to the north east. The point from which the photo was taken is approximately 10km from the facility and is indicative of a medium range view that locals and tourists using this gravel road will have when travelling west.)

Figure 7.8.: Photo simulation B - enlarged panoramic view (Photo Simulation B has been generated from a viewpoint situated south east of Poortjies WEF, looking to the north west. This photosimulation shows the cumulative Mainstream facility, including all three WEF's. The point from which the photo was taken is approximately 15km from the facility and is indicative of a long range view that locals and tourists using the TR8401 will have when travelling north or south.

Nature of Impact: Visual impact on sensitive visual receptors within the region		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Highly Probable (4)	N/A
Significance	**Moderate (52)**	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:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
» Plan ancillary infrastructure (i.e. substation and workshop) in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as far as possible, and make use of already disturbed areas rather than pristine sites wherever possible.
» Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken with adequate drainage structures in place to forego potential erosion problems.

Construction:

» Rehabilitate all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for infrastructure.

Operations:

» Maintain the general appearance of the facility as a whole.
» Monitor rehabilitated areas, and implement remedial action as and when required.

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 the proposed wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region should all facilities be constructed.

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.

7.6.4 Change of visual character and sense of place of the region

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as

topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role.

A visual 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.

This area has a largely natural and undeveloped character, and as such the landscape is characterised by wide-open expanses of undeveloped landscape. The visual quality of the receiving environment within the study areas is high, by virtue of the vast and undeveloped nature of the environment. This lends a distinct sense of place to the area, but the landscape is not unique.

The anticipated visual impact on the visual character and sense of place of the study area is expected to be of **high** significance. The low occurrence of visual receptors reduces the probability of this impact occurring.

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines.

Nature of Impact: Visual impact on sensitive visual receptors in close proximity to the proposed infrastructure.		
	No mitigation	***Mitigation considered***
Extent	Local **(2)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	Definite **(5)**	N/a
Significance	High **(70)**	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?	No	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
» Plan ancillary infrastructure (i.e. substation and workshop) 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 rather than pristine sites wherever possible.
» Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

Construction:

» Rehabilitate all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for infrastructure.

Operations:

» Maintain the general appearance of the facility as a whole.
» Monitor rehabilitated areas, and implement remedial action as and when required.

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 the Poortjies WEF together with its associated infrastructure, although in line with current development and land use trends in the region, will certainly contribute to the increased cumulative visual impact of renewable energy facilities.

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 the proposed facility on the visual quality of the landscape and sense of place of the region

	No mitigation	***Mitigation considered***
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Probable (3)	N/A
Significance	**Moderate (39)**	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?	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 the Poortjies WEF together with its associated infrastructure although in line with current development and land use trends in the region, will certainly contribute to the increased cumulative visual impact of renewable energy facilities.

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.

7.6.5 Lighting Impacts

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, and therefore light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another source of glare light, albeit not as intense as flood lighting, is 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. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low.

Last is the potential lighting impact known as sky glow. 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, contributes to the increase in sky glow. The wind energy facility may contribute to the effect of sky glow in an otherwise dark environment. Lighting impacts will be moderate significance both before and after mitigation.

Light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity to the wind turbines.

Nature: Visual impact of lighting at night on sensitive visual receptors in close proximity

to the proposed infrastructure.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	H Probable (3)	Probable (2)
Significance	**Moderate (42)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning & operation:

» Mount aircraft warning lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction.
» 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:

Yes, due to multiple wind energy facilities in the area.

Residual Impacts:

Residual impacts will be very low once mitigation measures are implemented or once offensive lighting is removed.

7.6.6 The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the Wind Energy Facility (the wind turbines) is not possible to mitigate. The functional design of the turbines cannot be changed in order to reduce visual impacts.

Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact.

The overall potential for mitigation is therefore generally low or non-existent.

The possible mitigation of both primary and secondary visual impacts as listed in the tables above should be implemented and maintained on an on-going basis.

7.6.7 Comparative Assessment of Substation Position and Access Road Alternatives

There is no preference in terms of visual impact for any of the proposed substation positions or access road alternatives.

7.6.8 Conclusions and Recommendations

» The visual impact on sensitive visual receptors (i.e. users of secondary roads and residents of homesteads) in close proximity to the proposed infrastructure (i.e. within 5km) is expected to be of high significance.
» The visual impact on sensitive visual receptors (i.e. users of roads and residents of homesteads) within the region (i.e. beyond the 5km offset) is expected to be of moderate significance.
» The potential visual impact of associated on-site infrastructure on sensitive visual receptors in close proximity thereto (i.e. within 5km) is expected to be of moderate significance and may be mitigated to low.
» The potential visual impact of construction on sensitive visual receptors in close proximity to the proposed infrastructure is likely to be of moderate and may be mitigated to low.
» The anticipated visual impact of lighting at night on sensitive visual receptors within the study area is likely to be of moderate significance, and may be mitigated to low.
» The potential visual impact on the N14 and TR8401 as tourist routes is expected to be of low significance.
» The anticipated visual impact on the visual character and sense of place of the study area is expected to be of high significance.

The impacts above are determined to have a post mitigation significance ranging from high to low. Anticipated visual impacts with a high residual significance include impacts on sensitive visual receptors in close proximity and within the region, and on the landscape character and sense of place within the region.

In spite of these high residual ratings, these visual impacts are not considered by the specialist to be fatal flaws for this development. This conclusion is based primarily on the remote location of the study area and the very low density of visual receptors within the study area. In addition, there are no reported objections from stakeholders within the region.

It is therefore recommended that the development of the Poortjies Wind Energy Facility as part of the proposed new Mainstream Renewable Energy Facility be supported from a visual perspective, subject to the implementation of the recommended mitigation measures.

7.7. Assessment of Potential Noise Impacts

A noise study is important as wind turbines can generate noises that can increase the ambient sound levels up to 2,000 meters from the source, depending on the associated environmental circumstances. This noise can also be considered as a disturbing noise by some receptors located very close to these wind turbines. The potential noise impact is evaluated in terms of the International Guidelines as well as the South African National Noise Control Regulations.

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.

This study uses the noise emission characteristics of the Vestas V117 3.3 MW wind turbine. With the input data as used, this assessment indicated that the potential noise impact would be insignificant during both the construction and operational phases.

The potential cumulative noise impact of the Poortjies Wind Energy Facility together with the other proposed wind energy facilities (Korana and Khai-Ma) was also investigated. The assessment indicated that the potential cumulative noise impact would be insignificant during the operational phases for the three evaluated facilities.

7.7.1. Relevant Noise Receptors

The land use in the study area is mainly wilderness. As the night-time noise environment is of particular interest in this document, current land use activities are not expected to impact significantly on the ambient sound environment. There are no residential areas (suburban) within 2 000m from the proposed facility with only two potential noise-sensitive receptors within 2 000m from the closest wind turbines of the proposed wind energy facility (refer to Figure 7.9).

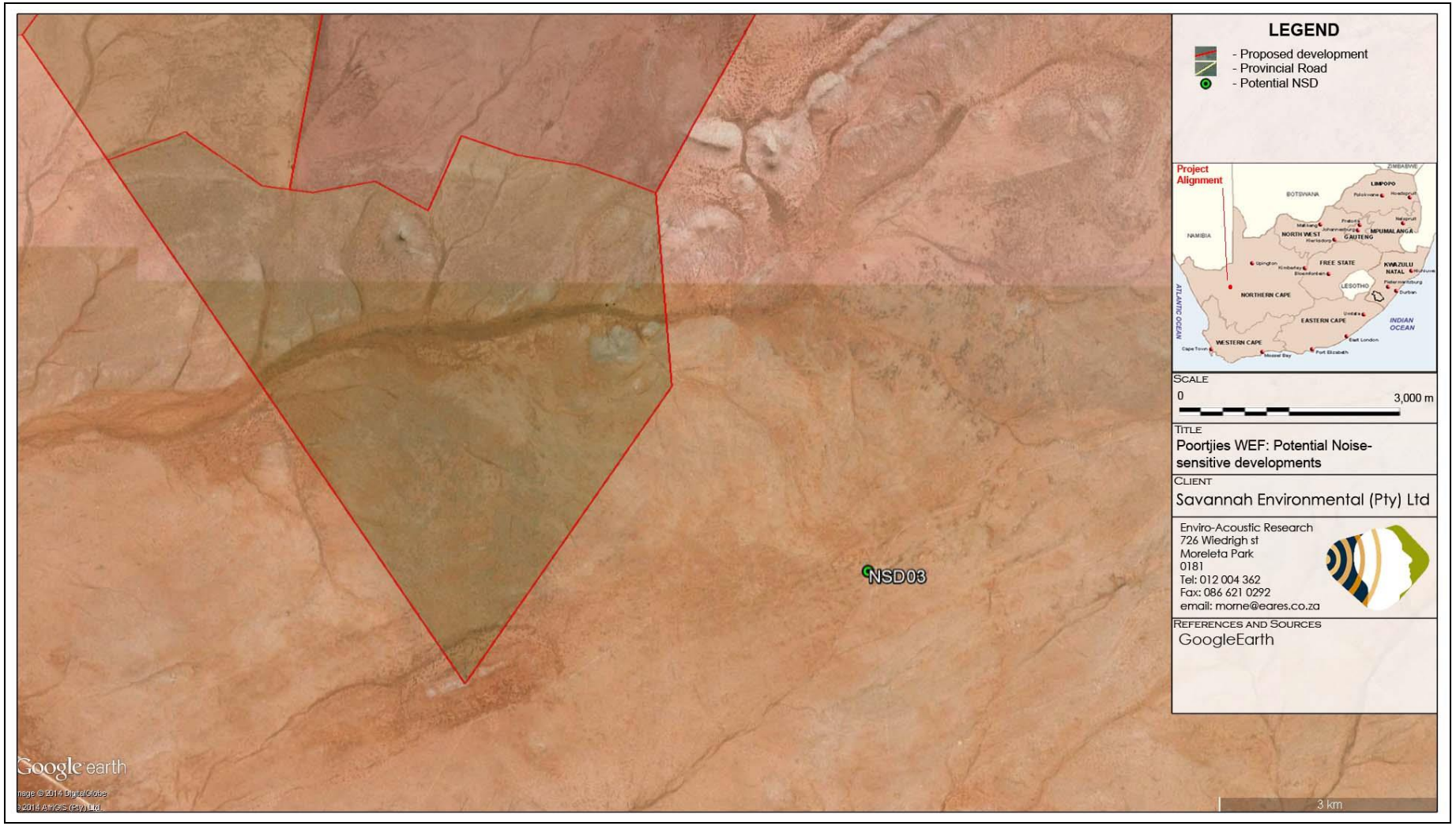


Figure 7.9: Aerial image indicating the only potential noise sensitive receptor in the vicinity of the Poortjies Wind Energy Facility

7.7.2. Noise from Construction activities

Noise sources during construction include the following:

» **Construction equipment**
Construction equipment likely to be required will typically include excavator/graders, bulldozers, dump trucks, vibratory roller, bucket loader, rock breaker(s), drill rig, flat-bed truck(s), pile drivers, concrete trucks, cranes, fork lift(s) and various 4WD and service vehicles. Octave sound power levels typical for this equipment are presented in the Noise report.

» **Blasting**
Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting will not be considered during the EIA phase for the following reasons:

* Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use the minimum explosives and will occur in a controlled manner. The breaking of obstacles with explosives is also a specialized field and when correct techniques are used, causes significantly less noise than using a rock-breaker.
* People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. However, these are normally associated with close proximity mining/quarrying.
* Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties generally receive sufficient notice (siren) and the knowledge that the duration of the siren noise as well as the blast will be over relative fast results in a higher acceptance of the noise. Note that with the selection of explosives and blasting methods, noise levels from blasting is relatively easy to control

» **Traffic due to construction vehicles**
A source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the wind turbine. Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

Results of Noise Modelling – Impacts as a result of Construction Noise

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 (20°C and 80% humidity).

Even though construction activities are projected to take place only during day time, it may be required at times that construction activities take place during the night (particularly for a large project). Below is a list (and reasons) of construction activities that might occur during night time:

» Concrete pouring: Large portions of concrete do require pouring and vibrating to be completed once started, and work is sometimes required until the early hours of the morning to ensure a well-established concrete foundation. However the work force working at night for this work will be considerably smaller than during the day.
» Working late due to time constraints: Weather plays an important role in time management in construction. A spell of bad weather can cause a construction project to fall behind its completion date. Therefore it is hard to judge beforehand if a construction team would be required to work late at night.

As it is unknown where the different activities may take place, it was selected to model the impact of the noisiest activity (laying of foundation totalling 113.6 dBA cumulative noise impact) at all locations where wind turbines may be erected, calculating how this may impact on potential noise-sensitive developments as well as mapping this modelled construction activity over distance. Overall, noise impacts during construction will have a low impact on the identified potential noise-sensitive receptors.

Nature: Numerous simultaneous construction activities that could cause noise impacts on receptors.	
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** – 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 **(3)**
Duration	**Short** – 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 **(2)**

Magnitude	Noise Rating Levels << Rating Level – **Low (2)**
Probability	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. **Possible (2)**
Significance	**Low (14)**
Status	Negative
Reversibility	High
Irreplaceable loss of resources?	Not relevant
Comments	*Modelling considered a worst-case scenario with significant activities taking place for up to 16 hours each day at all possible locations*
Can impacts be mitigated?	Yes, although mitigation not required.
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.	

7.7.3. Noise Sources: Operational Phase

Noise emitted by wind turbines can be associated with two types of noise sources:

» Aerodynamic sources: due to the passage of air over the wind turbine blades; and
» Mechanical sources that are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources generally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substations themselves, traffic (maintenance) as well as transmission line noise.

» **Noise from the Wind Turbines: Aerodynamic sources**[7]
Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:

[7] *Renewable Energy Research Laboratory, 2006; ETSU R97: 1996*

- Self noise due to the interaction of the turbulent boundary layer with the blade trailing edge;
- Noise due to inflow turbulence (turbulence in the wind interacting with the blades);
- Discrete frequency noise due to trailing edge thickness;
- Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade); and
- Noise generated by the rotor tips.

These types of noise are discussed in more detail in the Noise Impact Assessment report contained in Appendix M.

Results of Noise Modelling – Impacts associated with Noise from the Operational Phase

The Noise study focuses 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 ($L_{Req,N}$ = 35dBA) 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 wind energy facility as well as the likely ambient sound levels due to wind induced noises.

There exists a low risk of a noise impact developing during the operational phase of the development. Using a worst-case scenario with ambient sound levels being quieter than measured onsite, there exists a likely risk that the sound created by the wind turbines will be audible at a level that may be annoying. However, considering the ambient sound levels as measured onsite, it is unlikely that the wind turbines will create a noise loud enough to be audible above the wind-induced noise levels.

Based on the modelling results, it is concluded that the risk of a noise impact developing due to the wind turbines is very low.

Nature:	*Numerous wind turbines operating simultaneously during a period when a quiet environment is desirable.*
Acceptable Rating Level	Rural district
Extent (area where change $\Delta L_{Aeq,n}$>7dBA)	**Local** – Impact will extend less than 1,000 meters from activity. **(2).**
Duration	**Long** – Facility will operate for a number of years **(4).**

Magnitude	**Low (2) – All NSDs**
Probability	Considering the precautionary approach the level is raised by 1 – unlikely to possible. **Possible (2)**
Significance	**16 (Low) 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. See also* ***section*** *Error! Reference source not found.*
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.

7.7.4. Comparative Assessment of Substation Position Alternatives and Access Road

Transformer noises (Substation)

Also known as magnetostriction; this is when the sheet steel used in the core of the transformer (substation) tries to change shape when being magnetised. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed.

This deformation is not uniform; consequently it varies all over a sheet. With a transformer core being composed of many sheets of steel, these deformations are taking place erratically all over each sheet, and each sheet is behaving erratically with respect to its neighbour. The resultant is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are logged in areas where people stay close to these transformers. At a voltage frequency of 50 Hz, these "vibrations" takes place 100 times a second, resulting in a tonal noise at 100Hz. This is normally not an issue if the substation is further than 200 meters from a potentially sensitive receptor. This is a relatively easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer equipment.

There will be no differences in the significance of noise impacts for any of the alternative substation positions. Therefore any of the two proposed alternatives are considered acceptable from a noise perspective.

There will also be no differences in the significance of noise impacts for either of the alternative access routes. Therefore any of the two proposed alternatives are considered acceptable from a noise perspective.

7.7.5. Conclusions and Recommendations

With the input data as used, this assessment indicated that the potential noise impact would be of a low significance during both the construction and operational phases. Due to the low risk of a noise impact, no routine noise measurements are recommended. However, if a valid and reasonable noise complaint is registered relating to the operation of the facility, additional noise monitoring should be conducted by an acoustic consultant. Noise monitoring must be continued as long as noise complaints are registered.

The developer should re-evaluate this study if the layout is changed (where any wind turbines are moved closer, if any wind turbines are added within 1 000m from any potential noise-sensitive receptor) or if the developer selects to use a different wind turbine that is louder than the turbine evaluated in this report (a higher sound power level).

The findings of the noise impact study should be made available to all potentially noise-sensitive developments in the area with the contents explained to them to ensure that they understand all the potential risks that the development of a wind energy facility may have on them and their families.

7.8 Assessment of Potential Impacts on Heritage - Archaeology

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. In the case of the proposed activity the main source of impact is likely to be the construction of access roads, lay-down areas and excavation of the footings the turbines and substation foundations.

No sites of significant heritage potential were identified in the proposed site and broader study area and there are no protected sites or structures within the study area that require mitigation.

In terms of the information that has been collected, indications are that impacts to pre-colonial archaeological material will be limited. In terms of buried archaeological material, one can never be sure of what lies below the ground

surface. However indications are that this is extremely sparse for the study area and that impacts caused by the construction of footings and other ground disturbance are likely to be negligible.

Nature: Destruction and/or disturbance of archaeological sites and/or artefacts.		
	Before mitigation	**After mitigation**
Extent:	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)
Probability	Possible (2)	Possible (2)
Significance	**Low (14)**	**Low (14)**
Status	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	
Mitigation: » *No mitigation required prior to construction.*		
Cumulative impacts Other similar archaeological material would be impacted by other similar developments in the area but, given the widespread nature of this material, cumulative impacts are not expected to be significant.		
Residual impacts *None*		

Impacts on Colonial Period Heritage

Colonial period heritage – that is buildings and historical sites of significance have not been identified within the boundaries of the study area. The only area of concern is the proposed access road from the N14 which passes through the old Namies Village area, however no impacts on the area are expected. The access road which passes through the site of the village of Namies will result in impacts if widened, however potential impacts will still be low .

Nature: Impacts on colonial period heritage		
	Before mitigation	**After mitigation**
Extent:	Local (1)	Local (1)
Duration	Temporary (1)	Temporary (1)
Magnitude	Low (1)	Low (1)
Probability	improbable (1)	Improbable (1)
Significance	**Very low (3)**	**Very low (3)**
Status	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	

Mitigation:
» Not required
Cumulative impacts
None
Residual impacts
None

Impacts on the Cultural Landscape

Cultural landscapes are highly sensitive to cumulative impacts and large scale development activities that change the character and public memory of a place. In terms of the National Heritage Resources Act, a cultural landscape may also include a natural landscape of high rarity value, aesthetic and scientific significance. The construction of a large facility can result in profound changes to the overall sense of place of a locality, if not a region. Given the fact that this particular landscape is of limited aesthetic value, not particularly rare and extremely isolated the significance of the landscape impact is moderated.

Nature: Impacts on the cultural landscape		
	Before mitigation	***After mitigation***
Extent:	Local (1)	Local (1)
Duration	Temporary (1)	Temporary (1)
Magnitude	Low (1)	Low (1)
Probability	improbable (1)	Improbable (1)
Significance	**Very low (3)**	**Very low (3)**
Status	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	
Mitigation: None required		
Cumulative impacts None		
Residual impacts *N/A*		

7.8.1. Comparative Assessment of Substation Position and Access Road Alternatives

The study area is extremely sparse in terms of both archaeological and historical material/sites and neither substation position alternative is preferred from a heritage perspective as both are considered acceptable.

The access road which passes through the site of the village of Namies will result in impacts if widened, however impacts will still be of low significance. Either alternative is acceptable in terms of heritage impacts.

7.8.2 Conclusions and Recommendations

No important heritage sites occur within the development footprint of the proposed infrastructure for the Poortjies Wind Energy Facility. Impacts to heritage resources are not likely to be very significant and no "red flag" issues have been identified. It is concluded that, from a heritage perspective, the proposed wind energy facility may proceed.

The current access road passes through the middle of the ruined village of Namies. This area is of concern because there are components of the village (buildings and graves) that are located very close to the roads and could be impacted by any road widening. Here depending on how the access road is designed, mitigation may be required. No alternative however is preferred.

7.9. Assessment of Potential Social and/ Economic Impacts

The key social issues associated with the **construction phase** are the following:

Potential positive impacts:

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

Potential negative impacts:

» Impacts associated with the presence of construction workers on local communities;
» Influx of job seekers;
» Loss of farm labour;
» Increased risks to stock, crops, grazing and farming infrastructure associated with the presence of construction workers;
» Impact of heavy vehicles on local roads;
» Loss of agricultural land associated with construction related activities.

The key social issues affecting the **operational phase** include:

Potential positive impacts

» 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;
» The establishment of renewable energy infrastructure.

Potential negative impacts

» The visual impacts and associated impact on sense of place;
» Potential impact on tourism;
» Influx of job seekers to the area;
» Loss of farm labour;
» Impact on farming operations.

Both positive and negative social impacts are discussed below.

7.9.1. Construction - Creation of Employment and Business Opportunities and Opportunity for Skills Development

The construction phase is expected to extend over a period of ~ 18 to 24 months and create approximately 500 construction related jobs. Of this total approximately 15 % will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 30 % to semi-skilled personnel (drivers, equipment operators), and ~ 55% to low skilled personnel (construction labourers, security staff). The work associated with the construction phase will be undertaken by contractors and will include the establishment of the access roads and services and the erection of the wind turbines, substations and power line. Members from the local community are likely to be in a position to qualify for the majority of the low skilled and some of the semi-skilled employment opportunities. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community. Given the high unemployment levels and limited job opportunities in the surrounding area this will represent a significant social benefit. The remainder of the semi-skilled and majority of the skilled employment opportunities are likely to be associated with the contactors appointed to construct the wind energy facility and associated infrastructure.

The majority of low and semi-skilled employment opportunities are likely to be available to local residents in the area. 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. The proponent will 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 opportunites. A percentage of the wage bill will be spent in the local economy and will create opportunities for local businesses in the towns of Pofadder, Aggenys, Springbok, Kakamas, Keimoes and Upington.

The capital expenditure associated with the construction of a 100 MW wind energy facility will be in the region of R 2 billion. In terms of business opportunities for

local companies, expenditure during the construction phase will create business opportunities for the regional and local economy.

The sector of the local economy that is most likely to benefit from the proposed development is the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the construction workers on the site. This is confirmed by the experience with the Abengoa CSP Project located to the north east of Pofadder. The Abengoa project had created significant benefits for the local hospitality sector in Pofadder during the construction phase. In addition, the project also benefitted local shops and services in the town. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the construction workers on the site. The benefits to the local economy associated with the establishment of a single 100 MW Wind Energy Facility will be confined to the construction period (18-24 months).

The total wage bill with the construction of a 100MW wind energy facility (500 employees X 18 months) is estimated to be in the region of R75 million. This is based on the assumption that the average monthly salary for low, semi and skilled workers is R 5 000, R 12 000 and R 30 000 respectively. The injection of income into the area in the form of wages will represent a significant opportunity for the local economy and businesses in the local area.

In terms of local support, the IDP and LED Manager for the Khai-Ma Local Municipality both expressed strong support for the proposed project. They also indicated that the construction of the Abengoa CSP Facility, located ~ 50 km north east of the Pofadder had created significant employment and economic benefits in the town. They did, however, indicate that finding accommodation for workers had been an issue. In addition, while there were positive benefits for the local economy the presence of large numbers of construction workers had also created a number of negative social impacts (these impacts are also addressed in the tables below).

Nature: Job creation and skills development.		
	Without Enhancement	***With Enhancement***
Extent	Local – Regional (3)	Local – Regional (4)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	High (8)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (44)**	**Medium (56)**
Status	Positive	Positive
Reversibility	N/A	N/A

Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes.	
Mitigation: » Where feasible, 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. » Before the construction phase commences the proponent should meet with representatives from the Local Municipality to establish what skills exist in the area and develop a database. » 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. » The proponent, in consultation with the Local Municipality, should develop a database of local companies, specifically companies that qualify as Black Economic Empowerment (BEE) companies that qualify as potential service providers prior to the commencement of the tender process for construction contractors.		
Cumulative impacts: Opportunity to up-grade and improve skills levels in the area. However, due to relatively small number of local employment opportunities and limited skills range, this benefit is likely to be limited.		
Residual impacts: Improved pool of skills and experience in the local area. However, due to relatively small number of local employment and skills-transfer opportunities this benefit is likely to be limited.		

7.9.2. 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. 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. This risk is linked to the potential behaviour of male construction workers, including:

» An increase in alcohol and drug use;
» An increase in crime levels;
» An increase in teenage and unwanted pregnancies;
» An increase in prostitution; and
» An increase in sexually transmitted diseases (STDs).

The findings of the SIA indicate that the local farmers in the area are strongly opposed to construction workers being accommodated on the site. In this regard

the proponent has indicated that no construction personnel, apart from security, will be accommodated on the site.

All of the low skilled (165) and the majority of the semi-skilled (90) work opportunities associated with the construction of a single 100 MW wind energy facility are likely to benefit members from the local community. If these opportunities are taken up by local residents the potential impact on the local community will be low as these workers will form part of the local family and social network. Employing members from the local community to fill the low-skilled job categories will therefore reduce the risk and mitigate the potential impact on the local communities. The use of local residents to fill the low skilled job categories will also reduce the need to provide accommodation for construction workers in Pofadder and Aggenys. The likelihood of local skills being available appears to be reasonable given that a number of existing solar and wind energy projects are currently being constructed in the area. The skilled workers (45) are likely to be accommodated in the Pofadder Hotel and guest houses in Pofadder. In order to accommodate workers associated with the Abengoa Solar Energy Facility temporary accommodation has also been established in the town. This accommodation is also likely to be available for the workers associated with the proposed wind energy facility.

While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy.

In terms of potential threat to the families of local farm workers in the vicinity of the site, the risk is likely to be low. This is due to the large distances between the site and adjacent farm houses and the low number of permanent workers residing on local farms in the area. The potential risk is therefore likely to be limited. The risk can also be effectively mitigated by ensuring that the movement of construction workers on and off the site is carefully controlled and managed. However, given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)

Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low** for the community as a whole **(24)** **Moderate-High** for specific individuals who may be affected by STDs etc. **(51)**	**Low** for the community as a whole **(24)** **Moderate-High** for specific individuals who may be affected by STDs 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:

» 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 contractor 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, specifically construction workers from outside the area, should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting non-local workers to and from site on a daily basis.

» The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by construction workers from outside the area on local family structures and social networks.

» It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

***Cumulative impacts*:**

Impacts on family and community relations that may, in some cases, persist for a long period of time. 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: Residual impacts associated with STDs

7.9.3. Construction - 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, except over the Christmas-New Year period. The directly affected landowners also indicated that they would be able to reduce the potential risk to their livestock by moving them other parts of the farm during the construction phase. In addition, as indicated above, a number of the farmers have indicated that no construction workers should be allowed to stay on the site overnight with the exception of security personnel.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (2)
Duration	Medium term (3)	Medium term (3)
Magnitude	Medium (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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 proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase which are proven to be associated with the construction of the wind energy facility will be compensated for. The agreement should be signed before the construction phase commences.
- The proponent should consider developing a Code of Conduct for construction workers. The Code of Conduct should be signed by the proponent and the contractors 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 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 (see below). • 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 must 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 must ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation. • The housing of construction workers on the site should be limited to security personnel.
***Cumulative impacts*:** None, provided that proven losses are compensated for.
***Residual impacts**:* None

7.9.4. Increased risk of fires during construction

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 summer months.
» The risk of fire related damage is exacerbated by the limited access to fire-fighting vehicles.

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	
Irreplaceable loss of resources?	No	No

Can impact be mitigated?	Yes	
Mitigation: » The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction of the wind energy facility will be compensated for. The agreement should be signed before the construction phase commences. » Contractor to 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 summer months. » Contractor to provide adequate firefighting equipment on-site. » Contractor to provide fire-fighting training to selected construction staff. » 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. » Use of fire prevention and fire management strategies for the wind energy facility. » The landowners and developer should ensure that they join the local fire protection agency.		
Cumulative impacts: None, provided proven losses are compensated for.		
Residual impacts: None		

7.9.5. Impact associated with Construction Vehicles

The movement of heavy construction vehicles during the construction phase has the potential to damage local farm roads and create dust and safety impacts for other road users in the area. The project components will mostly likely be transported to the site from the Western Cape via the N7, N14 and the Old Springbok Road to the west of the site. The N7 provides the key link between the Western Cape and Namibia, while the N14 links the Northern Cape with the N7. Both routes are important commercial and tourist routes. The transport of components to the site therefore has the potential to impact on other road users travelling along the N7 and N14.

The Old Springbok Road links up with the N14 to the west of Pofadder and accommodates very low volumes of traffic. The impacts associated with the transport of the components of the facility along this section of the road are likely to be low. The Old Springbok Road to the south of Pofadder will also be used transport of construction workers to and from the site on a daily basis. The farmers who will be most affected are Mr Gerhard Visser and Mr Wimpie Visser, whose

farmhouses are located adjacent to the Old Springbok Road to the north of the site. A number of informal dwellings associated with emerging farmers farming in the area to the south of Pofadder will also be potentially affected. However, these dwellings are not located adjacent to the road. The most significant impacts will be linked to dust generated by vehicles used to transport staff to and from the site on a daily basis and the damage to the road surface along this section of the road.

Several abnormal loads using large trucks will be associated with the construction phase. In addition, crawler cranes (~ 750 t) and assembly cranes may also need to be transported onto and off the site. Other heavy equipment will include normal civil engineering construction equipment such as graders, excavators, cement trucks, etc.

The findings of the SIA indicate that the impact of traffic on the local roads would be low. The social impacts associated with the movement of construction related traffic along these roads are therefore likely to be low.

Nature: Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site, specifically for the farmhouses located adjacent to the Old Springbok Road to the north of the site.		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (1)
Duration	Short Term (2)	Short Term (2)
Magnitude	Medium (6)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (24)**	**Low (15)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» The transport of components to the site along the N7 and N14 should be planned to avoid weekends and holiday periods as far as possible.
» The section of the Old Springbok Road immediately opposite the farmsteads of Mr Gerhard and Wimpie Visser should be sealed prior to start of the construction phase. The total length of the section to be sealed should be discussed with the affected farmers. The road should be maintained during the construction phase.
» 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.
» The contractor must ensure that damage caused by construction related traffic to the Old Springbok Road is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor.
» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

» The Contractor should ensure that workers are informed that no waste can be thrown out of the vehicle windows while being transported to and from the site. Workers who throw waste out windows should be fined. » Waste generated during the construction phase should be transported to the nearest registered landfill site. The Pofadder landfill site does not have the required operating standards to prevent windblown litter from being generated.
Cumulative impacts: If damage to roads is not repaired then this will impact on the farming activities in the area and also result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage.
Residual impacts: None

7.9.6 Damage to and loss of farmland during construction

The activities associated with the construction phase have the potential to result in the loss of land available for grazing. In terms of current land uses the area identified for the proposed facility is used for livestock grazing. The farm owners, Mr Abrie and Jan van Niekerk, have entered into a lease agreement with Mainstream for the use of the land for the proposed wind energy facility. The impact on farm income due to the loss of grazing will be more than offset by the income from the facility. The farm owners also indicated that he would be in a position to relocate sheep from the affected area to other parts of the farm. The impact of the proposed wind energy facility on loss of grazing land will therefore be low.

In addition, the final disturbance footprint can be reduced by careful site design and placement of components. 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. However, Mr Abrie van Niekerk indicated that due to the low rainfall in the area it would take a long time for the disturbed areas to be successfully rehabilitated. This is an issue that should be addressed by the specialist involved in developing the rehabilitation plan for the project.

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind turbines and power lines will damage farmlands and result in a loss of farmlands for future farming activities.		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long term-permanent if	Medium term if damaged

	disturbed areas are not effectively rehabilitated (5)	areas are rehabilitated (3)
Magnitude	Medium (6)	Minor (2)
Probability	Probable (3)	Highly Probable (4)
Significance	**Moderate (39)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated
Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	Yes, however, loss of farmland cannot be avoided
Mitigation: • The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised as far as possible. • An Environmental Control Officer (ECO) should be appointed to monitor the construction phase. • All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase where these are not required for operation. • The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up a suitably qualified specialist. • The implementation of the Rehabilitation Programme should be monitored by the ECO.		
Cumulative impacts: Overall loss of farmland could affect the livelihoods of the affected farmer, and the workers on the farm and their families. However, disturbed areas can be rehabilitated.		
Residual impacts: None		

7.9.6. Operational Phase -Creation of Long- Term employment and business opportunities

Based on information from other wind projects in the country, the establishment of a 100 MW wind energy facility would create ~ 30 employment opportunities for over a 20 year period. Of this total approximately 20 will be low skilled, 8 semi-skilled and 2 high skilled positions. The annual wage bill for the operational phase would be ~ R 3 million. The establishment of three 100 MW wind energy facilities would create ~ 90 permanent employment opportunities with an annual wage bill of ~ R 9 million. The majority of employment opportunities associated with the operational phase is likely to benefit HD members of the community. However, given that the wind energy sector in South Africa is relatively new, the skilled positions may need to be filled by people from other parts of South Africa or even overseas.

It will also be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting employment and skills development contained in the KMLM IDP.

Given the location of the proposed facility, the majority of permanent staff is likely to reside in Pofadder or Aggeneys. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in one of these towns, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the 20 year operational lifespan of the project. The local hospitality industry in Pofadder, Aggeneys and Keimoes is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations.

As indicated above, the IDP and LED Manager for the Khai-Ma Local Municipality both expressed strong support for the proposed project.

Nature: Creation of long-term employment and business opportunities associated with the operational phase		
	Without Mitigation	***With Enhancement***
Extent	Local (1)	Local and Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (21)**	**Medium (32)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The establishment of a Community Trust should be discussed with the Local Municipality and other relevant stakeholders. » The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project.		
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. Creation of revenue stream to fund local projects, thereby enhancing local economic and social development in the area.
Residual impacts: Improved skills in the region.

7.9.7. 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 for energy. The proponent has indicated that they are committed to establishment of a Community Trust.

A Community trust provides an opportunity to generate a reliable and steady revenue stream over a 20 -25 year operational lifespan of the wind energy facility. This revenue can be used to fund development initiatives in the area and support 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 will be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development; and
- Support for SMMEs.

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development		
	Without Mitigation	**With Enhancement**
Extent	Local (2)	Local and Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (30)**	**High (70)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent in consultation with the local municipality 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 proponent in consultation with the local municipality 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: Improved overall wellbeing of the community.

7.9.8. Development of Renewable Energy Infrastructure

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 carbon emissions. The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

The overall contribution to South Africa's total energy requirements of the proposed wind energy facility is relatively moderate. However, the 100 MW produced will help to offset the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as an important contribution.

Nature: Development of renewable energy infrastructure in the Northern Cape, South Africa.		
	Without Mitigation	**With Mitigation**
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems (positive)	

Can impact be mitigated?	N/A	
Enhancement: N/A		
Cumulative impacts: Numerous renewable energy facilities would reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: Reduction in emissions would remain even if the facility is decommissioned.		

7.9.9. Potential Impact of the wind energy facility on tourism in the region

The tourism sector is regarded as an important economic sector in the Northern Cape Province. The tourism potential of the area is linked to the area's natural resources, including the relatively undisturbed scenery and landscape. The findings of the SIA indicate that the impact of the proposed wind energy facility on the area's sense of place will be low. In addition, the volume of traffic along the TR8401, to the east of the site, and the Old Springbok Road, to the west of the site, is low. While the N14 to the north of the site is an important tourist route, the site is partially screened from the road by the natural topography. In addition, the site is located ~20 km from the N14.

The impact of a 100 MW wind energy facility on the tourism potential of the area is therefore likely to be low.

Nature: Potential impact of the wind energy facility on local tourism		
	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent should liaise with representatives from the local municipality and local tourism representatives to raise awareness of the proposed facility as this could improve tourism in the area.		
Cumulative impacts: Potential cumulative impact on tourism in the local municipality.		
Residual impacts: None		

7.5.11. Comparative Assessment of Substation Positions and Access Road Alternatives

The overall social impact associated with the both alternatives is likely to be low. The preferred option from a visual perspective would also then be preferred from a social perspective due to lower associated impacts on sense of place. As there is no preference from a visual perspective either substation position as well as either access route alternative is acceptable from a social perspective.

7.5.12. Conclusions and Recommendations

The findings of the SIA undertaken for the proposed Poortjies Wind Energy Facility indicate that the development will create employment and business opportunities for locals during both the construction and operational phases of the project. The establishment of a Community Trust will also create an opportunity to support local economic development in the area. The development of renewable also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The proposed Poortjies Wind Energy Facility and establishment of the other renewable energy facilities in the area also have the potential to result in significant positive cumulative socio-economic impacts for the local and district municipalities. However, the facility will impact on the visual and landscape character of the area.

The overall finding of the SIA is that the potential positive socio-economic impacts associated with the proposed Poortjies Wind Energy Facility outweigh the potential social negative impacts. It is therefore recommended that the facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the report. Cumulative positive and negative social impacts will also be of an acceptable level.

7.9 Mitigation Strategy

Table 7.3 below deals with potential turbines falling in sensitive areas and other layout issues that need to be addressed by Mainstream for the final layout of the Poortjies Wind Energy Facility.

Table 7.3 Mitigation Strategy in terms of the current proposed layout

Issue	Implications for current layout
Flora	The only areas that require special attention are the seasonal drainage lines and quartzite ridges which should be treated as

Issue	Implications for current layout
	ecologically sensitive and should be avoided. No construction should take place within 50 m of the nominal centre line of the drainage lines or quartzite ridges. No turbines fall into these areas in terms of the current layout.
Fauna	A sensitivity map was drawn up Should the developments be restricted from the areas outlined as Moderate or High sensitivity and their buffers, then the overall impact of the development on the biodiversity and ecology of the area should be reasonably low. Faunal disturbance during the construction phase of the project is inevitable, this impact will however be temporary and most fauna are likely to return to the area once construction has been completed. Areas of High sensitivity and their buffers must be avoided by turbine placement, laydown areas and other associated infrastructure. Only access and connecting roads may intrude on High sensitivity buffers if no other alternatives exist. No turbines fall into these areas in terms of the current layout.
Surface Hydrology	» The current layout is acceptable in terms of surface water impacts.
Avifauna	» A 200m no-go buffer is proposed around water points to prevent disturbance and displacement of breeding Southern Pale Chanting Goshawks: **No turbines fall within with areas in terms of the current layout.** » A 50m no-turbine buffer is proposed around drainage lines (optimal Red Lark habitat). A total exclusion zone will not be feasible, as the internal road network will have to cross drainage lines at some point. However, the construction of infrastructure in drainage lines should be kept to an absolute minimum, and avoided where possible.
Bats	» The locations of potential roosts are shown in Figure 7.4 and a buffer of 300 m and 500 m should be applied around these (depending on the type of roost) and all other potential roosts in the Development site. **No turbines fall within with areas in terms of the current layout.**
Visual	The current layout is acceptable in terms of visual impacts.
Noise	The potential noise impact would be insignificant during both the construction and operational phases. The current layout is acceptable in terms of noise impacts.
Heritage	There are no protected sites or structures within the study area that require mitigation. The current layout is acceptable in terms of noise impacts.
Agricultural Potential	The current layout is acceptable in terms of impacts on soils

Issue	Implications for current layout
	and agricultural potential. The area is of low sensitivity due to the low agricultural potential of the soils at the site.
Social	The current layout is acceptable in terms of social impacts.

In terms of the current layout not turbines fall into high sensitivity areas.

7.10 Summary of Impacts associated with the Access Roads, Proposed Connector Substation and small on site Substation

There is no preference from any of the specialist studies regarding the proposed alternative substation positions, however **Substation Position Alternative 1 (southern alternative)** is nominated as the preferred alternative from a technical feasibility perspective.

There are no preferences regarding access, both alternatives are acceptable from an environmental perspective. **Access Road Alternative 2 (northern option)** is nominated as the preferred access route option by Mainstream and is therefore the recommended alternative.

7.11 The No Go Alternative

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 carbon emissions.

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 producer of carbon emissions in the world, this would represent a negative social cost.

In addition, the No-Development option would not contribute towards the objectives of the Khai-Ma Local Municipality IDP and LED to create employment and support economic development.

However, at both a provincial and national level, it should be noted that the Poortjies Wind Energy Facility is not unique. In that regard, a significant number of solar and wind energy facility developments are currently proposed in the region. Foregoing the proposed Poortjies wind energy facility would therefore not necessarily compromise the development of renewable energy facilities in the Northern Cape or South Africa. However, the benefits to the municipality and local communities would be lost should the facility not be developed.

The generation of electricity from renewable energy resources in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored in 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 national 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.

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.

ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS CHAPTER 8

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 project's potential impacts become more significant when considered in combination with the projects within the greater Mainstream Renewable Energy Facility (which consists of 4 facilities in total). Cumulative impacts of the Poortjies Energy Facility with other known or proposed renewable energy facility projects within the region are also assessed in this chapter.

8.1 Approach Taken to Assess Cumulative Impacts

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

» Loss of vegetation and impacts on ecology;
» Impacts on avifauna and bats;
» Soil and agricultural potential impacts;
» Heritage impacts;
» Noise impacts;
» Visual impacts; and
» Social impacts.

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially occurring due to the cumulative effects of the Poortjies Wind Energy Facility together with all other renewable energy facilities proposed to be constructed or being constructed within the region. These impacts will be registered throughout the broader region requiring mitigation through planning at a regional level.
» Cumulative impacts potentially occurring due to the cumulative effects of the Poortjies Wind Energy Facility together with the other proposed Mainstream renewable energy facilities proposed for the study area. These include:
  - Korana wind energy facility (DEA Ref: 14/12/16/3/3/2/681);
  - Korana solar energy facility (DEA Ref 14/12/16/3/3/2/683); and
  - Khai-Ma wind energy facility (DEA Ref: 14/12/16/3/3/2/684);

8.2 Cumulative Impacts of Renewable Energy Facilities in the Region

A number of wind and solar energy facilities have either been proposed or are under construction in the Aggeneys, Pofadder and Namies areas in the Northern Cape Province. A number of renewable energy developments have been proposed within less than 75km of the proposed development, as described in Table 8.1 and indicated on Figure 8.1.

Table 8.1: Renewable energy facilities within the broader region based on (information available at the time of compiling this report)

Project Name	Distance from the proposed site	Project Status (based on most recent data available)
Poortjies wind energy facility	Subject of this report	In process
Korana wind energy facility	Adjacent	In process
Khai-Ma Wind Energy Facility	Adjacent	In process
Korana solar energy facility	Adjacent	In process
Namies Wind Energy Facility	Adjacent	In process
Gamsberg Solar Facility	~25km	In process
Orlight SA Solar	~25km	Authorized
Black Mountain Mining Solar Facility	~35km	Authorized
Zuurwater Solar Facility	~40km	In process
AES Solar Facility	~50km	In process
Boesmanland Solar Facility	~50km	Authorized
Sato Solar Facility	~50km	In process
Xina Solar One	~50km	Authorized – (preferred bidder; under

Project Name	Distance from the proposed site	Project Status (based on most recent data available)
		construction)
Kaxu Solar One	~55km	Authorized – (preferred bidder; under construction)
Upington Solar Thermal Plant Phase 3	~55km	Authorized – (preferred bidder)
Koeris Solar and Wind Facility	~70km	Authorized (Solar only)
Konkoosies Solar Facility	~45km	Authorized – (preferred bidder; construction complete)
Proposed Solar Facility near Springbok	~75km	In process

As there is uncertainty as to whether all the above-mentioned developments will be implemented, it is also difficult to quantitatively assess the potential cumulative impacts. It is, however, important to explore the potential cumulative impacts qualitatively as this will lead to a better understanding of these impacts and the possible mitigation that may be required. As these cumulative impacts are explored in more detail the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions – a national interest) versus the local and regional environmental and social impacts and benefits (i.e. landscape, ecology, tourism, , employment etc.) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

It is 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 Poortijes Wind Energy Facility.

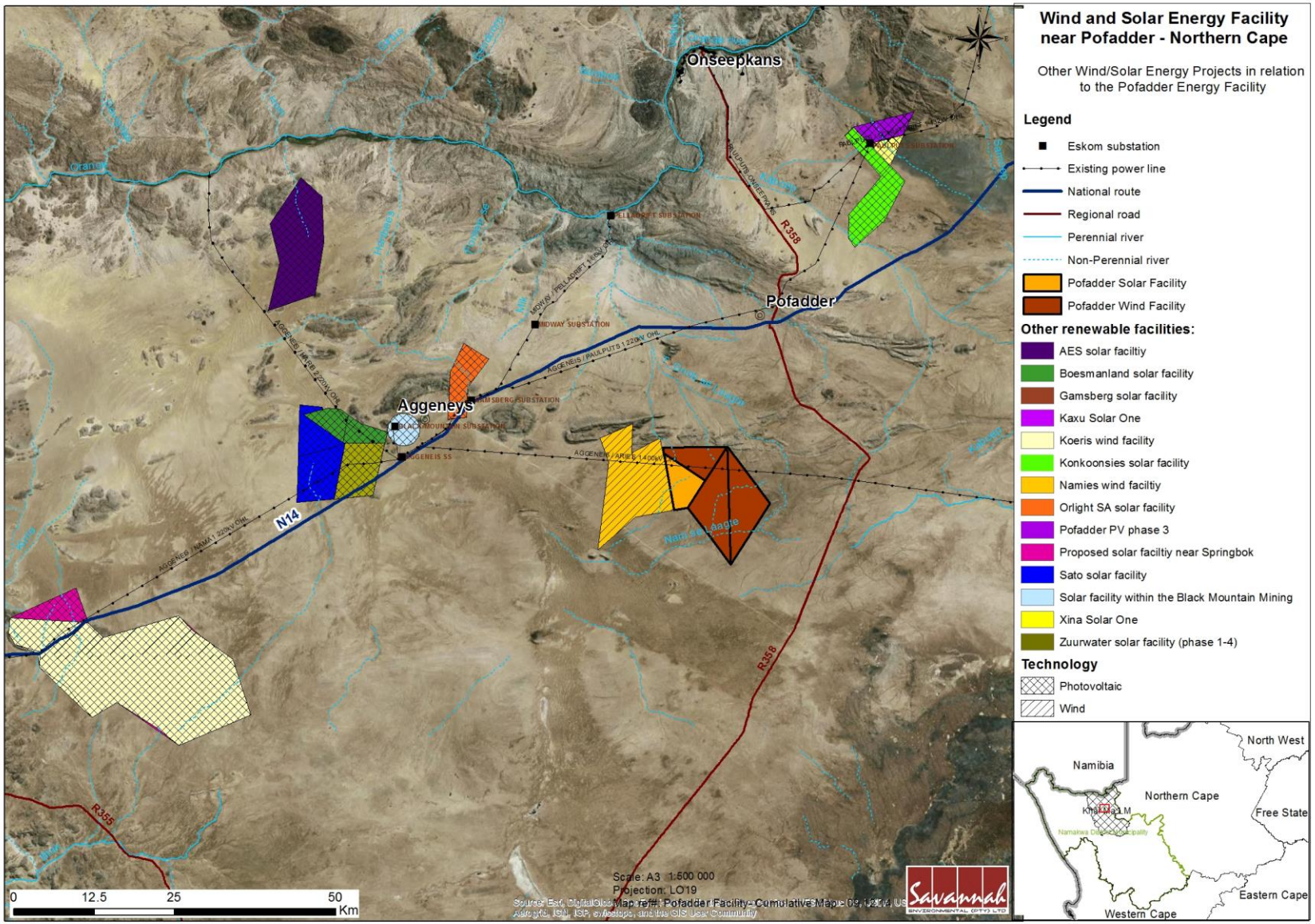


Figure 8.1: Map showing other projects in the region

9.2.1. Cumulative Impacts on Ecological Processes

The main cumulative impact on ecological processes as a result of the construction of numerous projects in the area would be related to the contribution to loss of vegetation and habitat for fauna species, as well as impacts on aquatic systems. Excessive clearing of vegetation, landscaping and loss of smaller fluvial systems could potentially influence runoff and storm water flow patterns and dynamics, which could cause excessive accelerated erosion of plains and possibly impact larger fluvial systems within the region.

These impacts would result largely from on-site construction activities. The cumulative impact on the Bushmanland Arid Grassland vegetation type and habitats in the area are not likely to be significant as the affected vegetation types and associated habitats are widespread and of low sensitivity. It is unlikely that the projects would impact on the conservation status of this vegetation type. Cumulative impacts would be expected to be low negative.

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. New power lines for example, should follow routes of existing servitudes if such exist; renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity (as is the case with the 4 Mainstream Renewable energy facilities), these developments should be situated as close together as possible and in a way that interferes as little as possible with natural ecosystem processes, not scattered throughout the landscape. In the case of the larger Mainstream renewable energy development, sensitivities have been considered within the proposed layouts in order to minimise impacts as far as possible.

9.2.2. Cumulative Impacts on Avifauna

Cumulative impacts on avifauna as a result of numerous developments within the region relate to increased collision risk with an increased number of wind energy facilities, and increased habitat loss.

Currently there is no agreed method for determining significant adverse cumulative impacts on ornithological receptors, although clearly a more strategic approach should be followed than is currently the case (Jenkins et al. 2011). The Scottish Natural Heritage (2005) guidance on cumulative effects of wind farms on birds recommends a five-stage process to aid in the ornithological assessment:

» Define the species/habitat to be considered;
» Consider the limits or 'search area' of the study;
» Decide the methods to be employed;
» Review the findings of existing studies; and
» Draw conclusions of cumulative effects within the study area.

Regional scale impacts

There are currently four applications for wind energy facilities within a 100km radius around Pofadder, which might result in the construction of approximately 370 wind turbines. It is difficult to guess at this stage how severe the cumulative collision impact of all these proposed wind developments will be on priority species on a regional basis, firstly because for many species no or inaccurate baseline population and mortality data exists, and secondly because the extent of actual impacts will only become known if the wind farms are actually developed and post-construction monitoring is implemented.

Within this context, it could be speculated that because the priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (possible exceptions are Red Lark and Sclater's Lark which are more range restricted but are not likely to be significantly impacted by turbine collisions), the potential cumulative impact of turbine collisions on priority species on a regional scale should be relatively minor, especially if the impact is envisaged to be low to start with as is likely to be the case here. It should be borne in mind that power lines kill many bustards in the Karoo (Shaw 2013), therefore any additional mortality even on a small scale, may well have a more significant cumulative impact than what is evident at first glance. However, it is envisaged that collisions of priority species, particularly Ludwig's Bustard, with the turbines will not be a major impact, for reasons already stated above. Provided the recommendations for minimisation for impacts within all developments are implemented, it is envisaged that the cumulative impact of mortality of priority species due to collisions with the turbines is likely to be low, even on a regional level. It is imperative that post-construction monitoring is implemented at all the proposed sites, in accordance with best practice in order to provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species, especially for future developments in the region, and ensure the implementation of appropriate mitigation measures throughout the life cycle of the facilities.

Site-specific scale

There are currently a total of approximately 190 turbines planned for a study area of approximately 175km², namely 70 turbines for Koranna WEF, 70 turbines for Kai-Ma WEF and 50 turbines for Poortjes WEF. In the current instance, not all the above criteria can be met in assessing the cumulative impact of potential

mortality due to collisions with the 190 proposed turbines at a study area level. The main reason is that no other studies have been done within this area with regard to avifaunal mortality levels, therefore there are no existing studies to review as far as existing impacts on the avifauna is concerned. In the absence of any scientifically verified data, general knowledge and experience will have to suffice. Given the extensive farming practices which are currently used in the study area, it can be surmised that the existing anthropogenic impacts on avifauna in the study area is relatively low. Although it cannot be confirmed, interviews with the landowners indicate that active persecution of large raptors for alleged stock killing is not commonly practised. Hunting of priority species is also not a major impact, although the hunting of some species has been confirmed by landowners. Overall, the very low human population in the study area is definitely advantageous to avifauna in general. All of these assertions would ideally need to be tested empirically in order to make comparisons possible, but a study of that proportions falls outside the scope of this project. The one impact that has been empirically confirmed is the mortality of Ludwig's Bustard due to collisions with the existing Aries - Aggeneys 400kV line. The extent of this mortality factor in the study area is unknown, but it can be assumed that it is a regular occurrence (Shaw 2013). The key question therefore is to what extent turbine collisions will contribute to this existing and potentially significant mortality factor. All in all, it is envisaged that collisions of priority species particularly Ludwig's Bustard, with the turbines will not be a major impact, for reasons already stated above. Provided the recommendations in this report are implemented, it is envisaged that the cumulative impact of mortality of priority species in the study area, especially Ludwig's Bustard, due to collisions with the turbines is likely to be low.

9.2.3. Cumulative Impacts on Bats

The cumulative impact for each issue was also assessed by considering current and future development of wind energy within a 560 km radius of the Development. This scale was chosen because it represents the maximum reported distance the Natal long-fingered bat is estimated to migrate in South Africa (Miller-Butterworth et al. 2003).

Impacts at a local scale could have negative consequences at larger scales if the movement between distant populations is impacted (Lehnert et al. 2014; Voigt et al. 2012). The cumulative impacts could be lower for species that do not migrate over such large distances or resident species that are not know to migrate. Cumulative impacts on bats are likely to increase as new facilities are constructed (Kunz et al. 2007). At least 30 wind energy facilities are being considered in the region including six projects which have been awarded preferred bidder status by the Department of Energy. The nearest approved wind energy facilities to the

proposed Development site, approximately 120 km south, are the Loeriesfontein 2 Wind Farm and the Khobab Wind Farm near Loeriesfontein in the Northern Cape. Cumulative impacts could result in declines in populations of even those species of bats currently listed as Least Concern, if they happen to be more susceptible to mortality from wind turbines e.g. high-flying open air foragers such as free-tailed and fruit bats. Further research into the populations and behaviour of South African bats, both with and without wind turbines, is needed to better inform future assessments of the cumulative effects of wind energy facilities on bats.

9.2.4. Cumulative Impacts on Soil and Agricultural Resources

The impact of the proposed Poortjies Wind Energy Facility on soil and the loss of agricultural land available to grazing is of very low significance due largely to the limited potential of the area regarding agriculture. The cumulative impact of multiple projects in the area (i.e. those associated with the larger Mainstream renewable energy development) an in the region is offset by major limitations to agriculture in the area due to the aridity and lack of access to water, as well as the shallow soils prevailing within the region. The potential loss of agricultural land will be very low as a result of the construction of numerous facilities at a regional level. In terms of the cumulative impact associated with the larger Mainstream renewable energy facility, a cumulative loss of approximately 500 ha of land would occur (or 6 % of the broader 12 717ha study area) should all 4 projects be implemented. The cumulative agricultural impacts are therefore considered to be of low significance.

Cumulative impacts in terms of loss of soil resources could potentially be realised. However, with the implementation of appropriate mitigation measures, impacts in this regard would be minimised. The cumulative impact on soils and agricultural potential is therefore expected to be low.

9.2.5. Cumulative 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. Therefore, the contribution of the proposed facility to the cumulative impact in this regard is expected to be limited. It still remains important for each renewable energy facility to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible.

9.2.6. Cumulative Visual Impacts

Extensive renewable energy facilities have been approved within the region between Pofadder and Springbok. These facilities consist mainly of solar and wind energy facilities (refer to Table 8.1 and Figure 8.1). Considering the number of facilities proposed in the region, it can be stated that the potential cumulative visual impact of these facilities would be very high, should all of these facilities be constructed. The proposed Mainstream Renewable Energy Facility, although in line with current development and land use trends in the region, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.

Figure 8.2 illustrates the anticipated cumulative visual impact of the larger proposed Mainstream Renewable Energy Facility, and specifically the anticipated *frequency* of visual exposure. Areas shaded in dark red are likely to be exposed to the wind turbines of *all three wind energy facilities*, while areas shaded in yellow are likely to be exposed to the wind turbines of only two of the wind energy facilities within the Mainstream Renewable Energy Facility. Areas shaded in green are likely to be exposed to only one wind energy facility, while areas not shaded are likely to be visually screened.

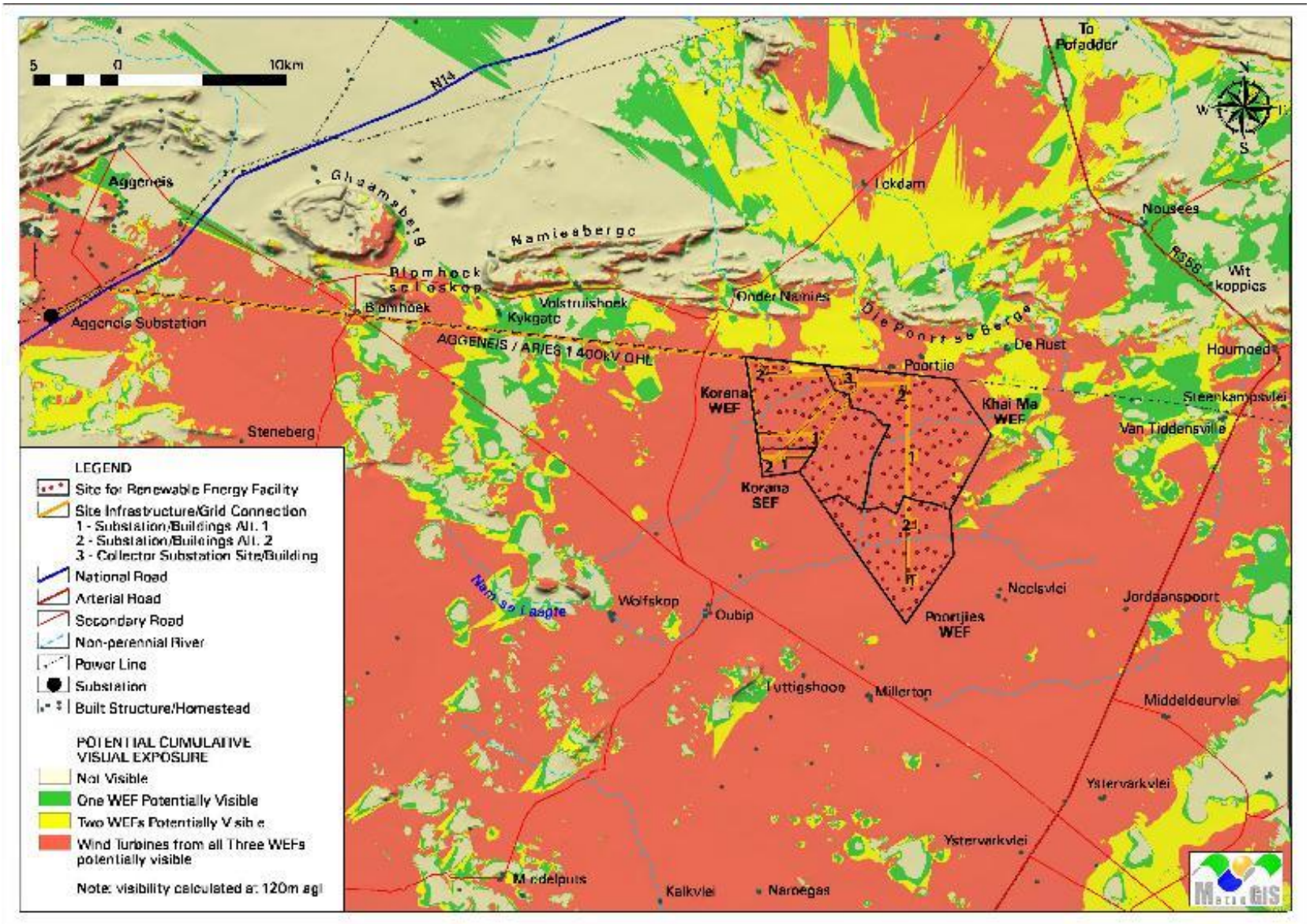


Figure 8.2: Potential cumulative visual exposure of all proposed facilities

A high cumulative visual impact is anticipated within 20km of the proposed facilities, with the highest frequency of exposure expected on the site and immediate surrounds, extending to the west, south west, south and south east of the study area. A few fragmented areas, primarily to the west and east of the site, will be screened from the potential visual impact of one or two of the wind facilities. Limited areas to the west of the site and beyond the low mountains to the north and north-west of the site will be screened from all potential visual impact.

Affected sensitive visual receptors include residents of homesteads and users of secondary roads. Those in closest proximity include residents of *Poortjie, Onder Namies, De Rust, Neelsvlei, Milnerton, Luttigshoop* and *Oubip*. Users of the R358 will also be exposed to potential visual impact, as will users of a limited section of the N14. The latter lies beyond the 10-20km offset, thus reducing the expected likelihood of this impact occurring.

9.2.7. Cumulative Noise Impacts

The proposed project is not expected to add to the noise levels at a regional scale due to the separation distance between the proposed facilities (being more than 20km in most cases). However, where projects are proposed in close proximity to one another, the potential for cumulative impacts exists.

As the developer proposes the development of two other wind energy facilities (Khai-Ma Wind Energy Facility and Korana Wind Energy Facility) adjacent to the Poortjies Wind Energy Facility (as well as adjacent to the proposed Namies Wind Energy Facility), there exists a risk for a cumulative noise impacts. The potential noise impact of the solar facility will not be considered for the following reasons:

» It is a daytime activity only;
» Even if it was operational at night, it is an activity with insignificant noise emission levels considering the potential noise emission levels of the wind turbines;
» The solar facility is located very far from any potential noise-sensitive receptor.

The sound power emission levels of the Vestas V117 3.3 MW were used to determine potential cumulative noise impacts associated with the 3 wind energy facilities proposed as part of the Mainstream Renewable Energy Facility. Impacts during the time period 22:00 – 06:00 were assessed.

Results: Cumulative Noise Impact - Operational Phase

Projected Noise Levels in the area due to the operation of the wind energy facilities are illustrated in Figure 8.3, illustrating the cumulative impact of all wind

turbines operating simultaneously at all three other proposed wind energy facilities. The following can be concluded from Figure 8.3:

» 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 by the SANA Requirements at all NSDs for all wind speeds.
» Cumulative noise rating levels is projected not to exceed 45 dBA at any receptor.
» The operations of the three facilities are unlikely to change the ambient sound levels sufficiently to create annoyance with the facility.

The cumulative noise impact associated with all three wind energy facilities operating simultaneously has been assessed to be of low significance based on the fact that there are very few sensitive noise developments in close proximity of the site.

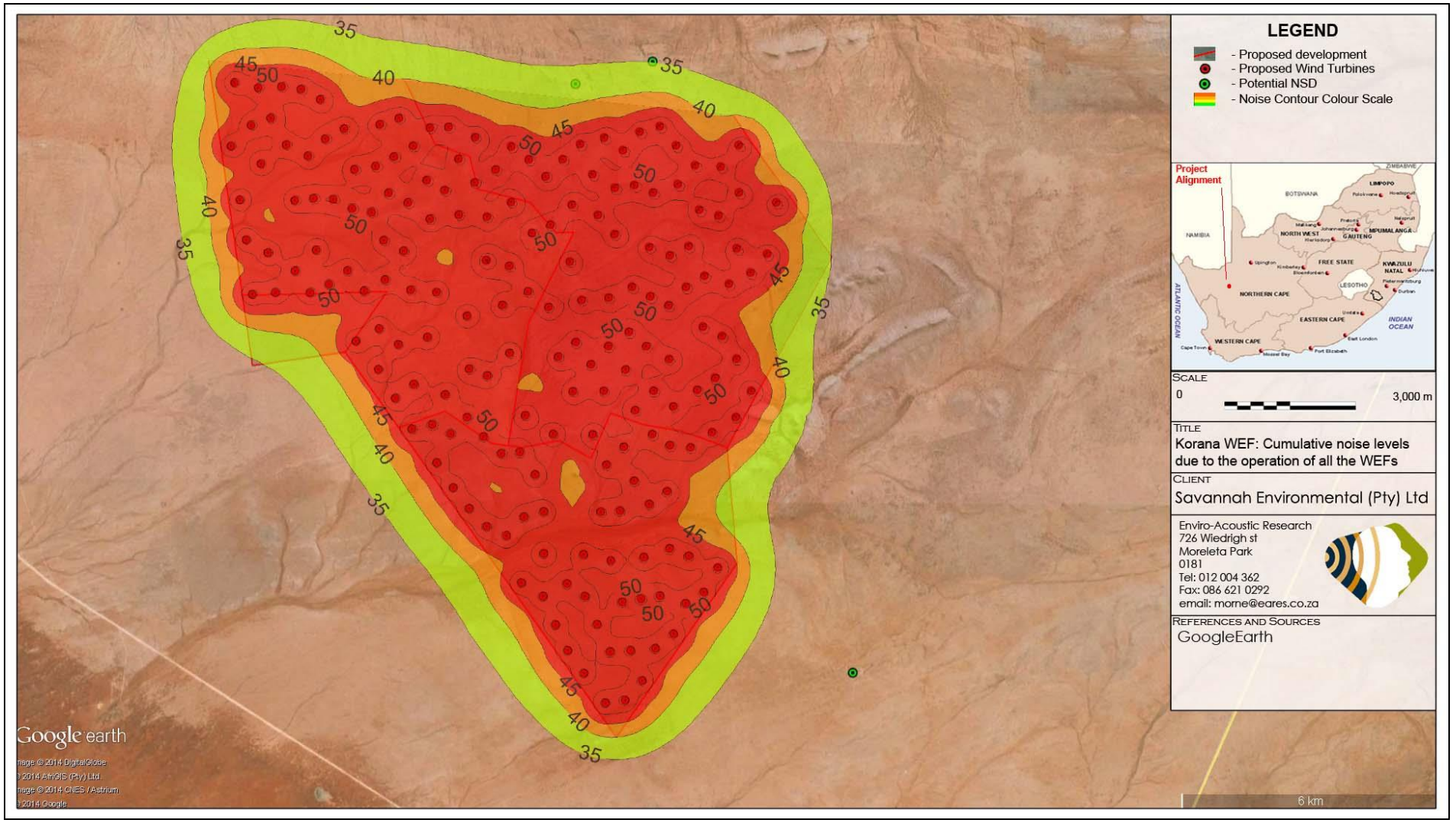


Figure 8.3: Projected conceptual operational Noise Rating Levels; Contours of constant sound levels

9.2.8. Cumulative Socio-Economic Impacts

Negative impacts on the social environment as a result of the establishment of a number of renewable energy facilities in the region is largely related to the impact on the visual character of the region (as discussed above), and will impact negatively on the landscape and the area's rural sense of place and character. The construction of the proposed wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region should all facilities be constructed.

The development of large-scale renewable energy projects in the region will likely draw a large number of labour, businesses and jobseekers. If the local labour force cannot be sourced locally or the local labour pool is inadequate for the wind energy projects, outside labour will likely move to the area to fill the available positions. The area may experience an influx of new residents who may move to the area looking for job opportunities; which will have effects on the existing population during the construction period and could entail problems of housing, sanitation, water usage and solid waste disposal. Employment at a wind energy facility peaks during construction and significantly declines during operation; since relatively few workers while in operation. Though there may be an influx of workers during construction, these workers are largely temporary. Rapid population growth is a common experience in rural towns near new large development projects. Towns with larger populations (greater than 1000 individuals) and with developed services will likely experience greater rates of population growth than areas without developed services. If more than one facility is constructed at one time, these impacts would be compounded, adding to the potential significance of the impact.

The establishment of the proposed Mainstream renewable energy facilities and other similar facilities in the region has the potential to create a number of socio-economic opportunities for the local municipality and district municipality, which, in turn, will result in a positive social benefit. This could result in positive permanent impacts on the economy, business development, stimulation of the local property market, employment and education as well as creation of downstream business opportunities in the region and the province. The cumulative impacts are likely to have significant positive impacts on the local economy. The significance of this impact is rated as a high positive with enhancement.

Although it is considered unlikely that all three additional projects be constructed simultaneously with the Poortjies Wind Energy Facility, the construction of more than one project simultaneously could potentially lead to an exacerbation or

compounding of potential negative social impacts identified due to the intensity of such impacts, including:

» Degradation of access roads
» Traffic congestion
» Nuisance impact on adjacent landowners
» Impact on farming practices
» Security issues
» Labour unrest

It is anticipated that should all four projects be constructed, that Khai-Ma and Korana Wind Energy Facilities will be constructed first.

8.4 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.

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 following conclusions can be drawn from the consideration of the potential cumulative impacts resulting from the construction and operation of multiple renewable energy projects proposed for the Mainstream Pofadder Renewable Energy Facility within the study area:

» The development footprints of the four proposed renewable energy projects that will form part of Mainstream's Pofadder Renewable Energy Facility are aligned with areas of lowest ecological sensitivity within the study area and micro-siting will avoid areas of high sensitivity identified.
» The study area has a very low heritage significance.
» There are very few noise sensitive developments in the greater study area.
» Shared infrastructure between the projects within Mainstream's Pofadder Renewable Energy Facility would include the existing shared access road as well as the collector substation proposed as part of the Khai-Ma Wind Energy Facility.
» Benefit to people in the area and increased opportunities for employment and spin-offs may occur.

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Poortjies Wind Energy Facility have been summarised below:

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

Based on the above, the cumulative impacts associated with the construction and operation of the Poortjies Wind Energy Facility, other facilities forming part of Mainstream's Pofadder Renewable Energy Facility, and other renewable energy facilities in the region are considered to be acceptable provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPrs for each project.

CONCLUSIONS AND RECOMMENDATION CHAPTER 9

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) is proposing to establish the Poortjies wind energy facility and associated infrastructure on a site located approximately 22 km south-west of Pofadder in the Northern Cape Province. This facility forms part of a larger Renewable Energy Facility which also incorporates two other commercial wind energy facilities and one (1) solar energy facility and associated infrastructure. A broader area of approximately 12000ha is being considered within which the renewable energy facilities are to be constructed (refer to Figure 1.2).

Table 9.1 Details of the proposed Poortjies Wind Energy Facility project

Component	Description/ Dimensions
Location of the site	Portion 1 of the farm Poortje 209 and the Remainder of the farm Poortje.
Municipal Jurisdiction	Khai-Ma Local Municipality
Electricity Generating capacity	100MW
Details of turbines	» Up to 50 wind turbines with a generating capacity of up to 4 MW each » Hub height of up to 140m » Rotor diameter of up to 150m
Extent of site	3197 ha
Internal access	Gravel roads of 32km in length
Site access	Either via Access Alternative 1 (northern road) or Access Alternative 2 (via the south)
Grid connection[8]	» A 132 kV overhead power line connecting the proposed Poortjies Wind Energy Facility to the proposed Khai-Ma Collector Substation or alternatively to the existing 400kV Aggeneys Substation. » Collector substation also required as part of larger facility. The collector substation is proposed on farm portions assessed as part of the Khai-Ma Wind Energy Facility and is not assessed here.
Services required	» 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

Component	Description/ Dimensions
	waste disposal site. .
Temporary infrastructure required during the construction phase	» Construction camps; » Construction yard and offices; » Laydown area and storage areas; and » Temporary access roads.

The environmental impact assessment (EIA) for the proposed Poortjies 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.

The Draft Environmental Impact Assessment Report was released for public review in January 2015 for a 40-day public review period. Following the review of the Draft EIA report, this Final EIA report was compiled and submitted to the National Department of Environmental Affairs.

9.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies as contained within Appendices F - M 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 proposed Poortjies Wind Energy Facility and associated infrastructure (including the on-site substation and access roads) on the site near Pofadder. 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.

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. This layout includes 50 wind turbines as well as associated infrastructure. Please note that a separate EIA process is being undertaken for the proposed construction of a 132 kV overhead power line connecting the proposed Poortjies Wind Energy Facility to the electricity grid. Reference to the power line connecting the facility to the grid is however provided within this report in the interest of fully describing all infrastructure associated with the project, such that a holistic picture of the project is provided.

No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium significance were identified which require mitigation (such that the majority of 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 in Chapter 7 of this report as well as within the **Environmental Management Programme (EMPr)** included within **Appendix P**.

The sections which follow provide a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA

9.1.1 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 special concern, disturbance and loss 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 41km^2 was considered for the facility, of which 2.6% 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 on the ground as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

i) Permanently transformed areas

Permanently affected areas comprise 50 turbine footprints (50 foundation areas of 30m x 30m), access roads (up to 8m in width), one 132 kV substation footprint (500m x 500m) and an operations and service building area (100m x 100m). It should be noted that the site currently has several access roads which are used

for farming activities. The layout of the facility has, in agreement with the Department of Agriculture, utilised these existing roads in the facility layout to reduce the need for new roadways. 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)**
50 turbine footprints (each 30m x 30m)	45 000
Permanent access roads within the site (8m width and 32km in length)	256 000
One on-site substation footprint (500m x 500m)	250 000
Operations and service building area (100m x 100m)	10 000
TOTAL	561 000m^2 (of a total area of 32 765 000m^2) **i.e. 1.7% of site**

Approximately 1.7% of the entire extent of the site can be anticipated to be permanently transformed during the construction and operation of the Poortjies Wind Energy Facility.

ii) Temporarily affected areas

Temporarily affected areas during the construction phase comprise 50 laydown areas for turbines (each laydown area assumed to have a footprint of 60m x 60m) and a temporary crane travel track and construction access roads utilising the same route as the permanent access road (an additional 4m in width to the permanent road of 8 m (i.e. taking the total roadway to be used during construction to 10m in width)). The area of temporary disturbance is as follows:

Facility component – temporary	**Approximate area/extent (in m^2)**
50 turbine laydown areas (60m x 60m per turbine)	180 000
Temporary crane travel track and construction access roads utilising the same route as the permanent access road (additional 4m in width) and 32km in length	128 000
TOTAL	308 000 (of a total area of 32 765 000m^2) = **0.9%** of site

Therefore, ~0.9% of the entire extent of the site can be anticipated to be temporarily disturbed to some extent during the construction of the Poortjies

Wind Energy Facility. Considering permanent and temporary footprints, up to 2.6% of the total extent of ~32km^2 will be disturbed by the construction and operation phases of the project.

9.1.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of the wind turbines and associated infrastructure, Table 9.2 indicates the significance ratings for the potential environmental and social impacts associated with the project.

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

Nature	Without mitigation / enhancement	With mitigation / enhancement
Impacts on Ecology		
Loss or fragmentation of vegetation & protected plant species	Low	Low
Loss of Ecological Processes	Low	Low
Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.	Medium	Low
Impact on threatened animals species/habitat	Medium	Low
Impacts on Avifauna		
Displacement due to disturbance and habitat destruction	Medium	Low
Bird Mortalities due to collisions with wind turbines	Medium	Low
Impacts on Bats		
Disturbance and/or destruction of bat roosts due to construction activities	Medium	Low
Mortality of bat species through collision	Medium	Low

Nature	Without mitigation / enhancement	With mitigation / enhancement
with turbines or barotraumas caused by turbines operation.		
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with high agricultural potential and land capability and impact on land-use	Medium	N/A - No mitigation possible
Soil erosion / degradation during construction	Low	Low
Loss of topsoil and veld degradation during construction	Low	Low
Soil contamination	Low	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction Phase (Positive Impact)	Medium (+)	Medium (+)
Impact of the presence of construction workers in the area on local communities	Low	Low
Risk of Stock theft and damage to farm infrastructure	Medium	Low
Increased risk of fires during construction	Medium	Low
Increases traffic on roads due to construction	Low	Low
Damage to and loss of farmland during construction	Medium	Low
Benefits associated with the establishment of a community trust	Medium (+)	High (+)
Operational Phase -Creation of Long- Term employment and business opportunities	Low (+)	Medium (+)
Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa	Medium (+)	Medium (+)
Long-Term Impact of the project on Existing Farming Activities on the Site	Low	Low
Impact of the wind energy facility on tourism in the region	Low	Low
Visual Impacts		
Visual impact on sensitive visual receptors within the region	Medium	N/A - No mitigation possible
Visual impact on sensitive visual receptors in close proximity to the proposed	High	N/A

Nature	Without mitigation / enhancement	With mitigation / enhancement
infrastructure.		
Change in visual character and sense of place	Medium	N/A - No mitigation possible
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	Medium	Low
Noise Impacts		
Noise impacts due to construction activities	Low	Low
Noise impacts from the wind turbines – operational phase	Low	Low
Impacts on Heritage Artefacts		
Impact of construction on archaeology	Low	Low
Potential Impacts on Hydrology		
Loss of riparian systems	Medium	Low
Increase in sedimentation and erosion	Low	Low
Impact on localized surface water quality	Low	Low

9.1.3. Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Poortjies Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 9.1 and A3 map in Appendix P**). The following sensitive areas/environmental features have been identified on the site:

» ***Bats sensitive areas*** - The locations of potential bat roosts identified through the pre-construction monitoring are shown in Figure 9.2. As it may be possible to limit bat roost abandonment by avoiding construction activities near roosts, it is recommended that a buffer of 300 m and 500 m should be observed around these (depending on the type of roost) and all other potential roosts identified in the Development site.
» ***Fauna*** - Areas designated with a high sensitivity are landscape features providing rocky habitats. These rocky habitats are highly sensitive due to the high biodiversity and abundance of fauna that they support. The seasonal waterways and water bodies are designated as moderate sensitivity since these water features and their associated habitat support life on site and attract faunal activity within and around them.

» ***Visual receptors*** occur in the study area. The visual impacts of the wind energy facility will be of a medium- high significance. It is however not possible to mitigate visual impacts.
» ***Bird Habitat and Sensitive Areas -*** Turbine positioning should take cognisance of sensitive areas identified for the site (as indicated on Figure 9.2).

On the basis of the sensitivities identified, the areas which can be considered as a 'no go' areas for the construction of infrastructure (including turbines) are:

» The seasonal drainage lines and quartzite ridges should be treated as ecologically sensitive and should be avoided. No construction should take place within 50 m of the nominal centre line of the drainage lines or quartzite ridges.
» 200m no-go buffer is proposed around water points to prevent disturbance and displacement of breeding Southern Pale Chanting Goshawks.
» A 50m no-turbine buffer around drainage lines (optimal Red Lark habitat). A total exclusion zone will not be feasible as the internal road network will have to cross drainage lines at some point. However, the construction of infrastructure in drainage lines should be kept to an absolute minimum, and avoided where possible.
» Identified bat roosts with 300m – 500m buffer depending on the type of roost.
» High sensitivity areas in terms of faunal habitat.

No turbines should be located within the environmental sensitive areas listed above. Based on the findings of the EIA studies undertaken and the recommendations above, the original proposed layout for the project (as presented within this EIA) was revised in order to avoid areas of high sensitivity. Both the original layout (Figure 9.2) and the revised layout (Figure 9.3) are shown below.

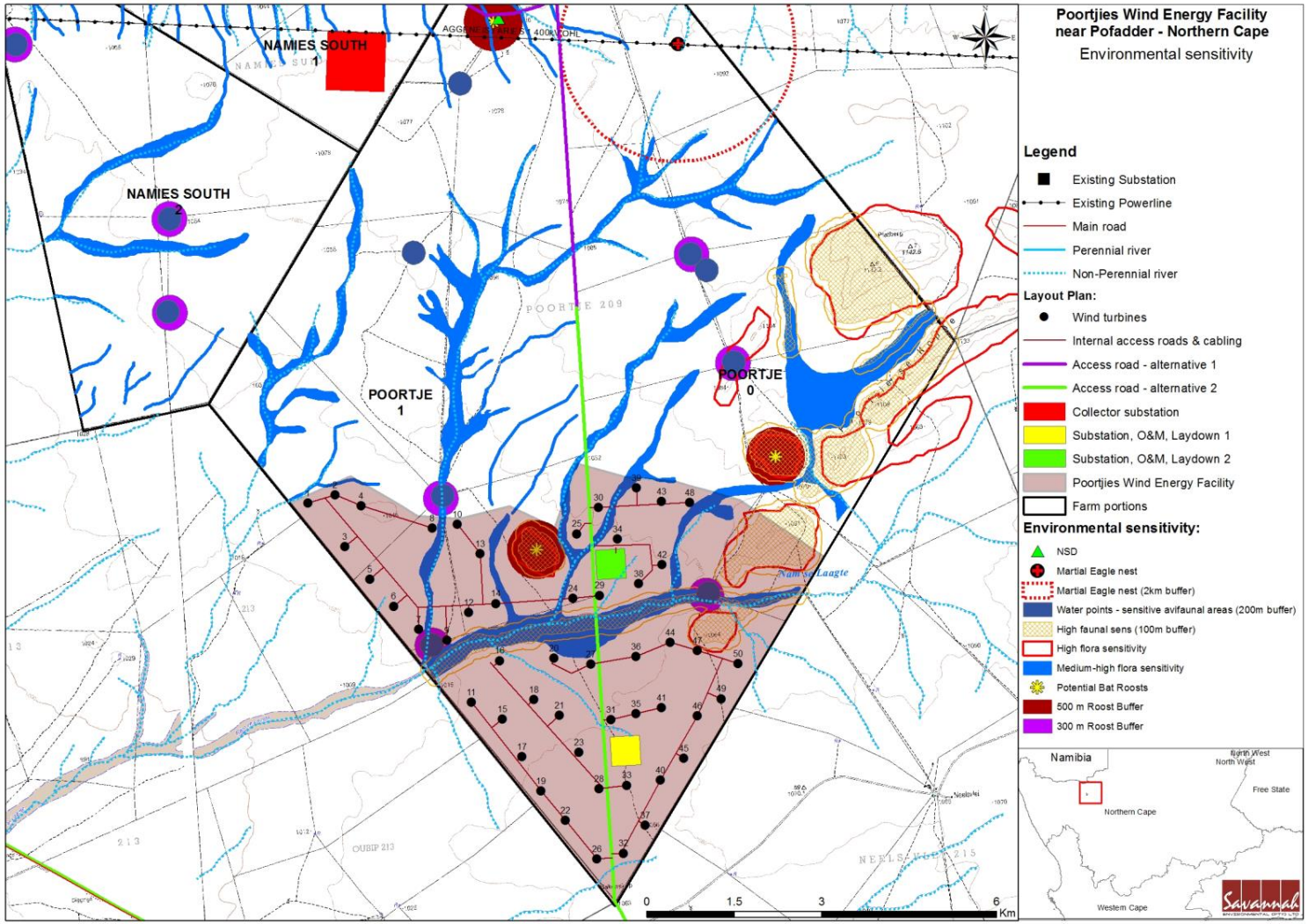


Figure 9.1: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed development footprint for the Poortjies Wind Energy Facility **(Appendix P contains A3 map)**

9.2. Comparative Assessment of Substation Positions and Access Road Alternatives

There is no preference from any of the specialist studies regarding the proposed alternative substation positions. However, **Substation Position Alternative 1 (southern alternative)** is nominated as the preferred alternative for grid connection from a technical feasibility perspective, being closer to the center of the site.

There are no preferences regarding access since both alternatives are acceptable from an environmental perspective. **Access Road Alternative 2 (northern option)** is nominated as the preferred access route from a technical feasibility perspective by Mainstream and is therefore the recommended alternative.

9.3. Cumulative Impacts

The potential cumulative impacts resulting from the construction and operation of multiple renewable energy projects proposed for the Mainstream Pofadder Renewable Energy Facility within the study area are likely to be largely contained to within the boundaries of the study area (apart from the visual impacts), and with the application of the necessary mitigation measures, contained within each of the respective sites.

Cumulative impacts are discussed in detail in Chapter 8 of this report. Overall, the conclusions of the assessment of cumulative negative environmental impacts indicate that the cumulative impacts of the project can be managed to an acceptable level.

9.4. Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise as a result of the project proceeding. This could include:

» Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the wind energy facility (which is limited to the development footprint). The cost of loss of biodiversity has been minimised through the careful location of the development to avoid key areas sensitivity.
» Visual impacts associated with the wind energy facility. The cost of loss of visual quality to the area is reduced due to the area already being visually impacted to some extent by power lines, as well as the limited number of sensitive receptors located close to the development site.

» Change in land-use and loss of land available for grazing on the development footprint. The cost in this regard is expected to be limited due to the limited footprint of the facility, the low agricultural potential and carrying capacity of the property and the fact that current agricultural activities can continue on the remainder of the property during construction and operation.

These costs are expected to occur at a local and site level and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are implemented.

Benefits of the project include the following:

» The project will result in important economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will persist during the preconstruction, construction and operational phases of the project.
» The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective SDFs and IDPs.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of wind energy to the mix.
» South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to reliance on fossil fuels. The proposed project will contribute to South Africa achieving goals for implementation of renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW renewable energy project.

The benefits of the project are expected to occur at a national, regional and local level. As the economic costs to the environment have been largely limited through the appropriate placement of infrastructure on the site within lower sensitivity areas, the expected benefits of the project will partially offset the localised environmental costs of the project.

9.5. 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 Poortjies Wind Energy Facility in the Northern Cape has been established by South Africa Mainstream Renewable Power Developments (Pty) Ltd. The positive implications of establishing the Poortjies 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 good inland wind energy resources on this site would be realised.
» The National electricity grid in the Northern Cape would benefit from the additional generated power.
» The project will assist the district and local municipalities in reducing levels of unemployment through the creation of jobs, skills development opportunities and support of local business.
» The project will contribute towards the promotion of clean, renewable energy in South Africa.

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 Poortjies Wind Energy Facility site is located directly adjacent to the Korana WEF, as well as adjacent to the proposed Juwi Renewable Energy Namies Wind Energy Facility, and forms part of the larger Mainstream Renewable Energy Facility. This proximity of the facilities to one another could be considered as a renewable energy hub, consolidating impacts in a single node in an area 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 across an area.

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:

» Drainage lines and quartzite ridges. No construction should take place within 50 m of the nominal centre line of the drainage lines or quartzite ridges.
» Potential bat roosts and associated buffers of 300 m and 500 m (depending on the type of roost). A 200m no-go buffer is proposed around water points to prevent disturbance and displacement of breeding Southern Pale Chanting Goshawks.
» High sensitivity faunal areas identified.

These areas are indicated in Figure 9.1. **No turbines are situated in sensitive areas in terms of the current layout.**

9.6. 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 and power line, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the conclusion of the EIA project team that the application for the proposed Poortjies Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level as recommended within this EIA Report. It is therefore recommended that the project is authorised,

The alternative layout presented in Figure 9.3 is the recommended preferred alternative. The following infrastructure should be included within an authorisation issued for the project:

» The site is proposed to accommodate up to 50 wind turbines. The facility would be operated as a single facility with each turbine being up to 4MW in capacity. The capacity of the facility will be up to 100MW.
» Each wind turbine is expected to consist of a concrete foundation (30m x 30m x 4m), a tower, a hub (up to 140m above ground level, depending on the turbine size decided upon) and three blades (with a rotor diameter of up to 150m).
» Permanent internal access roads (up to 8 m in width and including turning circles where required) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised, widened and upgraded where possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (500 m x 500 m) to facilitate grid connection (Alternative 1 position).

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 to M must be implemented.
» The 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. This layout should take cognisance of all sensitive and no go areas identified within this EIA.
» An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
» All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
» Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
» 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 bat communities. Where necessary, additional mitigation measures should be implemented to minimise impacts on these communities.

» Disturbed areas during construction should be kept to a minimum and rehabilitated as quickly as possible.
» Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation. Adequate storm-water 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/foremen 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).
» All other relevant and required permits be obtained by the developer prior to the commencement of construction.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.

REFERENCES **CHAPTER 10**

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