MAINSTREAM RENEWABLE POWER SOUTH AFRICA NOUPOORT (PTY) LTD

Proposed Construction of a Wind Farm near Noupoort, Northern Cape Province, South Africa

Final Environmental Impact Report:

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Signature:	
For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Remainder of the Farm No.168, Colesberg, Noord Kaap	C02100000000016800000
Portion 1 of the Farm No. 181, Colesberg Noord Kaap	C02100000000018100001
Portion 21 of the Farm No. 182, Colesberg Road, Noord Kaap Harmonie	C02100000000018200021

TITLE DEEDS: Refer to Appendix 1

PHOTOGRAPHS OF SITE:

General Characteristics of the study area

General Characteristics of the study area

SENSITIVE VISUAL RECEPTORS: Potentially sensitive areas have been identified. These particularly include the receptor locations in natural contexts located to the west of the site (away from the town of Noupoort) and a farmstead to the south of the site.

TYPE OF TECHNOLOGY: Wind Energy - turbines

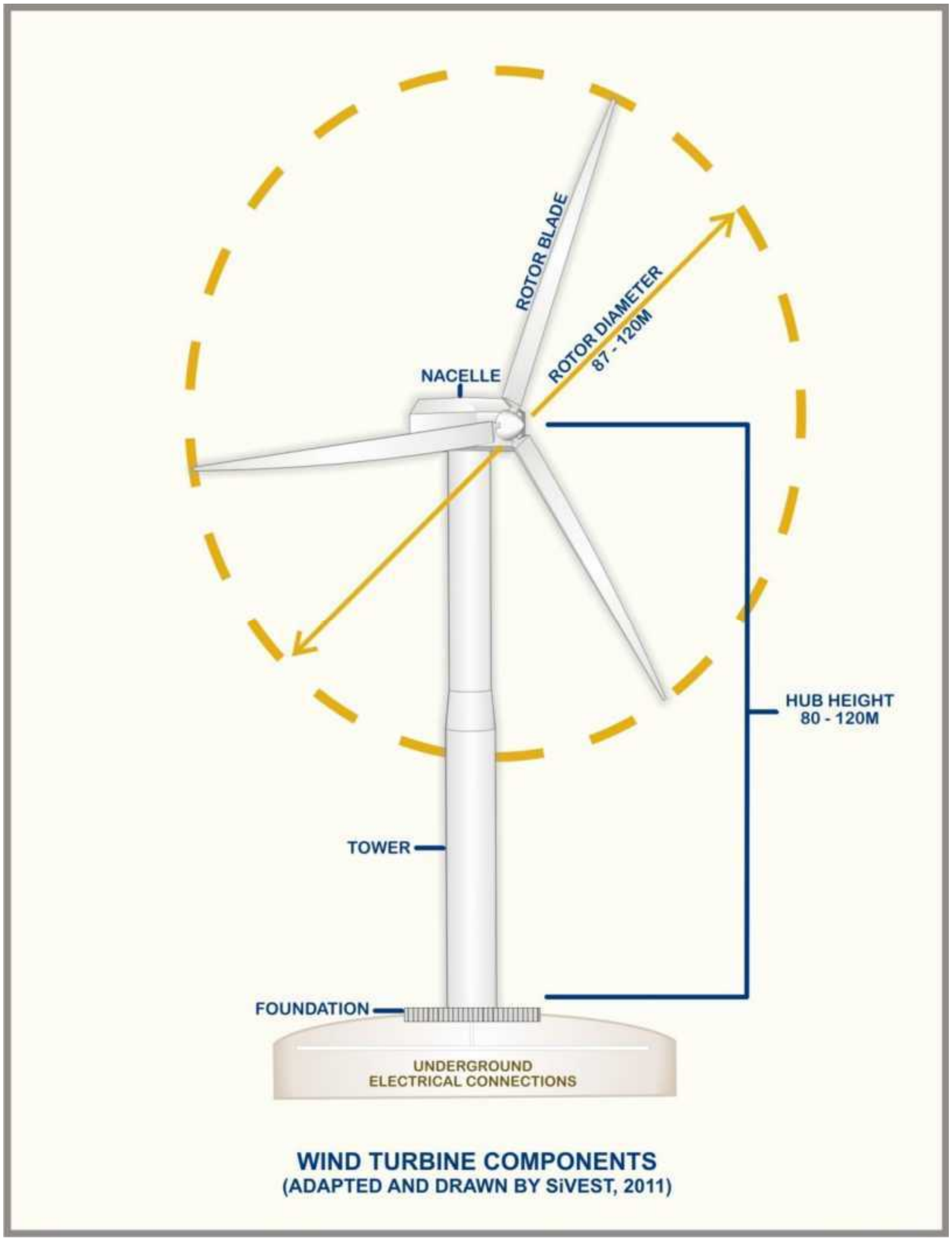
HUB HEIGHT: 80-120m

ROTOR DIAMETER : Up to 120 m

SURFACE AREA TO BE COVERED: 55.1 Hectares for the wind farm infrastructure and 1 873 Hectares for the entire buildable area during construction.

STRUCTURE ORIENTATION: The structures will not be fixed and will be able to rotate in order to catch the prevailing winds.

TURBINE DESIGN: The final design is not available but average specs are presented below:



FOUNDATION DIMENSIONS: Total footprint for each wind turbine and the associated hard standing area is approximately 2 800m².

BLADE ROTATION DIRECTION: The blade rotation direction may be clockwise or counter-clockwise. This will only be selected once the final turbine designs have been selected.

TEMPORARY LAYDOWN AREA DIMENSIONS: 100m X 100m (10 000m^2) during construction.

GENERATION CAPACITY: Depending on grid connectivity capacity will be either up to 30MW feeding into the 66kV line at Noupoort Substation or up to 188.6 MW feeding into the 132kV line at Newport Substation or breaking the 132 kV line south of Noupoort between the Newport and Ludlow Substations..

ONSITE MEASURED WIND PARAMETERS: Data is confidential. Mainstream has measured wind at sufficient height since September 2010. The data gathered indicates that there is enough wind resource to construct a viable wind farm .

MAINSTREAM RENEWABLE POWER SOUTH AFRICA

CONSTRUCTION OF A WIND FARM NEAR NOUPOORT, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

FINAL ENVIRONMENTAL IMPACT REPORT

Executive Summary

South Africa Mainstream Renewable Power Noupoort (Pty) Ltd (Mainstream) intends to develop a wind farm near Noupoort in the Northern Cape Province of South Africa. SiVEST Environmental Division has been appointed as independent consultants to undertake the Environmental Impact Assessment (EIA) for the proposed wind farm. The objective of the project is to generate electricity to feed into the National Grid by constructing wind turbines (and associated infrastructure).

The proposed development requires environmental authorisation from the Department of Environmental Affairs (DEA). However, the provincial authority will also be consulted (i.e. the Northern Cape Department of Tourism, Environment and Conservation (NCDTEC). The EIA for the proposed development will be conducted in terms of the newly released EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on the 2nd of August 2010. In terms of these regulations, a full EIA is required for the proposed project. All relevant legislations and guidelines (including Equator Principles) have been consulted during the EIA process and will be complied with at all times.

The proposed project is required to improve electricity supply to the Eskom Grid and to assist in achieving the Government's mandate for the establishment of renewable energy generation facilities.

The proposed project involves the construction of a wind farm. Layout alternatives have been investigated and these relate to the location of the proposed development and associated infrastructure on the site. These are illustrated below:

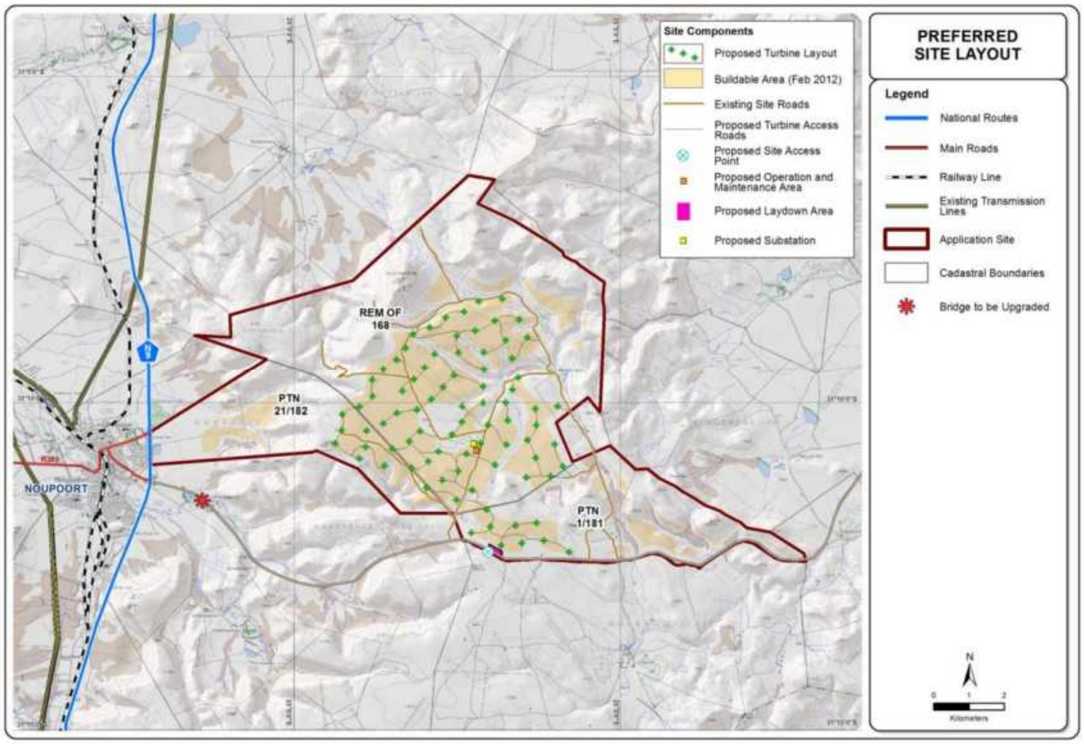


Figure i: Site layout alternatives (refer to Appendix 7 for A3 Maps)

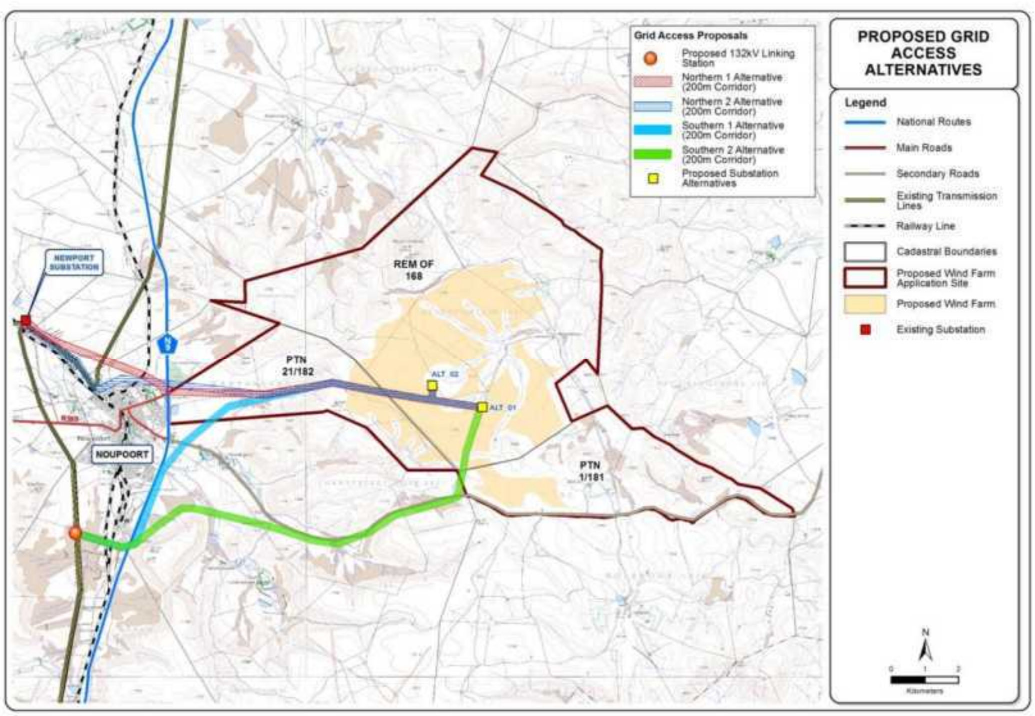


Figure ii: Proposed grid access alternatives (refer to Appendix 7 for A3 Maps)

The proposed wind farm site near Noupoort, falls within the following vegetation types: Karoo Escarpment Grassland; Tarkastad Montane Shrubland and Eastern Upper Karoo.

The following assessments were conducted during the Impact phase to identify the issues associated with the proposed development. These include the following:

- Biodiversity (including fauna and flora) Assessment
- Avi-faunal Assessment
- Bat Assessment
- Surface Water Impact Assessment
- Soils and Agricultural Potential Assessment
- Visual Impact Assessment
- Noise Impact Assessment
- Heritage Assessment
- Palaeontological Assessment
- Socio-economic Impact Assessment

Based on the impact studies that were conducted, a few sensitive aspects have been identified within the study area. These areas have been assessed and used to inform the final layout of the proposed wind farm. The table below summarises the specialist findings of the Impact Report.

Table i: Summary of findings

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity (Flora and Fauna)	▪ The study area consists of a mix of natural veld and unimproved grassland which is used as grazing land for cattle and sheep. Vast grazing land is interspersed incised river channels, which flow intermittently, are present. Large mountains are present within the study site. ▪ Various mammal, amphibian and reptile species are likely to occur within the study area. ▪ The potential impacts of the proposed development during the construction phase mainly related to loss of habitat for red data and general species; potential loss of species richness, edge effect and erosion. The impact of the proposed development will be limited to the turbine construction areas and the associated infrastructure such as roads. Surrounding vegetation will remain intact and will not be impacted upon. As such the impact is localised and if the mitigation measures are implemented, the overall impact can be reduced. ▪ No significant impacts on vegetation and habitat are expected during the operation phase of the proposed development, as long as rehabilitation of the impacted surrounding areas has taken place.	Sensitive areas have been identified within the boundaries of the study area. These relate to rocky cliffs, high mountain sides and tops as well as rivers and wetlands. The preservation of these features, as well as conservation of biodiversity should be maximised through the selection of a site that avoids areas of concern as highlighted in this report. The preferred area steers away from these sensitive areas and strict mitigation measures will further reduce the identified impacts
Avi-fauna	▪ This proposed development site contains some intrinsic avian biodiversity value. It does not contain any unique habitats or landscape features, nor does it affect any known, major avian fly-ways. However, the site contains	Identified sensitive and no-go areas have been identified and must be respected. Additionally, recommended buffer zones particularly around the Blue Crane nesting site must be enforced.

	two topographical characteristics that are usually linked to increased collision risk, namely slopes which could be used by soaring species for lift, especially during light wind conditions, and valleys which act as natural funnels for birds commuting through the site. If possible, these areas should be kept free of turbines. ▪ There are regionally and/or nationally important impact susceptible species present (or potentially present), and the proposed facility may have a significant detrimental effect on these birds, both during the construction and operational phases of the development.	Implementation of the required mitigation measures should reduce potential mortalities due to collision with the wind turbines, displacement due to disturbance, habitat loss due to the footprint of the wind farm mortalities due to collision with associated power line infrastructure impacts to Low. However, this can only be verified in the longer term by implementing an integrated per- and post construction monitoring programme which has been undertaken as of October 2011.
Bats	▪ Two species of bat were confirmed on site Egyptian free-tailed bats (*Tadarida aegyptiaca*) and Cape serotine bats (*Neoromicia capensis*)) but more species are considered to be common here. Although neither confirmed species are of conservation concern, they likely provide important agri- and ecosystem services. ▪ Construction phase impacts relate to destruction of bat roosts and foraging habitat. Operation phase impacts relate to bat mortalities due to collisions and barotrauma during migration and foraging. ▪ Several mitigation measures have been stipulated to address impacts in addition to identifying sensitive areas or exclusion areas for the placement of the wind turbines to minimise the impact. Long term monitoring has been proposed for research purposes and has been implemented as of December 2011.	The inland water bodies and stream areas indicated in the data of the buildable areas and their buffers should be treated as sensitive, implicating that no turbines are allowed to be placed in this zone due to the elevated impacts it can have on bat mortalities and have been treated as such. No wind turbines have been placed within these sensitive areas to avoid excessive bat fatalities. Curtailment is recommended as an operational mitigation measure for this site, should operational monitoring highlight the need, as bats were detected flying in open areas as well (not indicated as sensitive). Curtailment will reduce fatalities for bats flying in open areas. To determine the correct cut in speed should this be required and whether the site falls within a bat migration route, a 12 month long

		term monitoring is currently being done which was initiated in December 2011.
Surface water	▪ Although the development site exists in an arid area, there are a number of surface water features on the site. These differ in characteristics from drainage lines in rocky terrain to narrow valley bottom wetlands and well-defined streams. In the context of the study area's arid characteristics these surface water features are environmentally and socio-economically important, and are sensitive to disturbance, being especially prone to erosion. ▪ These surface water areas have been designated as sensitive features of the environment, and as such they have been delimited as no-go areas with a buffer to be maintained around them. This report has found that the proposed development could cause direct and indirect impacts on the surface water features on the site. This is especially related to the associated (linear) infrastructure associated with the proposed wind farm, in particular roads and underground cabling. The construction of this infrastructure could be associated with the physical destruction of wetland habitat, as well as possible hydrological and hydromorphological modification of the surface water feature and introduce possible pollutants into the surface water drainage feature. Without the implementation of mitigation measures, the impact of the	A number of general and site-specific mitigation measures have been recommended to ameliorate the potential impacts and these have been included in the EMPr for the proposed development. The most important of these is the avoidance of surface water features by infrastructure as far as possible. Where this is not possible (e.g. where access roads have to cross surface water features), the design and construction of the infrastructure must be planned to take into account the sensitivity of the feature and to ensure the implementation of the relevant mitigation measures. Should these be adhered to, the development will be able to be constructed and developed without causing significant impacts on the surface water features on the site.

	proposed development on surface water features could be significant.	
Soils and Agricultural Potential	▪ The study area is dominated by unimproved veld which is predominantly utilized as grazing land for cattle and sheep. Cultivation, in terms of Lucerne, is possible in valley bottoms were the soils tended to be deeper with higher soil moisture contents due to topographic position. ▪ The study area is almost completely framed by steeper slopes, valley lines and / or ridges while the central areas are characterised by flat and gently sloping topography with an average gradient of less than 10%. The soils identified are predominantly shallow and rocky with a low agricultural potential. Lithic soils (Mispah and Glenrosa Forms) cover 87% of the surveyed area. Virtually all the soils encountered had a layer that was limiting to plant growth and the effective soil depth rarely extended below 50 cm. ▪ The site is not classified as high potential nor is it a unique dry land agricultural resource. The study area has been classified as having an extremely low potential for crop production due to severe climatic limitations, steep topography and restrictive soil characteristics but are considered to have a moderate when utilised as grazing land, its current use.	Normal grazing (the dominant agricultural activity) can be permitted around the turbines. The active Lucerne subsistence fields have been delineated as No-Go Areas in terms of agriculture. These active fields only constitute 0.1% of the assessment area. Even though disrupting these fields would not constitute a fatal flaw it is recommended that these cultivated fields are precluded from the site layout. Other than these fields and the limited subsistence agricultural fields tended by Sipila Nongunzenzela Trust the Noupoort site is dominated by grazing land and this activity is considered non-sensitive when assessed within the context of the proposed development. Consequently, the impact of the proposed development on the study area's agricultural potential will be extremely low, with the loss of agricultural land being attributed to the creation of the service roads and around the turbine foundations
Noise	▪ With the input data as used, the noise impact assessment indicated that the proposed project will have a noise impact	Where potentially sensitive receptors are nearby, care must be taken to ensure that the operations at

	of a low significance on all NSD in the area during the construction phase, but of a medium significance on NSD06 during the operational phase. As the wind turbine to be selected is not confirmed, modelling made use of the Nordex H90 2500HS wind turbine. Mitigation measures are proposed that will reduce the potential noise impact to a more acceptable low significance.	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.
Visual	▪ The visual assessment was undertaken based on the final draft layout for the wind farm that was made available for assessment in the final stages of the EIA. It is a critical factor that this layout was designed based on a consideration of a number of visual sensitivity factors, in particular areas on which turbines would be most visible to surrounding areas in which sensitive receptors are present. Although not all 'exclusion areas' were avoided, certain critical areas were not developed, and as such it is very important to note that this new layout represents a scenario under which visual mitigation measures have been applied. ▪ In spite of the changes to the layout to avoid certain parts of the site, the assessment has identified that certain key observation locations will be subject to a visual contrast	The identified potentially impacted areas can be effectively ameliorated by further altering the turbine layout by removing turbines from the parts of the two buffer zones (that to the east of the 'escarpment edge' and that to the north of the Oorlogspoort Road) in which turbines have been placed. It is thus recommended that consideration be given to removing turbines from these locations, as this would result in an acceptable degree of visual change and intrusion associated with the wind farm at all locations (**Note –** this recommendation is subject to technical constraints and other environmental factors that may override visual impact considerations. The current layout already represents the implementation of mitigation measures in terms of restricting turbines

	and thus potential visual intrusion that is inconsistent with the current visual environment. These locations are those receptor locations in natural contexts located to the west of the site (away from the town of Noupoort which has been assessed to be subject to an acceptable level of change) and a farmstead to the south of the site.	from visually sensitive areas. The above recommendations would be favourable to reducing the visual impact however the locations of these turbines are not considered to be a fatal flaw).
Heritage	▪ Several heritage resources have been identified on site which can be classed as having high significance. ▪ The cultural landscape qualities of the region essentially consist of one component. It is a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial (farmer) component. ▪ The following sites, features and objects of cultural heritage significance have been identified: ▪ A rock shelter that was occupied during the Later Stone Age is located in a valley which is outside the area that has been identified as buildable for the turbines. Because of its location in the valley, it is highly unlikely that there would be a physical impact on it arising from the development of the wind farm. However, some of the wind turbines might be visible from the shelter. As the site is in no physical danger and it has already been intensively studied, no mitigation measures are required. ▪ Two old farmsteads were identified. Both these features are located outside of the areas that have been identified as buildable for the wind turbines and therefore there would be no physical impact on it.	In order to safeguard the identified sites, it is recommended that buffer zones identified are set out around each of the identified sites. These include: ▪ The rock shelter should be demarcated with a buffer of at least 50 metres from the outer edge of the shelter, up to and including the river bank. ▪ The farmsteads should be demarcated with a buffer of at least 10 metres from the outer edge of all structures and features such as gardens, orchards, etc. ▪ Cemeteries should be demarcated by a buffer of at least 10 metres from the outer edge of the fence, or the last visible graves if there is no fence. ▪ The stone walled structures should be demarcated by a buffer of at least 10 metres from the outer edge of the individual structures These buffer zones have been incorporated into the site layout as exclusion areas.

	▪ Informal cemetery, probably for farm labourers. Approximately 20 graves, all only marked with stones. No names or other inscriptions could be found. These graves are probably linked to the homestead discussed above. Therefore there would be no impact on it as a result of the proposed development. ▪ A number of stone walled structures were erected by sheep herders who brought the sheep up onto to high areas during the summer and then vacated then during winter when it became too cold. Typically these structures seem to consist of a small area used for sleeping and a larger enclosed space used to keep the sheep in overnight. ▪ Fortunately all of these structures are located in the valleys or on ridges, areas which are unlikely to be impacted on by the proposed development. However, if there is to be an impact on any of these structures, the relevant structures should be recorded in full (mapped, photographed and excavated) prior to the development taking place. ▪ Potential impacts identified for the construction phase include focus on the physical disturbance of the stone age material and its context, damage to farmsteads, damage to cemeteries and damage to farm related features. ▪ Mitigation measures focus on implementing buffer zones to identified sites to prevent potential damage.	Based on current information regarding sites in the surrounding area, apart from the rock shelter that is viewed to have Grade II significance, all other sites known to occur in the study region are judged to have Grade III significance and therefore would not prevent the proposed development for continuing after the implementation of the proposed mitigation measures and its acceptance by SAHRA. All suggested mitigation measures that are to be implemented have been included in the EMPr for the proposed development.
Palaeontology	▪ The Mainstream wind farm study area east of Noupoort, Northern Cape, is largely underlain by continental sediments of the Katberg Formation (Karoo Supergroup) that are known to contain important fossil biotas of Early	It is considered that no further palaeontological heritage studies or specialist mitigation are warranted for this alternative energy project, pending the exposure of any substantial fossil remains (e.g.

	Triassic age, notably vertebrates, trace fossils and rare plants of the Lystrosaurus Assemblage Zone. ▪ These fossils are of international palaeontological significance in that they document the recovery of terrestrial biotas following the catastrophic end-Permian mass extinction event of 251 million years ago. Several Early Triassic vertebrate fossil localities have already been recorded by previous workers close to the Noupoort study area and are represented in museum collections (e.g. the BPI at Wits University, Johannesburg). ▪ Over the great majority of the study area, including flatter-lying areas that are most likely to be directly affected by the proposed development, the Katberg Formation bedrocks are mantled with superficial deposits such as scree, soil and alluvium that are generally of low palaeontological sensitivity. ▪ The very few good exposures of potentially fossiliferous mudrocks within the region mainly occuring on steeper hill slopes in the escarpment region that lie outside the wind farm development footprint. Even where bedrock exposure is good, fossil vertebrate remains are sparse, disarticulated and usually fragmentary (e.g. reworked bones and teeth in channel conglomerates). Rare plant fossils recorded are very poorly preserved and not identifiable to a specific plant group. Trace fossils (various invertebrate burrows) are locally abundant but assemblages are very low in diversity and represent common Katberg forms. ▪ It is concluded that the construction phase of the proposed	vertebrate bones and teeth, large blocks of petrified wood) during the construction phase. The ECO responsible for the developments should be alerted to the possibility of fossil remains being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA. These recommendations have been incorporated into the EMP for the Mainstream Noupoort Wind Farm.

<table>
<tr>
<td></td>
<td>Mainstream Noupoort Wind Farm is likely to have only a LOW NEGATIVE impact on local palaeontological heritage resources. The operational and decommissioning phases of wind farms will not involve significant negative impacts.
Fatal flaws or no-go areas with respect to fossil heritage conservation have not been identified for this project.
There are no preferences on palaeontological heritage grounds for any particular alternative site for the on-site substation, operational and maintenance buildings or lay down area. Likewise, the various alternative transmission line routes from the wind farm to the Eskom grid near Noupoort are assessed as having a similar low negative impact with the exception of the Southern 2 Alternative. In this last case, negative impacts might be slightly higher (but still LOW overall) due to the comparatively good Katberg Formation bedrock exposure along Oorlogspoort.</td>
<td></td>
</tr>
<tr>
<td>Socio-economic</td>
<td>A summary of the construction impacts are shown in the table below:
<table>
<tr><th>Change Process</th><th>Issue</th><th>Pre-Mitigation</th><th>Post-Mitigation</th></tr>
<tr><td>Economic</td><td>Employment and output creation</td><td>+18</td><td>+30</td></tr>
<tr><td rowspan="2">Socio-Cultural</td><td>Social mobilisation</td><td>-20</td><td>-7</td></tr>
<tr><td>Health and safety</td><td>-60</td><td>-28</td></tr>
<tr><td>Average</td><td>Overall construction impacts</td><td>-20</td><td>-1.6</td></tr>
</table>
Apart from the possibility of temporary employment, overall (i.e.</td>
<td>Though all of the identified social impacts can be mitigated or enhanced successfully, this can only be done if Mainstream, or its appointed contractor(s), commit to the responsibility of ensuring that the level of disturbance brought about to the social environment by the more negative aspects of the project, is minimised as far as possible.

It is therefore recommended that:
Social issues identified during the EIA phase are addressed. This could be done by engaging social specialists where necessary or by ensuring that ECOs used during</td>
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<td>based on the average significant ratings of impacts as reflected in the table above) the construction phase is characterised by negative low social impacts.

In certain instances the implementation of mitigation measures can bring about positive changes. One such case would be the implementation of an effective HIV/AIDS prevention programme that extends to the local communities where construction workers will spend their free time, as this can also serve to inform and empower local people to make better and more informed decisions regarding their future (sexual) behaviour. Where Mainstream has the opportunity to bring about positive change to local communities they should pursue such opportunities where possible.

The majority of impacts that would occur during the construction phase would affect people’s sense of wellbeing and security within their social environment. A number of changes to the socio-economic environment would lead to economic impacts, but for the most part these impacts would be restricted to individuals or individual households and would not extend to the community at large.

A summary of the operations and maintenance impacts are shown in the table below.

<table>
<tr><th>Change Process</th><th>Issue</th><th>Pre-Mitigation</th><th>Post-Mitigation</th></tr>
<tr><td>Economic</td><td>Employment and</td><td>+18</td><td>+33</td></tr>
</table>
</td>
<td>construction have the necessary knowledge and skills to identify social problems and address these when necessary. Guidelines on managing possible social changes and impacts could be developed for this purpose.

Neighbouring landowners are informed beforehand of any construction activity that is going to take place in close proximity to their property. Prepare them on the number of people that will be on site and on the activities they will engage in.
Employees are aware of their responsibility in terms of Mainstream’s relationship with landowners and communities surrounding the site. Implement an awareness drive to relevant parts of the construction team to focus on respect, adequate communication and the ‘good neighbour principle.’

All mitigation measures in the SIA are incorporated in the EMP to ensure that Mainstream and the contractor adhere to these</td>
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</table>

	output creation		
	Tax income	+14	+14
	Corporate Social Investment	+27	+48
	Agricultural output	-11	-11
	Tourism	-10	-10
	Property prices	-10	-10
Socio-cultural	Sense of place	-24	-20
Average	Overall operations and maintenance impacts	+0.6	+6.3

The presence of the wind farm during the operation and maintenance phase overall will have a low positive impact, although certain elements will yield medium positive impacts whereas other elements are expected to have a more negative connotation. Most positive impacts are of an economic nature, most significantly Mainstream's corporate social investment in the area, which in turn could lead to an array of other positive social upliftment projects (outside the scope of this study). Negative impacts are expected to be on the low side and would in all probability be over-shadowed by the more positive contributions that Mainstream will make to the area through their CSI.

These specialist studies were conducted to address the potential impacts relating to the proposed development that were identified during the scoping phase. An impact assessment was conducted to ascertain the level of significance each identified impact, and to identify mitigation measures which may be required. The potential positive and negative impacts associated within these studies have been evaluated and rated accordingly. The results of the specialist studies have indicated that no fatal flaws were identified by the specialists.

Based on the findings of the specialist studies, the following layout was chosen as the preferred layout.

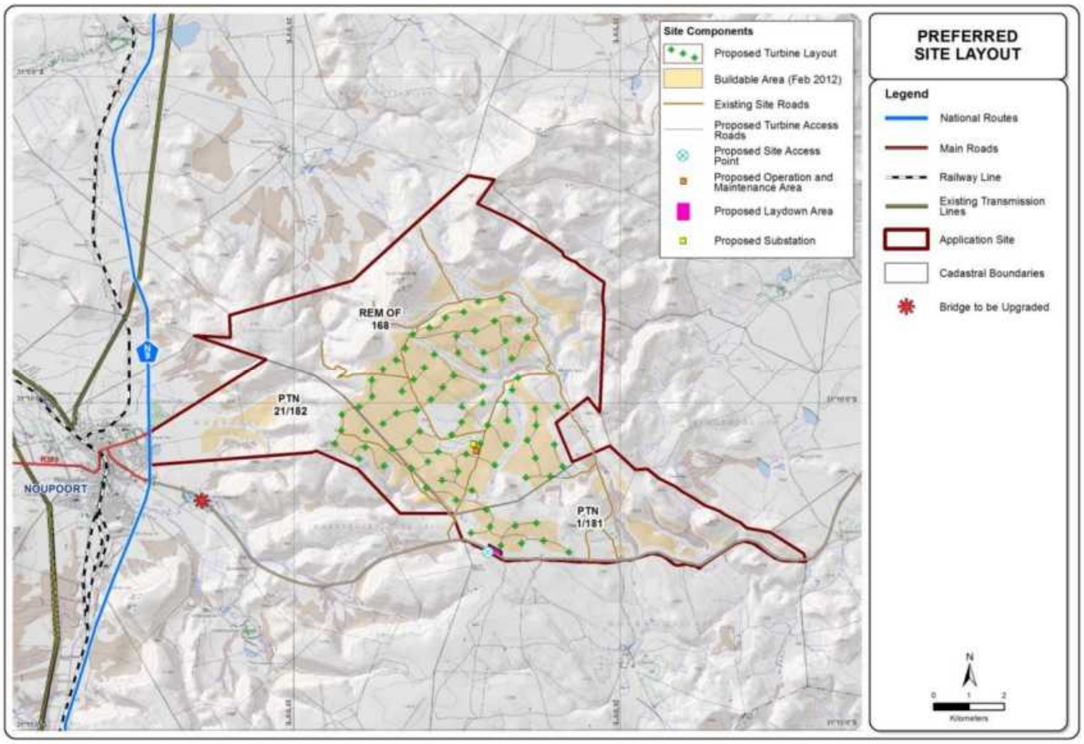

Figure iii: Preferred site layout

It is the opinion of the EAP that the proposed project be allowed to proceed provided that the recommended mitigation measures are implemented.

MAINSTREAM RENEWABLE POWER SOUTH AFRICA

CONSTRUCTION OF A WIND FARM NEAR NOUPOORT, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

FINAL ENVIRONMENTAL IMPACT REPORT

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Glossary of terms

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Cumulative Impact: In relation to an activity, cumulative impact means 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.

"Equator Principles": A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing

Environmental Impact Assessment: 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 the application.

Environmental Impact Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

Heritage Significance Grades:
a) Grade I: Heritage resources with qualities so exceptional that they are of special national significance;
(b) Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
(c) Grade III: Other heritage resources worthy of conservation,

Heritage resources: This means any place or object of cultural significance. See also archaeological resources above

Historical Period: Since the arrival of the white settlers - c. AD 1840 - in this part of the country

Hyrdomorphic / hydric soil: Soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring growth and regeneration of hydrophytic vegetation. These soils are found in and associated with wetlands.

Iron Age: Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. These people, according to archaeological evidence, spoke early variations of the Bantu Language. Because they produced their own iron tools, archaeologists call this the Iron Age.
Early Iron Age AD 200 - AD 900
Middle Iron Age AD 900 - AD 1300
Late Iron Age AD 1300 - AD 1820

Kilovolt (kV): a unit of electric potential equal to a thousand volts (a volt being the standard unit of electric potential. It is defined as the amount of electrical potential between two points on a conductor carrying a current of one ampere while one watt of power is dissipated between the two points).

Macro-geomorphological: Related to / on the scale of geomorphic provinces. A geomorphic province is a spatial entity with common geomorphic attributes.

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red Data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping Report: An “issues-based” report which forms the first phase of an Environmental Impact Assessment process.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.
Early Stone Age 2 000 000 - 150 000 Before Present
Middle Stone Age 150 000 - 30 000 BP
Late Stone Age 30 000 - until c. AD 200

List of Abbreviations

AP - Action Plan
BID - Background Information Document
CRM - Cost Recovery Mechanism
DEA - Department of Environmental Affairs
DoE - Department of Energy
DWA - Department of Water Affairs
EAPs - Environmental Assessment Practitioner
EHS - Environmental, Health, and Safety
EIA - Environmental Impact Assessment
EIR - Environmental Impact Report
EMPr - Environmental Management Programme
ENPAT - Environmental Potential Atlas
ECA - Environmental Conservation Act No 73 of 1989
EP - Equator Principles
EPFI - Equator Principles Financial Institutions
FGM - Focus Group Meeting
FSR - Final Scoping Report
GDP - Gross Domestic Product
GIIP - Good International Industry Practice
GIS - Geographic Information System
GPS - Global Positioning System
GW - Gigawatts
HIA - Heritage Impact Assessment
I&AP(s) - Interested and Affected Parties
IBA(s) - Important Bird Area(s)
IDP - Integrated Development Plan
IEP - Integrated Energy Plan
IPP(s) - Independent Power Producers
IUCN - International Union for the Conservation of Nature and Natural Resources
KSW - Key Stakeholder Workshop
kV - Kilo Volt
LGMSA - Local Government: Municipal Systems Act No. 32 of 2000
MSA - Middle Stone Age
MYPD2 - Multi Year Price Determination 2
MW - Megawatt
MSBL - Multi-Site base load (MSBL)
NCDTEC - Northern Cape Department of Tourism, Environment and Conservation
NEA - The National Energy Act No. 34 of 2008
NERSA - National Energy Regulator of South Africa
ERA - The Electricity Regulation Act No. 4 of 2006
IRP - Integrated Resource Plan

ISMO - Independent System and Market Operator
NEMA - National Environmental Management Act No. 107 of 1998
NEMBA- National Environmental Management: Biodiversity Act No. 10 of 2004
NFEPA - National Freshwater Ecological Priority Areas
NHRA - National Heritage Resources Act No. 25 of 1999
NSBA - National Spatial Biodiversity Assessment
NWA - National Water Act No. 36 of 1998
NEMAA- National Environmental Management: Air Quality Act of 2004
OHSA - Occupational Health and Safety Act No. 85 of 1993
PFA - Project Facilitation Act No. 67 of 1995
PoS - Plan of Study
PM - Public Meeting
PPA - Power Purchase Agreement
PPP - Public Participation Process
REFIT - Renewable Feed-In Tariff Programme
RFP - Request for Proposals
RFQ - Request for Qualifications
SA - South Africa
SABAP 2 - Southern African Bird Atlas Project 2
SAHRA - South African Heritage Resources Agency
SANBI - South African National Biodiversity Institute
SAWS - South African Weather Service
SBO - Single Buyer Office
SDF - Spatial Development Framework
ULM - Umsobomvu Local Municipality
VAC - Visual Absorption Capacity

MAINSTREAM RENEWABLE POWER SOUTH AFRICA

CONSTRUCTION OF A WIND FARM NEAR NOUPOORT, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

FINAL ENVIRONMENTAL IMPACT REPORT

1 INTRODUCTION

South Africa Mainstream Renewable Power Noupoort (Pty) Ltd (hereafter referred to as Mainstream) has appointed SiVEST to undertake the EIA process for the proposed construction of a wind farm near Noupoort in the Northern Cape Province of South Africa. The objective of the project is to develop a wind farm in order to generate electricity to feed into the national grid. The project is also in line with the government's commitment to provide renewable energy as an alternative energy source to those currently utilized.

In terms of the Environmental Impact Assessment Regulations (2010) published under the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended, the proposed development is regarded as a listed activity under Government Notice R544 - R546 of 2010. The Scoping Phase of the project has been completed and has been accepted by the National Department of Environmental Affairs (DEA), refer to Appendix 3 for the acceptance letter from DEA. This project is now at the EIA phase of the EIA Process.

This report has been compiled in accordance with World Bank standards and the Equator Principles. The Equator Principles ("EP") are a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing (Equator Principles, 2006).

This wind farm project is considered a Category B project, according to the Equator Principle rating system. Category B Projects are those with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures (Equator Principles, 2006).

1.1 Structure of this Report

This Final Environmental Impact Report (FEIR) is structured as follows:

- Chapter 1 introduces the project and discusses the experience of the Environmental Assessment Practitioners (EAP), including specialists, who have contributed to the report. It expands on the relevant legal ramifications applicable to the project and describes the Equator Principles, IFC Performance Standards and the relevant development strategies and guidelines.
- Chapter 2 details the approach used to undertake the study i.e. the scoping study, authority consultation and the EIR.
- Chapter 3 elaborates on the assumptions and limitations pertaining to the EIA process for the proposed development.
- Chapter 4 provides explanation to the need and desirability of the proposed project by highlighting issues such as research supporting wind farms, security of power supply, local employment as well as regional and local income profile, facts justifying wind energy.
- Chapter 5 details the information pertaining to the sustainability aspects of the wind farm outlining how the proposed development will develop under the clean development mechanism (CDM).
- Chapter 6 gives detailed technical descriptions of the components of the wind farm.
- Chapter 7 identifies the various alternatives of the wind farm with particular reference to the site layouts and the no-go alternative.
- Chapter 8 provides a description of the region in which the proposed development is intended to be located. Although the chapter provides a broad overview of the region, it is also specific to the application. It contains descriptions of the site and the specialist studies conducted during scoping are also summarised.
- Chapter 9 describes the Public Participation Process (PPP) undertaken during the EIA Phase and tables issues and concerns raised by Interested and Affected Parties (I&APs).
- Chapter 10 documents the findings of the specialist studies and associated potential impacts of the proposed wind farm.
- Chapter 11 presents a rating of each environmental issue before and after mitigation measures.
- Chapter 12 identifies potential cumulative impacts per environmental issue (specialist study) as well as mitigation measures.
- Chapter 13 gives a comparative assessment of all identified alternatives and the no-go alternative based on the various environmental issues (specialist studies).
- Chapter 14 provides a description of the environmental monitoring and auditing process to be undertaken for the proposed wind farm.
- Chapter 15 presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.

- Chapter 16 summarises the findings and recommendations per specialist study and provides the overall conclusion.
- Chapter 17 lists references indicated in the EIR.

1.2 Expertise of Environmental Assessment Practitioner

SiVEST has considerable experience in the undertaking of EIAs. Staff and specialists who have worked on this project and contributed to the compilation of this Impact Report are detailed in Table 1 below.

Table 1: Project Team

Name and Organisation	Role
Kelly Tucker – SiVEST	Project Leader
Shaun Taylor – SiVEST	Report compilation
Liesl Koch – SiVEST	Biodiversity (Flora and Fauna) Assessment
Paul da Cruz – SiVEST	Surface water Assessment, Visual Assessment
Kurt Barichievy – SiVEST	Soils and Agricultural Potential Assessment
Andrea Gibb – SiVEST	Visual Assessment
Chris van Rooyen	Avi-fauna Assessment
Werner Marais	Bat Assessment
Morne de Jager	Noise Assessment
Johnny Van Schalkwyk	Heritage Assessment
John Almond	Palaeontology Assessment
Nonka Byker and Sean Smith – MasterQ	Social Assessment
An Kritzinger – MasterQ	Economic Assessment
Bernard Casey	Geotechnical Assessment
Kerry Schwartz – SiVEST	GIS and Mapping
Nicolene Venter – SiVEST	Public participation
Mabel Qinisile - SiVEST	
Shaun Taylor – SiVEST	

Please refer to attached CV’s for more information (Appendix 2). Declarations of independence for the above listed specialists are included in Appendix 8.

1.3 Key Legal and Administrative Requirements Relating to the Proposed Development

1.3.1 National Environmental Management Act No. 107 of 1998 – NEMA EIA Requirements

The National Environmental Management Act (NEMA) No. 107 of 1998 has since been amended on several occasions from the date of its inception. This Act replaces parts of the Environment Conservation Act (ECA) No. 73 of 1989 with exception to certain parts pertaining to Integrated Environmental Management. The act intends to provide for:

- co-operative environmental governance by establishing principles for decision-making on matters affecting the environment;
- institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state;
- to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment;
- and to provide for matters connected therewith.

NEMA now governs the EIA process with the recent promulgation of the new EIA regulations in June 2010 (Government Gazette No. 33306 of 18th June 2010).

Activities that may significantly affect the environment must be considered, investigated and assessed prior to implementation.

In terms of the EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on 2nd August 2010, a full EIA is required for the proposed project

1.3.2 NEMA EIA Requirements

In terms of the Regulations, which have been released on the 18th of June 2010 and placed into full effect on the 2nd of August 2010, a full Environmental Impact Assessment is required for the proposed development based on triggered activities. However, several activities which trigger a basic assessment were also identified and need also be specified. Ultimately, these activities will not form a separate assessment, but will fall into the greater EIA.

The following Schedules of the Government Notice No. R. 544 - 546 of the 18th June 2010 are of relevance to the project in question (Table 2). All of the Listed Activities identified in terms of Sections 24(2) and 24D include:

Table 2: Listed activities in terms of the NEMA Regulations

Number and date of the relevant notice:	Activity No (s)	Description of listed activity
Government Notice R544 (18 June 2010)	Activity 1	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where- i. The electricity output is more than 10 megawatts but less than 20 megawatts or ii. The output is 10 megawatts or less but the total extent of the facility covers an area in excess of one hectare.
	Activity 10	The construction of facilities or infrastructure for the transmission and distribution of electricity- i. outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.
	Activity 22	The construction of a road outside urban areas i) with a reserve wider than 13.5 metres ii) where no reserve exists where the road is wider than 8 metres
	Activity 23	The transformation of undeveloped, vacant or derelict land to- i) residential, retail, commercial, recreational, industrial or institutional use, inside an urban area, and where the total area to be transformed is 5 hectares or more, but less than 20 hectares, or ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area, and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares except where such transformation takes place for linear activities
	Activity 24	The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this schedule such lad was zoned open space, conservation or had an equivalent zoning.
	Activity 38	The expansion of I. Bridges; Within a watercourse or within 32 meters of a watercourse, measured from the edge of a watercourse, where such

		expansion will result in an increased development foorprint but excluding where such expansion will occur behind the development setback line.
Government Notice R545 (18 June 2010)	Activity 1	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where the electricity output is 20 megawatts or more.
	Activity 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for i) Linear development activities; or ii) Agriculture or afforestation where activity 16 in this schedule will apply
Government Notice R546 (18 June 2010)	Activity 4	The construction of a road wider than 4 metres with a reserve less than 13,5 metres - (a) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and Northern Cape provinces: ii) Outside urban areas, in: a) A protected area identified in terms of NEMPAA, excluding conservancies; b) National Protected Area Expansion Strategy Focus areas; c) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; d) Sites or areas identified in terms of an International Convention; e) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; f) Core areas in biosphere reserves; g) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve; h) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is

		determined.
	Activity 12	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation a) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; b) Within critical biodiversity areas identified in bioregional plans;
	Activity 13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: 1) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), in which case the activity is regarded to be excluded from this list; 2) The undertaking of a linear activity falling below the thresholds mentioned in Listing Notice 1. a) Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority. b) National Protected Area Expansion Strategy Focus areas. c) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape and Western Cape: i) In an estuary; ii) Outside urban areas, the following: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an International

		Convention; (ee) Core areas in biosphere reserves; (ff) Areas within10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; (gg) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.

1.3.3 National Heritage Resources Act No. 25 of 1999

This Act requires all developers to undertake archaeological impact studies whenever any type of development activity is undertaken. Preliminary archaeological impact studies will consequently become a common procedure for all development activities, even if such development may be exempted in terms of the NEMA.

The law ensures community participation in the protection of national heritage resources and will involve all three levels of government in the management of the country's national heritage. The South African Heritage Resources Agency (SAHRA) will establish and maintain a national policy, strategy plans and standards for heritage resources management and will monitor the system as a whole.

Heritage authorities will assist and co-operate with individuals and organisations concerned with the study, the conservation, promotion and utilisation of national heritage resources. A newly established National Heritage Resources Fund will provide financial assistance for heritage projects.

A heritage and Palaeontological assessment has been conducted to explore how the proposed development may impact on heritage resources as protected by the Act.

1.3.4 National Water Act No. 36 of 1998

The National Water Act (NWA) No 36 of 1998 was promulgated on the 20^{th} August 1998. This Act is important in that it provides a framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act also recognises that water belongs to the whole nation for the benefit of all people.

It is important to note that water resources are protected under the Act. Under the act, water resources as defined include a watercourse, surface water, estuary or aquifer. A watercourse is defined as a river or spring, a natural channel in which water flows regularly or intermittently, or a wetland, lake or dam into which, or from which water flows.

One of the main aims of the Act is the protection of water resources. 'Protection' in relation to a water resource entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource; and
- The rehabilitation of the water resource.

In the context of the proposed development and any potential impact on water resources, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (*inter alia*):

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

This definition of pollution is quite wide ranging, and it applies to all types of water resource. Activities which cause alteration of the biological properties of a watercourse (i.e. the fauna and flora contained within that watercourse are also considered pollution).

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include (inter alia):

- measures to cease, modify, or control any act or process causing the pollution;
- comply with any prescribed waste standard or management practice;
- contain or prevent the movement of pollutants;
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse.

A surface water assessment has been conducted to explore how the proposed development may impact on water resources as protected by the Act.

A Water Use License (WUL) will be applied for with the Department of Water Affairs (DWA). In terms of the National Water Act, 1998 (Act No. 36 of 1998) the proponent will require a WUL for the following activities listed in Table 3 if the activities do take place (more may become of relevance after consultation with DWA):

Table 3: Water Use License Requirements

Form Number	**Application form**	**Description**
DW 758	Registration	Registration of Water Use
DW 760	Section 21a	Taking water from a water resource
DW 763	Section 21c	Impeding or diverting the flow of water in a watercourse
DW 781	Section 21i	Altering the bed, banks, course or characteristics of a watercourse. Confirm once alternative layouts are received.

Consultation will be undertaken with the Department of Water Affairs (DWA) prior to submission of the Integrated Water Use License Application (IWULA). An application for the WUL will be made to the DWA and this will be undertaken prior to the submission of the Final Environmental Impact Report is submitted to the DEA. DWA will, however, only consider applications once an Environmental Authorisation is granted to the Applicant. A technical report will accompany the WUL application. All registered Interested and Affected Parties will be afforded an opportunity to review this document. Adverts in the EIA process and the EIA Newsletter, have included the WUL and asked I&APs to comment on the WUL as well as the EIA Process.

1.3.5 Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)

These are developed to protect both animal and plant species within the various provinces of the country which warrant protection. These may be species which are under threat or which are already considered to be endangered. The provincial environmental authorities are responsible for the issuing of permits in terms of this legislation. The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) and the Nature and Environmental Conservation Ordinance 19 of 1974 are of relevance to the Northern Cape Province.

A biodiversity assessment has been conducted to explore how the proposed development may impact on biodiversity as protected by the Act.

1.3.6 National Environmental Management: Biodiversity Act No. 10 of 2004

The overarching aim of the National Environmental Management: Biodiversity Act (NEMBA) No. 10 of 2004, within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

The South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.
NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake a Faunal and Botanical Impact Assessment where proposed developments, in an area that is considered ecologically sensitive, require an environmental authorisation in terms of NEMA, with such Assessment taking place during the basic assessment or EIA. These two studies will be undertaken during the Mainstream project.

The NEMBA is relevant to the proposed project as the construction of the wind farms and other components (such as power lines and the substations) may impact negatively on biodiversity. The project proponent is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required and to also invite SANBI to provide commentary on any documentation resulting from the proposed development.

1.3.7 National Forests Act, 1998 (Act No. 84 of 1998)

The National Forest Act (NFA), 1998 (No. 84 of 1998) was enacted to:

- Promote the sustainable management and development of forests for the benefit of all;
- Provide special measures for the protection of certain forests and trees;
- Promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;
- Promote greater participation in all aspects of forestry and forest products industry by persons disadvantaged by unfair discrimination.

The NFA enforces the necessity for a license to be obtained prior to destroying any indigenous tree in a natural forest and, subject to certain exemptions, cutting, disturbing, damaging, destroying or removing any protected tree. The list of protected trees is currently contained in Government Notice 734 of 16 September 2011. Licenses are issued by the Minister and are subject to periods and conditions as may be stipulated.

The NFA is relevant to the proposed project as the removal and/or disturbance and/or clearance of protected vegetation may be required and a license\permit in terms of the NFA may be required for this to be done. The biodiversity studies conducted indicated that there is a possibility that a license\permit may be required although this can only be determined once a final walkdown study is conducted before development commences.

1.3.8 Conservation of Agricultural Resources Act No. 43 of 1982

The Conservation of Agricultural Resources Act (CARA) No. 43 of 1982 controls the utilization of natural agricultural resources in South Africa. The Act promotes the conservation of soil, water sources and vegetation as well as the combating weeds and invader plants. The Act has been amended in part by the Abolition of Racially Based Land Measures Act, No. 108 of 1991.

The primary objective of the Act is to conserve natural agricultural resources by:

- maintaining the production potential of land;
- combating and preventing erosion and weakening or destruction of the water resources;
- protecting vegetation; and
- combating weeds and invaders plants.

The CARA is relevant to the proposed project as the construction of wind energy facilities as well as other components (such as power lines and the substations) may impact on agricultural resources and vegetation on the site. The Act prohibits the spreading of weeds and prescribes control measures that need to be complied with in order to achieve this. As such, measures will need to be taken to protect agricultural resources and prevent weeds and exotic plants from invading the site as a result of the proposed development.

An agricultural potential assessment has been conducted to explore how the proposed development may impact on the agricultural production potential of the proposed site.

1.3.9 Subdivision of Agricultural Land Act No. 70 of 1970, as amended

The Subdivision of Agricultural Land Act No. 70 of 1970 controls the subdivision of all agricultural land in South Africa; prohibiting certain actions pertaining to agricultural land. Under the Act the owner of agricultural land is required to obtain consent from the Minister of Agriculture in order to subdivide agricultural land.

The purpose of the Act is to prevent uneconomic farming units from being created and degradation of prime agricultural land. To achieve this purpose the act also regulates leasing and selling of agricultural land as well as registration of servitudes.

The Act is of relevance to the proposed development as any land within the study area that is zoned for agricultural purposes will be regulated by this Act.

Although the whole of this Act has been repealed by section 1 of the Subdivision of Agricultural Land Act Repeal Act 64 of 1998, this Repeal Act has not been implemented and no date of coming into operation has been proclaimed.

It is important to note that the implementation of this act is problematic as the Act defines 'Agricultural Land' as being any land, except land situated in the area of jurisdiction of a municipality or town council, and subsequent to the promulgation of this Act uninterrupted Municipalities have been established throughout South Africa.

1.3.10 National Road Traffic Act No. 93 of 1996, as amended

The National Road Traffic Act (NRTA) No. 93 of 1996 provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed wind farm and photovoltaic plant.

1.3.11 Astronomy Geographic Advantage Act No. 21 of 2007

The Astronomy Geographic Advantage Act No. 21 of 2007 provides for:

- The preservation and protection of areas that are uniquely suited for optical and radio astronomy;
- Intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas and matters connected therewith.

In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. As such, all land within a 3 Kilometer radius of the center of the Southern African large Telescope (SALT) dome located in the Northern Cape Province, falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope.

Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation; of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavours.

The South African SKA was notified of the proposed project, provided with the opportunity to comment on the project and a meeting was held with SiVEST, the project proponent and the South African SKA on Friday 14th October 2011.

During the scoping phase (17 November 2011) comments were received from the Southern African SKA, noting that a high-level impact assessment of the proposed construction of a wind farm on SKA stations located nearest the proposed site was undertaken.

1.3.12 Additional Relevant Legislation

- Occupational Health and Safety Act No. 85 of 1993
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- Development Facilitation Act No. 67 of 1995
- Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998)

1.4 Equator Principles

The Equator Principles are a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing. A number of banks, exchanges and organisations worldwide have adopted the Principles as requirements to be undertaken for project funding on application and approval. Furthermore, certain funding institutions have not formally adopted the Principles, but require clients to be compliant with them in order to qualify for loans. The Equator Principles are summarised below:

Principle 1: Review and Categorisation
When a project is proposed for financing, the Equator Principles Funding Institution ("EPFI") will categorise the project based on the magnitude of its potential impacts and risks.

Principle 2: Social and Environmental Assessment
For each project assessed as being either Category A or Category B, the client / borrower must conduct a Social and Environmental Assessment ("Assessment") process to address the relevant impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Social and Environmental Standards
The Assessment will refer to the applicable IFC Performance Standards and applicable Industry Specific EHS Guidelines.

Principle 4: Action Plan and Management System
The client / borrower must prepare an Action Plan ("AP") or management system that addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment. The management measures are required to comply with the applicable host country, social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP.

Principle 5: Consultation and Disclosure
The client / borrower or third party expert must consult with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities' concerns.
In order to accomplish this, the non-technical summaries must be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner.

Principle 6: Grievance Mechanism

To ensure that consultation, disclosure and community engagement continues throughout construction and operation of the project, the borrower must, scaled to the risks and adverse impacts of the project; establish a grievance mechanism as part of the management system. This will allow the borrower to receive and facilitate resolutions of concerns and grievances about the project's social and environmental performance raised by individuals or groups from among project-affected communities.

Principle 7: Independent Review

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower must review the Assessment, AP and consultation process documentations in order to assist the EPFIs due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

An important strength of the Principles is the incorporation of covenants linked to compliance. For Category A and B projects, the client / borrower will covenant in financing documentation:

- To comply with all relevant host country, social and environmental laws, regulations and permits in all material respects
- To comply with the AP (where applicable) during the construction and operation of the project in all material respects
- To provide periodic reports in a format agreed with EPFIs (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that is; i) document compliance with the AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country social and environmental laws, regulations and permits
- To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan

Principle 9: Independent Monitoring and Reporting

To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower to retain qualified and experienced external experts to verify its monitoring information, which would be shared with EPFIs.

Principle 10: EPFI Reporting

Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

Although this report is not written in terms of the Equator Principles (EPs), it fully acknowledges that EPs will need to be complied with should funding for the project be required. In general, the following documentation will need to be considered in that regard:

- The "Equator Principles" 2006
- International Finance Corporations Performance Standards on Social and Environment, IFC, April, 2006 namely:
    - Performance Standard 1: Social and Environmental Assessment and Management Systems
    - Performance Standard 2: Labor and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement
    - Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
    - Performance Standard 7: Indigenous Peoples
    - Performance Standard 8: Cultural Heritage
- International Finance Corporation – World Bank Guidelines, General EHS Guidelines 2007.

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These EHS Guidelines are applied as required by the World Bank's respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

1.5 Key Development Strategies and Guidelines

1.5.1 Integrated Development Plans

An Integrated Development Plan (IDP) is defined in the Local Government: Municipal Systems Act No. 32 of 2000), as an inclusive and strategic plan that:

- Links, integrates and co-ordinates plans and takes into account proposals for the development of the municipality;
- Aligns the resources and capacity of the municipality with the implementation of the plan
- Forms the policy framework on which annual budgets must be based; and
- Is compatible with national and provincial development plans and planning requirements binding on the municipality in terms of legislation.

The main purpose of the IDP is considered the enhancement of service delivery and fighting poverty through an integrated and aligned approach between different role-players and stakeholders.

Each municipality is required to produce an IDP which would address pertinent issues relevant to their municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development.

The Noupoort site falls within the Umsobomvu Local Municipality (ULM) which is located within the greater Pixley ka Seme District Municipality. In terms of the District IDP 2009-2010 for the Pixley ka Seme District Municipality the core requirements in terms of electricity for the District Municipality are:

- To provide access to electricity or alternative sources of energy to all;
- The upgrading and maintenance of the electricity network.

1.5.2 Integrated Energy Plan for the Republic of South Africa, 2003

The Integrated Energy Plan (IEP), developed by the former DME (now DMR), was formulated to address the energy demand of the country balanced with energy supply, transformation, economics and environmental considerations in concourse with available resources. One of the main objectives of the plan is to promote universal access to clean and affordable energy, with emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes. Another objective is to ensure that environmental considerations in energy supply, transformation and end use are made. This project is thus a goal in order to implement this plan.

1.5.3 Independent Power Producer Process

(The following information was extracted from the Eskom website: Guide to Independent Power Producer (IPP) processes in South Africa and Eskom, June 2010 http://www.eskom.co.za/live/content.php?Item_ID=14324)

The objective of this section is to provide an overview of the processes in the country and within Eskom relating to Independent Power Producers (IPPs). It is important that certain enabling policies, rules and regulations are in place to provide certainty and transparency in the introduction of IPPs.

- Country Process

South Africa has two acts that direct the planning and development of the country's electricity sector:

- The National Energy Act (NEA) No. 34 of 2008
- The Electricity Regulation Act (ERA) No. 4 of 2006.

In August 2009, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- Formal Programmes

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) developed by the DoE sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP. Table 4 below highlights the energy plan that has been proposed until 2030.

Table 4: Government Energy Plans up until 2030 in terms of the IRP

New Build Options								
	Coal	**Nuclear**	**Import Hydro**	**Gas - CCGT**	**Peak - OCGT**	**Wind**	**CSP**	**Solar PV**
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500	0	0	0	0	400	0	300
2015	500	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300
2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400	100	300
2019	250	0	0	237	0	400	100	300
2020	250	0	0	237	0	400	100	300
2021	250	0	0	237	0	400	100	300
2022	250	0	1143	0	805	400	100	300
2023	250	1600	1182	0	805	400	100	300
2024	250	1600	282	0	0	800	100	300
2025	250	1600	0	0	805	1600	100	1000
2026	1000	1600	0	0	0	400	0	500
2027	250	0	0	0	0	1600	0	500
2028	1000	1600	0	474	690	0	0	500
2029	250	1600	0	237	805	0	0	1000
2030	1000	0	0	948	0	0	0	1000
	6250	**9600**	**2609**	**2370**	**3910**	**8400**	**1000**	**8400**

A decision that additional capacity be provided by an IPP must be made with the concurrence of the Minister of Finance. Once such a decision is made, a procurement process needs to be embarked upon to procure that capacity in a fair, equitable and transparent process.

The New Generation Regulations set out the procurement process. The stages within a bid programme are prescribed as follows:

- Request for Qualifications (RFQ)
- Request for Proposals (RFP)
- Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to approval by the Regulator.

To start renewable energy procurement in order to achieve targets as in the IRP the DOE has launched a call for renewable energy projects issued on the 3rd of August 2011. The request for qualification and proposals for new generation capacity under the IPP procurement programme, will have a continuous roll out and milestones till the end of 2013. DoE have allowed for 1850MW of wind energy capacity to be allocated in the next two years.

2 APPROACH TO UNDERTAKING THE STUDY

The Environmental Impact Assessment was undertaken in accordance with the Environmental Impact Assessment Regulations (2010) published in GN No. R 543, No 544, No 545 and No 546 in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended; the World Bank Standards (IFC Guidelines) and the Equator Principles as well as with the relevant legislation and guidelines mentioned above.

2.1 Environmental Scoping Study

The Scoping Study identified the potential positive and negative impacts associated with the proposed development. The Scoping Study also identified the studies which were required to be undertaken as part of the EIA-phase of the project. The Draft Scoping Report was made available for public review from Tuesday 4 October 2011 to Monday 14 November 2011. Comments received on the Draft Scoping Report were included in the Final Scoping Report which was submitted to the DEA on the (2nd December 2012). The DEA accepted the Final Scoping Report on 22 February 2012. The following studies have been further investigated in the EIA Phase:

- Biodiversity (flora and fauna) Assessment (Liesl Koch – SiVEST)
- Avifauna Assessment (Chris van Rooyen)
- Bat Assessment (Werner Marais – Animalia)
- Surface Water Impact Assessment (Paul da Cruz – SiVEST)
- Agricultural Potential (Kurt Barichievy – SiVEST)
- Noise Impact Assessment (Morne de Jager – M^2)
- Visual Impact Assessment (Paul da Cruz, Andrea Gibb, Kerry Schwartz – SiVEST)
- Geotechnical Assessment (Mainstream)
- Heritage Assessment (Johnny van Schalkwyk)
- Palaeontology (Dr. John Almond – Naturaviva)
- Socio-economic Impact Assessment (Nonka Byker, Sean Smith and An Krtizinger – MasterQ)

2.2 Authority Consultation

The National Department of Environmental Affairs (DEA) are the determining authority on this application. The following consultation took place with DEA:

- Following amendments to the original application, the project application was acknowledged on the 17th of July 2011.
- Two reference numbers were allocated to the proposed development. These include the EIA reference number (12/12/20/2319) and the NEAS reference number (DEA/EIA/0000382/2011).
- Authorisation was thus granted for the EAP to undertake a Scoping study and submit a Scoping Report for the project.
- A Landowner notification form formed part of the application form and was accordingly submitted on the same date.
- The Final Scoping Report and Plan of Study for EIA were submitted to DEA on the (2nd December 2012)
- A meeting was held at the DEA on the 20 February 2012, to discuss the way forward for the proposed project.
- The Acceptance of the Final Scoping Report and the Plan of Study for EIA was received on the 22 February 2012, allowing the EAP to continue with the EIA phase.
- An amendment to the application form to accurately reflect the activities to be undertaken for the proposed development was submitted to the DEA on the 16th March 2012 and was subsequently accepted.
- The DEIR was submitted on the 16th March 2012 to the DEA. Correspondence from the DEA was received acknowledging receipt of the DEIR.

A record of all authority consultation is included within Appendix 5.

Consultation with other relevant authorities and Key Stakeholders was and is also being undertaken in order to actively engage them and provide them with an opportunity to review all project documentation and report and to provide comment on the proposed development.

Authorities and key stakeholders consulted include the following:

- Department of Water Affairs (DWA);
- Northern Cape Department of Economic Development and Tourism;
- Northern Cape Provincial Government;
- Department of Environment and Nature Conservation;
- Department of Agriculture Forestry and Fisheries (DAFF);
- South African Heritage Resources Agency (SAHRA);

- Department of Heritage: Northern Cape Province;
- South African National Roads Agency Limited (SANRAL);
- Transnet Fright Rail;
- Birdlife South Africa;
- WESSA: Northern Cape;
- ANC and ANC Youth League;
- Telkom;
- South African Civil Aviation Authority;
- Air Traffic and Navigation Services (ATNS);
- Square Kilometre Array (SKA);
- Umsobomvu Local Municipality; and
- Pixley ka Seme District Municipality.

2.3 Environmental Impact Report

The EIR Phase of the project has focused on consulting with Interested and / or Affected Parties as well as conducting specialist studies to address the potential impacts identified during the Scoping Phase.

The purpose of the EIR is to:

- address issues that have been raised during the scoping phase;
- assess alternatives to the proposed development in a comparative manner;
- assess all identified impacts and determine the significance of each impact; and
- to formulate mitigation measures.

3 ASSUMTIONS AND LIMITATIONS

- All information provided by the Applicant to the Environmental Team was correct and valid at the time it was provided.
- It is not always possible to involve all Interested and / or Affected Parties individually. However, every effort has / is being made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations / parties.

4 PROJECT NEED AND DESIRABILITY

According to Eskom, the demand for electricity in South Africa has been growing at approximately 3% per annum. This growing demand, fuelled by increasing economic growth and social development within Southern Africa, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmental impact, climate change and the need for sustainable development. The use of renewable energy technologies, as one of a mix of technologies needed to meet future energy consumption requirements is being investigated as part of Eskom's long-term strategic planning and research process.

As the demand for electricity grows, there is need to establish new generation capacity in South Africa within the next several years. The technologies may differ in their generation costs, state of commercial development and most importantly, suitability to the South African Environment.

The Government of South Africa has also committed to supporting the development of renewable (both solar and wind) electricity generation in order to satisfy sustainable and short term solutions to the current energy crisis.

As one of its strategies to meet future energy consumption requirements, the country is opting for the use of renewable energy technologies. This technology is therefore fast becoming an important energy option. In addition to providing ideal location for solar energy plants, the Northern Cape Province also provides good opportunities for wind generation projects hence the selection of the Noupoort site.

According to the wind potential layer, developed by Environomics and MetroGIS (2011) for the Strategic Environmental Framework for the Optimal Location of Wind Farms in the Coastal Provinces of South Africa (Phase 1 for REFIT 1) (Figure 1), large parts of the Northern Cape region of South Africa have the highest suitability for the selection of wind farm sites. Hence, the Northern Cape can in general be seen as ideal for the establishment of wind farms. It must be remembered that wind energy is plentiful, renewable, widely distributed, clean and reduces greenhouse gas emissions when it displaces fossil-fuel derived from electricity. In this light, renewable wind energy can be seen as desirable.

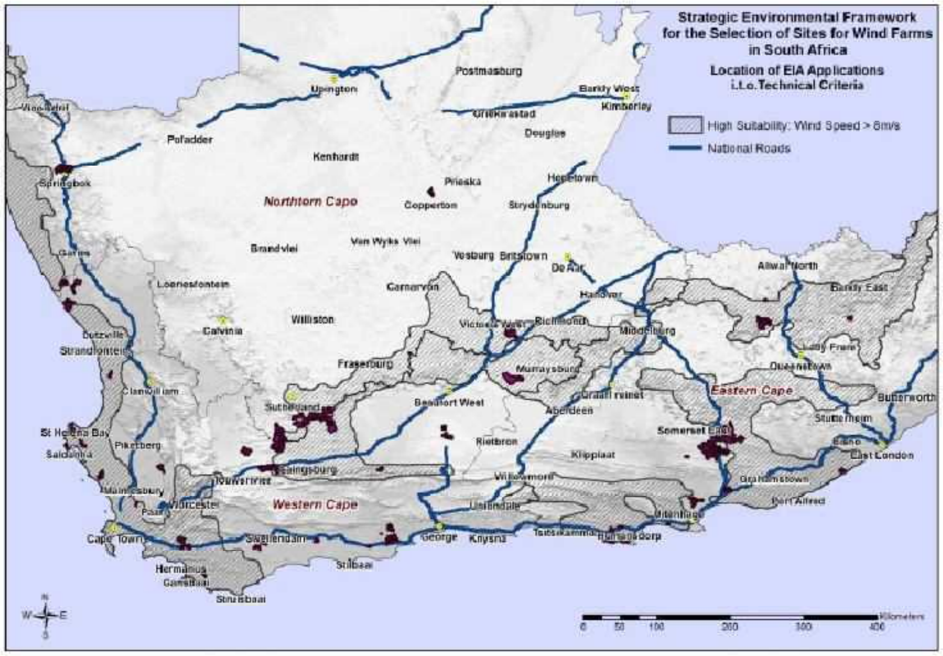

Figure 1: Wind Potential Map (Source: Environomics and MetroGIS, 2011).

4.1 Research Supporting Wind Energy

South Africa has abundant reserves of wind and solar energy resources. Electricity generated by means of wind power can provide the country with secure, reliable and clean sources of power while stimulating economic growth and job creation. A recent technical study carried out by Mainstream's Energy Analysis Group confirms SA has potential to generate over 70 000MWs of wind energy or 42% of the country's forecast total electricity demand for 2025. This research also showed that if 30GW of wind energy were installed, the industry would be able to provide 9GW of power (at a conservative 30% capacity factor) and of this 6GW would be base load, supplied at exactly the times when the country needed it most.

South Africa has a growing energy intensive economy, highly reliant on fossil fuels. 93% from coal fired power plants. SA currently has 44 157MWs of power generation capacity installed, with 248 Terawatt hours of electricity consumed annually. Current forecasts by 2025 indicate that SA will need almost twice today's electricity demand, doubling to approximately 80 000MWs. The generation of electricity from wind energy can contribute substantially to meeting this demand.

4.2 Security of Power Supply

In the period immediately after the supply shortage and 2007 / 2008 power blackouts, Eskom announced a number of new power generation facilities including new coal-fired power stations, refurbishment of mothballed stations and oil, diesel or gas powered turbines in order to ensure appropriate supply and the needed reserve margin. In the intervening period several of these projects have experienced delays as the economic recession has lead to reductions in demand pressure. However, with possible recovery looming, the situation may change in 2010 / 2011 and demand growth may resume. Short to medium term electricity supply security is instrumental in securing economic growth and investor confidence (HIS Global Insight, 2009).

The project has the potential of "securing" economic activity by assisting in removing supply constraints if Eskom generation activities result in a supply shortfall. When supply is constrained it represents a limitation to economic growth. When a supply reserve is available, it represents an opportunity for economic growth.

The project will contribute to local economic progress by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Northern Cape. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally.

4.3 Local Employment

Local employment statistics from 2007 (Census Survey, 2007) show that employment in the ULM is low (33.7%). Unemployment stands at 24.7 %. From a regional point of view, local employment lags behind the District and Province statistics with the district having an employment rate 4.6% higher than the ULM in 2007 and The Northern Cape having one 6.6% higher than ULM in 2007. Local development in Noupoort may help to raise employment rates especially during the construction phase providing income to the largely unemployed local community.

4.4 Regional and Local Income Profile

According to the Census Survey (2007), over half of the working age population which are those between the ages of 15 and 65 (54.9%) mentioned that they received no monthly income whatsoever which is very high. The largest category of persons earning an income fall within the R 801 – R1 601 bracket. It is highly evident that the higher income levels are very scarcely populated in this LM and that, generally speaking, income levels are very low in the area. A large scale development such as the proposed wind farm may help to significantly contribute to raising the income profile of the firstly, the Noupoort area and secondly, the greater region (ULM).

4.5 Facts Justifying Wind Energy

Wind is an internationally tried and tested highly reliable form of power generation. It is also the fastest growing form of power generation in the world with upward of 150 000 MWs installed globally and this is forecast to increase by more than 30 000 MWs each year over the next decade. In 2008, more wind energy capacity was installed in Europe and the US than any other form of power.

- Renewable energy reduces electricity generation costs

SA has some of the most highly subsidised electricity in the world. Diversifying a country's portfolio of generation plants leads to lower overall generation cost. Everywhere wind power has been introduced it has reduced the long term price of electricity and has helped stabilise the price volatility of fossil fuels. It is seen as the cornerstone of German, British, Danish, and Spanish generation.

- Renewable energy reduces fossil fuel prices

Increased levels of renewable energy generation on an electricity system lowers the demand for coal, oil & gas, reducing the price of these commodities and ultimately the cost of electricity.

- Renewable energy decreases greenhouse gas emissions

SA is currently the 12th largest polluter in the world and the largest in Africa. Renewable energy reduces carbon emissions, resulting in avoidable costs to the economy in terms of global obligations and the domestic social and economic impacts of such emissions.

- Renewable energy increases water availability

Agricultural & economic yield is increased due to an increased availability of water resources that would have alternatively been used for coal-fired power generation. Eskom currently uses 1400 Litres of water per 1000 kWh of energy produced.

- Renewable energy creates jobs

Large-scale renewable energy deployment creates significant employment in the development, construction and operation of the wind farms, significantly contributing to rural development, transferring skills and knowledge from abroad and enhancing a domestic manufacturing supply chain.

- Renewable energy aids grid stability

In certain areas, particularly in the south of the country, renewable energy aids grid stability.

5 PROJECT SUSTAINABILITY

Mainstream's objective is to develop the proposed wind farm near Noupoort under the Clean Development Mechanism (CDM). As such, project information gathered during the EIA process will be submitted to the South African Designated National Authority (DNA) who sits within the Department of Energy (DME) to be assessed against the Sustainable Development Criteria for CDM projects as defined by the DME in South Africa.

5.1 CDM Background

The purpose of the Clean Development Mechanism (CDM) is to assist developing countries such as South Africa achieve sustainable development, and to assist industrialized countries achieve compliance with their emission targets under the Kyoto Protocol (KP) through the acquisition of certified emission reductions accruing from project activities. Specifically, the CDM can contribute to South Africa's sustainable development objectives through:

- Transfer of technology and financial resources;
- Sustainable ways of energy production;
- Increasing energy efficiency & conservation; and
- Poverty alleviation through income and employment generation.

Currently, the project information is being compiled in a Project Design Document, that will be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) towards the end of this year.

The project will generate electricity from a renewable energy with an associated carbon dioxide emission of close to zero for every kWh that is generated into the grid. For every kWh generated, approximately 0.97 to 1.1 kg carbon dioxide emissions will be reduced from the national grid managed by Eskom. The estimated reduction of CO2 over the 20 year period for this project will be presented once the energy analysis is completed.

6 TECHNICAL PROJECT DESCRIPTION

At this stage, it is estimated that the proposed project will encompass the installation of a number of wind turbine generators and their associated components in order to generate electricity that is to be fed into the existing Eskom distribution and/or transmission lines that cross or are located nearby the proposed site. The total power generation capacity limit and the number of wind turbines to be accommodated will ultimately depend on the size of the developable area which will be determined by the EIA. However, it is currently envisaged that 82 wind turbines are to be developed with a cumulative generation capacity of 188.6 Megawatts (MW). The voltage of the connection lines from the wind farm substation to the grid will be dependent on the total generation capacity and the actual available connection as determined by Eskom. The available grid connection have a voltage of 66kV to 132kV. Ideally the project would tap into the 132kV line allowing a full 188.6 MW to be fed into the grid. The EIA is being conducted for the full 188.6 MW. Ultimately, the total footprint of the development will be 1 873 Hectares.

The key components of the project follow in the sub-sections below.

6.1 Turbines

The size of the wind turbines will depend amongst others on the developable area, wind resource and available technology when the wind farm is constructed. and the total generation capacity that can be produced as a result. The wind turbines will have a hub height of between 80 to 120m and a rotor diameter of 87 to 120m (Figure 2). The blade rotation direction will depend on wind measurement information received later in the process. The rotation will range from 6 to 20 rpm. The foundation of each wind turbine will be approximately 20m x 20m. The footprint for each wind turbine will therefore be approximately 400m². A hard standing area, of approximately 2 400m², for crane usage will accompany each wind turbine. Hence, the total footprint for each wind turbine and the associated hard standing area will be 2 800m². The foundation will be up to 2.5m deep. As already mentioned, it is anticipated at this stage that 82 wind turbines will be constructed. The total disturbed footprint for the wind turbines on the affected properties for the Noupoort study site will therefore be approximately 55.1 hectares. The electrical generation capacity for each turbine will range from 1 - 3 MW depending on the final wind turbine design selected for the proposed development. The total generation capacity for the Noupoort study site is envisaged to be a maximum of 188.6 MW as stated earlier.

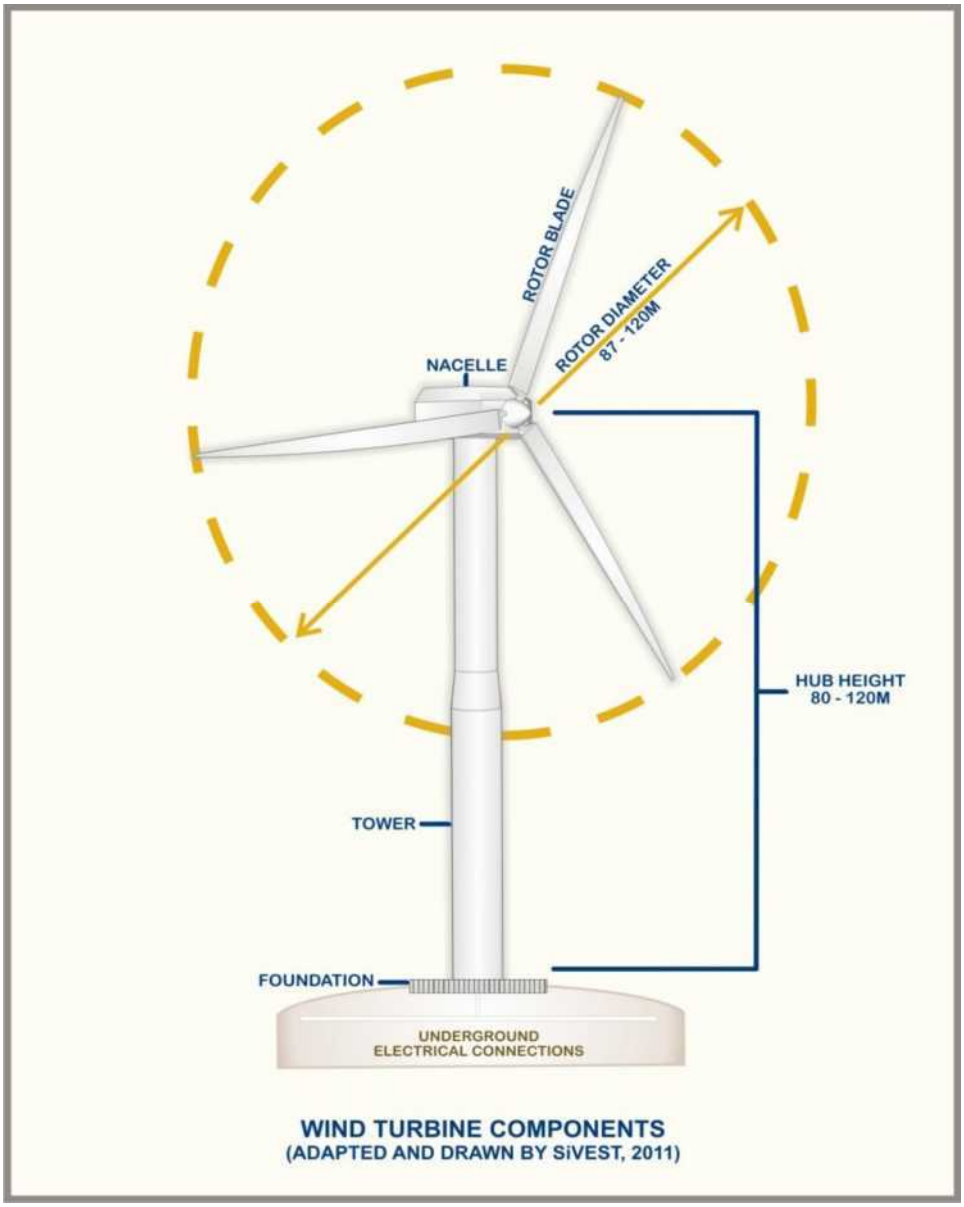

Figure 2: Typical Components of a wind turbine.

6.2 Electrical Connections

The wind turbines will be connected to each other and to the substation using buried (up to a 1m depth) medium voltage cables (Figure 3) except where a technical assessment of the proposed design suggests that overhead lines are appropriate such as over rivers and gullies. Where overhead power lines are to be constructed, monopole tower structures will be used. The dimensions of the monopole structures will depend on grid safety requirements and the grid operator. No servitudes will be associated with the wind farm infrastructure although servitudes for Eskom infrastructure may be required on site. As previously mentioned, the electrical connection to the grid will be dependent on the total generation capacity and the actual available connection as determined by Eskom. The transmission lines could therefore have a voltage of 66kV to 132kV.

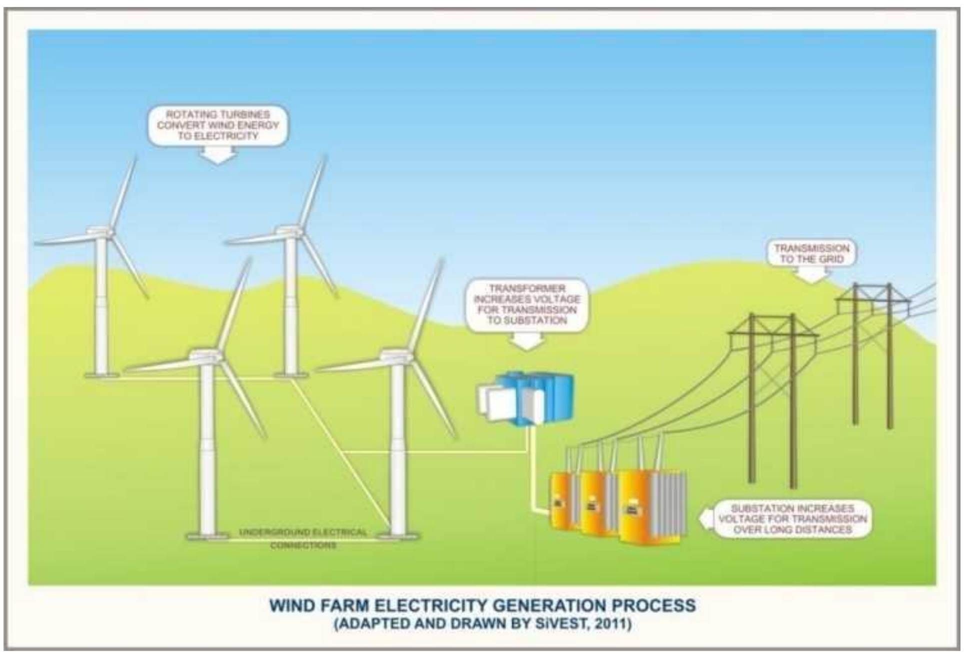

Figure 3. Conceptual wind farm electricity generation process showing electrical connections.

6.3 Substations

A new substation (approx. 90 x 120m) and associated transformers will be developed which will supply the generated electricity to the Eskom grid. The transformers' operating voltage may range from 22, to 132kV. The footprint of the substation site will be approximately 10 800m². The substation will be built preferably close to existing distribution line(s). The connection from the substation to the Eskom grid line will be an overhead line and pole. This will be dependent on the location of the substation relative to the existing line(s). Eskom grid line and access servitudes will be required, the sizes of which will depend on the voltage connection.

6.4 Roads

The access roads are proposed to be 6-10m wide. The roads will be gravel roads from the site on to the public road. An internal road network to the turbines and other infrastructure will include:

- Turning circles for large trucks.
- Passing points and culverts over gullies and rivers if required
- Existing roads will be upgraded.

The Noupoort study site could involve the upgrading of bridges and culverts on the Oorlogspoort road to accommodate axle loads of the heavy truck transport loads for the components of the wind turbines. It is envisaged that the bridges and culverts could be reinforced by either concrete or temporary hydraulic supports.. It is anticipated that as a pre-cautionary measure, temporary intermediate support structures will be implemented mid-span on each of the two bridge spans. It is possible that steel frames founded on gabion foundations will be constructed, resting on the river bed.

6.5 Temporary construction area

A maximum 10 000m^2 temporary lay down area will be constructed for the proposed development. Components that will comprise the temporary lay down area include an access route and a contractor's site office areaof up to 5 000m^2.

6.6 Other infrastructure

Other infrastructure includes the following:

- Administration and warehouse buildings: A single storey building with a maximum area of up to 5 000 m^2 with a warehouse/workshop space and access, office, telecoms space, security and ablution facilities are to be developed. The buildings will most likely be situated preferably close to the substation.
- Borrow pits (if required).
- Fencing (if required).
- Linking station (if required).

7 ALTERNATIVES

In terms of the EIA regulations, feasible alternatives are required to be considered through the EIA process. Layout Alternatives and the No-go alternative were considered in this Final Environmental Impact Report.

From the outset of the proposed development, Mainstream advanced the following criteria when considering sites for a wind farm:

- Estimation of wind energy resource (which is derived from Mainstream's propriety information based on national available wind data and advanced theoretical modelling developed in-house and by consultants);
- Proximity to residential areas;
- Proximity to environmentally (social and biophysical environments) and heritage sensitive areas (in consultation with appropriate specialists);
- Potential impacts on fauna and flora (in consultation with appropriate specialists).
- Availability of national wind farm development sensitivity maps such as those currently being prepared by Birdlife SA and being finalised by the Western Cape Government for the west coast region. (**Note these maps were not yet developed during the selection process**);
- International best practise in siting of windfarms,
- Potential visual impact;
- Potential impact on aviation;
- Presence of obstacles on the site such as rivers, dams, roads, existing gridlines and current land use;
- Need for grid stabilization in the area;
- Need for energy security in the area;
- Need for rural development through job creation in the area;
- Accessibility of the area as a result of the topography;
- Grid connection options – is connection affordable and in national interest?
- Willingness of land owners to participate
- Possibility to support land reform objectives.

After the potentially appropriate sites were selected, the affected land owners were contacted and options to develop, including long term lease agreements, were negotiated.

7.1.1 Layout alternatives

Once the specific land portions were identified and lease agreement were in place, Mainstream developed a map of the available area on the specific farm/farms that could be earmarked for possible development. This area is referred to as the 'buildable' area. The following applicable buffer zones (Table 5) were additionally applied to the sensitive areas identified in the table below so as to identify the undevelopable areas.

Table 5: Buffer zones applications to sensitive areas

SENSITIVE AREA	BUFFER
Airports and Military Facilities	15-30km
Privately owned and managed run ways	5km including consultation with the SACAA
Public Roads/railway	200m
Houses	800m
Residential Areas	800m
Rivers/Floodplains/Wetland/Lakes	100m - 200m
Forestry (away from the prevailing wind)	500m
Forestry (non-prevailing wind direction)	200m
Forestry (when turbine is keyholed[1])	500m
Protected and archaeological areas	100 – 200m
Communication corridors/radar/Microwave towers	200m
Existing Generation/Wind farms	> 1km
Existing Servitudes	As per servitude + (1.5 x Tip height)
Site Boundary	200m
Electrical grid distribution/transmission lines	200m – 300m
Substation	500m

With further consultation with the affected land owners, Mainstream was also able to preliminarily identify specific areas (areas where farming is practised or future farming is expected to be practised) on their land which was excluded from the proposed development.

Specialist studies were then undertaken throughout the scoping phase and EIA phase to eliminate potentially sensitive areas from the buildable areas for the locations of the key components of the project. Once this had been undertaken, various layout alternatives were investigated. These include the location of:

[1] Placing the turbine in a forest

- Substation locations (2 alternatives investigated)
- Grid access locations (4 alternatives investigated)
- Site Access locations (2 alternatives investigated)
- Laydown area locations (2 alternatives investigated)
- Operations and Maintenance building locations (2 alternatives investigated)
- Turbine locations (based on specialist feedback)

In terms of the grid access locations, two power line routes were investigated one route to the north linking to the Newgate Substation and one route to the south breaking the 132kV Newgate – Ludlow line. Whether the Northern or Southern connection route is used will be determined by Eskom and ongoing land access negotiations. This EIR request approval for both the Northern and Southern grid connection routes and therefore alternatives was proposed for both the Northern and the Southern access routes. It is anticipated that all power line route alternatives will either link in with existing lines or link into a linking station to the south west of the proposed site. It is expected that the capacity will be 132 kV.

As such, layouts for the wind turbines were set and alternative layout locations and/or routes for each of the key components (listed above) were proposed (Figure 4). A comparative assessment and evaluation of each of the layout alternatives is provided in Chapter 13.

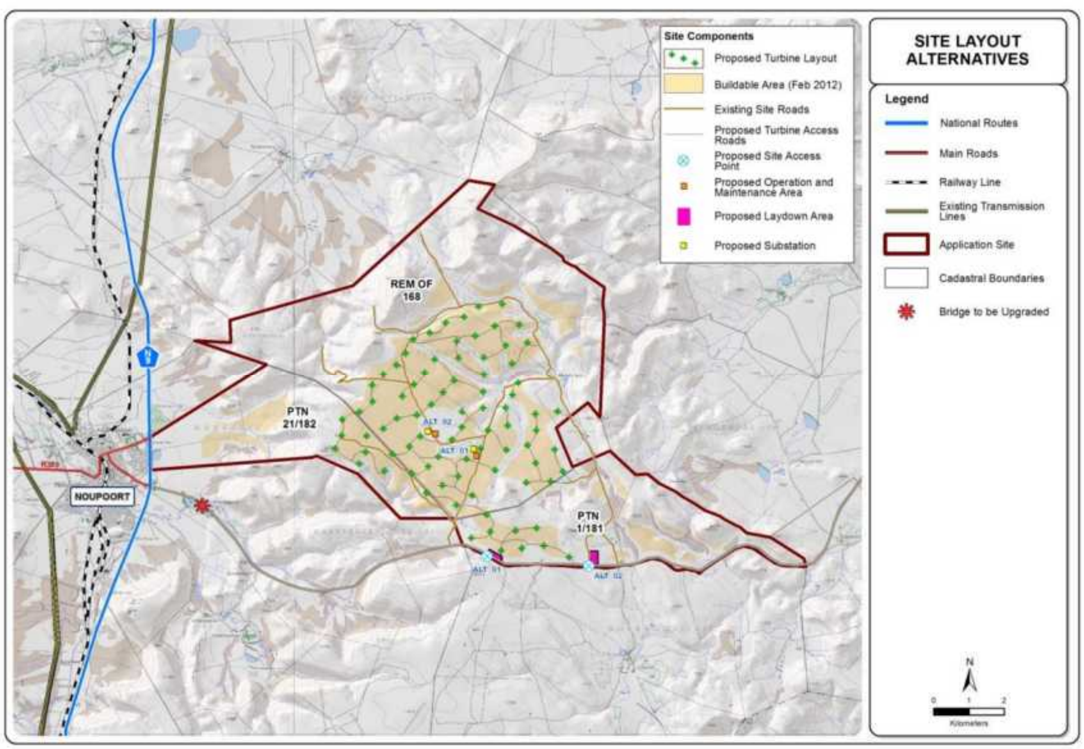

Figure 4. Layout alternatives map of the key components of the project.

7.1.2 No-go Alternative

The 'no-go' alternative is the option of not establishing the proposed wind farm. South Africa is currently under immense pressure to provide electricity generating capacity to accommodate for the pressures which have been identified in this regard. With the current global focus on climate change, the government are under severe pressure to explore alternative energy sources in addition to coal fired power stations. Although wind power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed wind farm would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project would contribute to this solution. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

In light of the above, the no-go alternative has also been comparatively evaluated in Chapter 13.

8 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The Northern Cape Province is considered to be one of the most suitable regions for the establishment of wind farms. Accordingly, land portions located outside of the town of Noupoort have been identified as a potential site. A general description of the study area is outlined in the section below. The receiving environment in relation to each specialists study is also provided. A site visit was undertaken at the end of March 2011 by selected members of the SiVEST specialist team.

8.1 Regional Locality

Noupoort is situated within the Umsobomvu Local Municipality in the greater Pixley ka Seme District Municipality, Northern Cape Province. Noupoort is approximately 53 km south east of the town of Colesberg, 35km north of Middelburg and 55km south west of Hanover town (Figure 5). The town of Noupoort is situated off the N9 highway on the main route from the Eastern Cape to Colesberg on the N1 route. There is an existing railway line which runs alongside the N9.

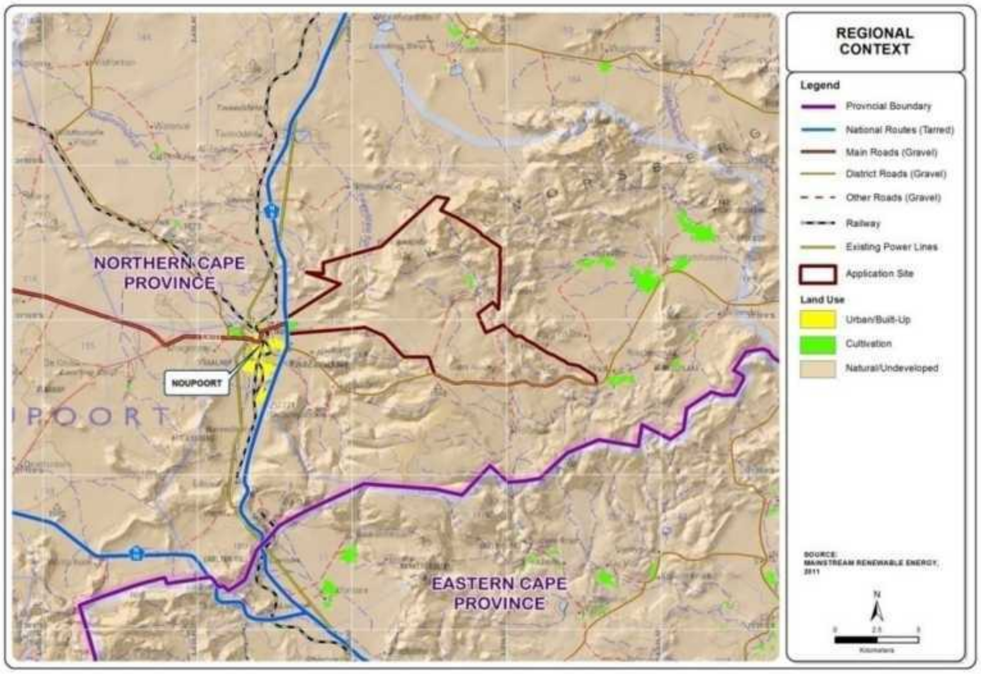

Figure 5: Noupoort Regional Study Area.

Please note that all maps which are included in Appendix 7 are in A3 format.

8.2 Study Site Description

The total study area of the Noupoort site made up by the three portions of land is approximately **7 632 hectares** in size (Figure 6). The descriptions of the three portions of land and the size of each include:

- Remainder of the Farm No.168, Colesberg, Noord Kaap (approx. 4 745.62 hectares);
- Portion 1 of the Farm No. 181, Colesberg Noord Kaap (approx. 1 469.99 hectares);
- Portion 21 of the Farm No. 182, Colesberg Road, Noord Kaap Harmonie (approx. 1 276.80 hectares).

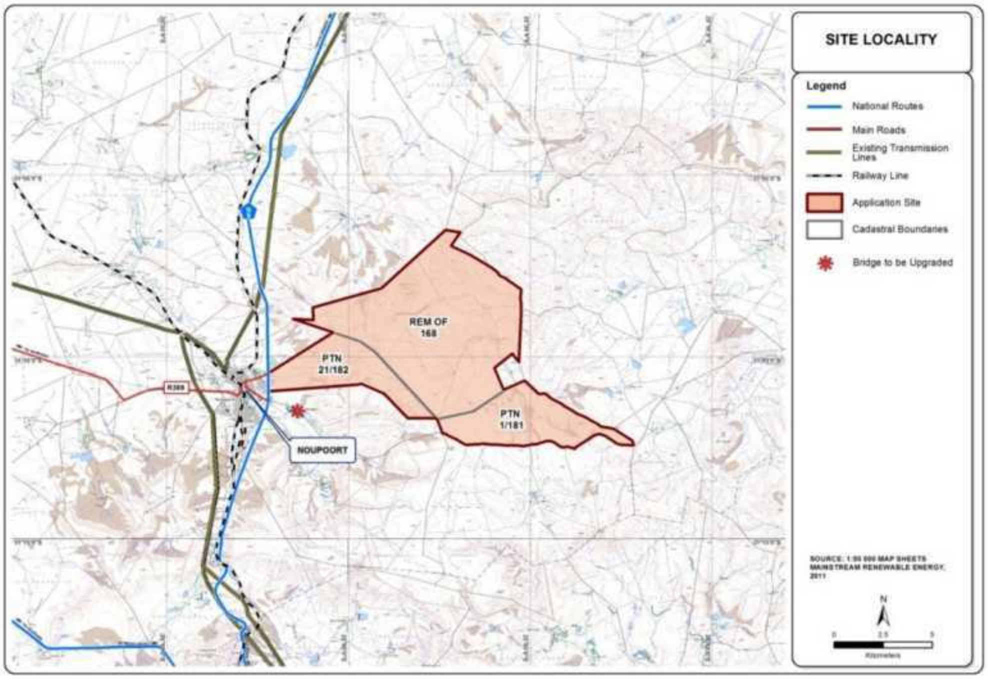

Figure 6: Noupoort Site Locality Map.

Figure 7: Map indicating the position of the main bridge and associated culverts which form part of the study

8.3 Climate

Noupoort normally receives about 261mm of rain per year, with most rainfall occurring mainly during autumn (www.saexplorer.co.za). It receives the lowest average rainfall (2mm) in August and the highest (56mm) in March (www.saexplorer.co.za). The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Noupoort range from 13.6°C in June to 29.2°C in January (www.saexplorer.co.za). The region is the coldest during July when the mercury drops to 0.2°C on average during the night (www.saexplorer.co.za). An overview of the typical mean monthly and annual precipitation as well as minimum and maximum daily temperatures for Noupoort are shown in Table 6 below.

Table 6: Mean monthly and annual precipitation and temperature for Noupoort (http://www.saexplorer.co.za/south-africa/climate/noupoort_climate.asp).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rainfall (mm)	34	45	56	28	15	5	3	2	6	19	26	22	261mm (per annum)
Midday Temp (°C)	29	28	25	21	17	14	14	17	20	23	25	28	21 (average)
Night Temp (°C)	13	13	11	7	3	1	0	2	4	7	9	11	6 (average)

8.4 Biodiversity (including Fauna and Flora)

8.4.1 Land use

The study area consists of a mix of natural veld and unimproved grassland which is used as grazing land for cattle and sheep. Vast grazing land is interspersed incised river channels, which flow intermittently, are present. Large mountains are present within the study site.

8.4.2 Topography

The study area is almost completely framed by steeper slopes, valley lines and / or ridges while the central areas are characterised by flat and gently sloping topography with an average gradient of less than 10%.

8.4.3 Habitats

Faunal populations are dependent on the flora that supports them therefore assumptions regarding the presence of fauna can be made based on the flora present.

The following habitat types have been identified within the study area:

- Wetlands / drainage areas

These areas are characterised by the presence of several grass species and limited shrub species. Dominant species include *Merxmuellera disticha, Schoenoplectus corymbosus, Perotis patens* and *Agrostis lachnantha. Kniphofia* species were noted in one of the drainage areas which contained patches of exposed bedrock and rocks (Figure 8).

These areas were noted to be very active in terms of faunal activity with evidence of mole rat and mongoose burrows. Where water was present, a variety of amphibian species were observed.

Figure 8: Drainage area in the central part of the site

- Rocky ridges bordering on mountainous areas

These areas are characterised by steep cliffs associated with the mountainous areas of the study site (Figure 8). These areas create several small microclimates which results in better species diversity in these areas. A more distinct woody layer is present and dominant species include *Rhus erosa, Euclea undulata, cotyledon orbiculata* and *eriocephalus ericoides*

Figure 9: Example of a rocky ridge on the site

- Tussock grasslands

Open grasslands on the site are characterised by tussocks dominated by the grass species *Merxmuellera disticha.* These areas are mostly devoid of a woody layer (Figure 9).

Figure 10: Example of tussock grasslands in the central part of the site. Note pair of Blue Cranes.

8.4.4 Transformation

The study area currently operates as a cattle and sheep farm with a few areas exhibiting natural vegetation. The transformation rate of this vegetation type is low and thus the site can be considered to be in a fairly natural state. Low lying areas on the site have been exposed to grazing activities and thus existing impacts are present. Higher altitude areas are less accessible and have hence been protected from grazing activities making them important in the greater context of the study area.

8.5 Avi-fauna

8.5.1 Natural environment

Vegetation structure is more critical in determining bird habitat than actual plant composition (Harrison *et al*. 1997). Therefore, the description of the habitat presented in this study concentrates on factors relevant to birds, and does not give an exhaustive list of plant species which occur in the study area. The vegetation classification system presented in the Atlas of southern African birds (SABAP1) (Harrison *et al*. 1997) is used for purposes of this report. The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data.

The proposed wind farm site is situated in Grassy Karoo, an ecological transition zone between the Nama Karoo and Grassland biomes (Harrison *et al*. 1997). The Karoo supports a particularly high diversity of species endemic to southern Africa. Its avifauna characteristically comprises ground-dwelling species of open habitats, but the many tree-lined watercourses allow penetration of several species characteristic of arid woodland (Harrison *et al*. 1997). The ecotonal nature of the Grassy Karoo is apparent from the presence of typical species of both grasslands and Karoo at the wind farm site e.g. Melodious Lark *Mirafra cheniana* and Layard's Tit-babbler *Sylvia layardi*. It would appear that many grassland species that have suffered major reductions in the Grassland biome are still found regularly in the Grassy Karoo e.g. Blue Crane *Anthropoides paradiseus*.

The site contains a number of natural drainage lines which is used for irrigation purposes. In some areas, the drainage lines widen into associate small seasonal wetland areas. Some of the drainage lines are flanked by rocky, boulder-strewn slopes. In the northern and western side of the site, there are several prominent hills, of which the largest is called Oppermanskop.

8.5.2 Modified environment

Whilst most of the distribution and abundance of the bird species at the wind farm site are associated with natural vegetation, as this comprises the vast majority of habitat, it is also necessary to examine the modified environment available to birds.

In addition to the natural vegetation, the following modified habitats were identified at the wind farm site:

- **Agricultural lands**: There are a number of irrigated cultivated fields within the boundaries of the proposed wind farm site which consist mostly of lucerne and fodder. In some areas, old lands have reverted back to grassland. The same suite of priority species which utilise the natural vegetation may also from time to time forage in these cultivated fields, particularly Blue Cranes.
- **Dams**: A newly constructed farm dam was recorded on the site, and the remnants of a previous dam are still present in a drainage line. There are likely to be additional small dams in the study area. These are sources of surface water that could periodically attract

several priority species of waterbirds, raptors and sandgrouse (refer to the Avi-fauna specialist report in Appendix 6).

See Figure 11 below for a map of the wind farm site, indicating important habitat features, and the location of monitoring transects and vantage points for flight observations.

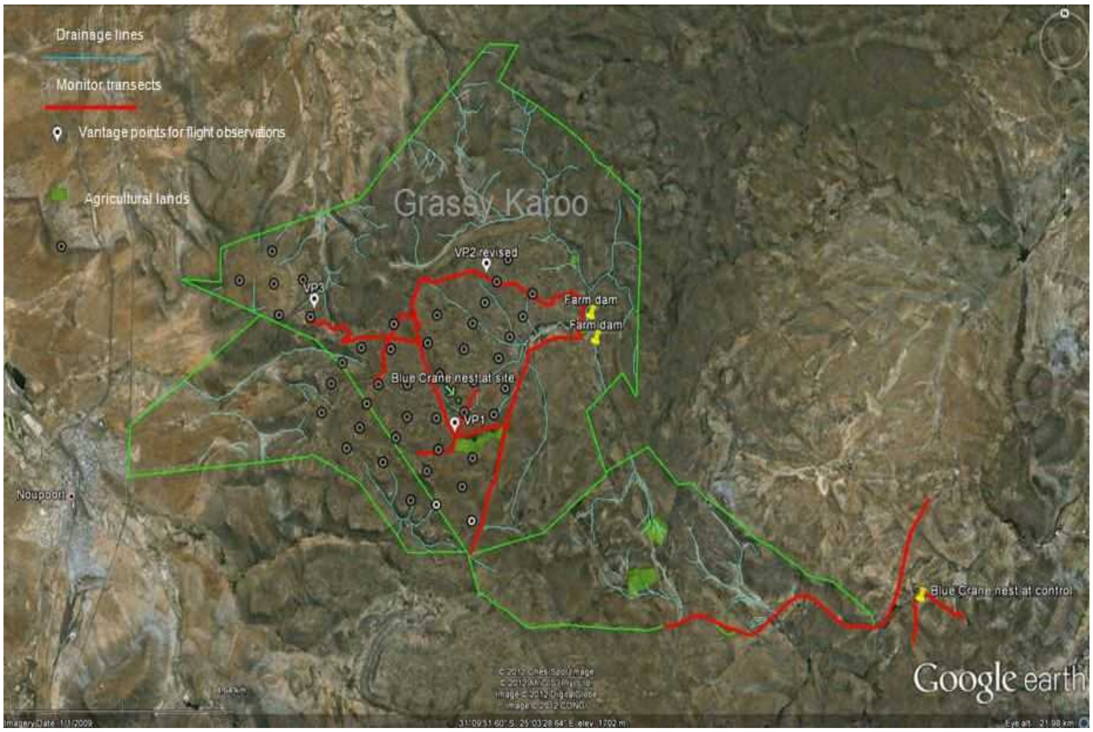

Figure 11: The bird habitat and the location of monitoring transects and vantage points for flight observations at the development area and control area.

8.6 Bats

The Bat Assessment was conducted by Werner Marais from Animalia cc. The full report is included in Appendix 6. The environmental baseline from a bat perspective is presented below.

8.6.1 Species probability of occurrence

The table (Table 7) below lists the species that may potentially occur on site. In general the larger area around the site (approximately 30km radius) is dominated by the Eastern Upper Karoo, although the hills of the Tarkastad Montane Grassland present on the actual site is likely to offer suitable bat roosting habitat.

Table 7: Table of species that may be roosting on the study area, the possible site specific roosts, and their probability of occurrence. LC = Least Concern; NT = Near Threatened; V = Vulnerable; DD = Data Deficient (Monadjem *et al*., 2010).

Species	Common name	Probability of occurrence	Conservation status	Possible roosting habitat to be utilised on study area
Eidolon helvum	Straw coloured fruit bat	Very Low - None	LC	A non breeding migrant
Rhinolophus clivosus	Geoffroy's horseshoe bat	High	LC	Roosts gregariously in caves and rock hollows. Mountainous nature of area can provide many rock hollows
Rhinolophus darlingi	Darling's horseshoe bat	Medium	LC	Roosts gregariously in caves and rock hollows, and culverts. Edge of distribution.
Rhinolophus denti	Dent's horseshoe bat	High	DD	Caves, hollows, mines, culverts. Some rock hollows offered by mountains, well in distribution.
Nycteris thebaica	Egyptian slit-faced bat	High	LC	Culverts, hollows, aardvark burrows, etc.
Tadarida aegyptiaca	Egyptian free-tailed bat	High	LC	Crevices, buildings, rock crevices in mountainous area
Miniopterus natalensis	Natal long-fingered bat	Medium	NT	Roosts gregariously in caves, no known caves close to the study site. But mountainous terrain may have caves.
Cistugo lesueuri	Lesueur's Wing-gland bat	Very low	V	Widespread in Lesotho. Prefers high montane grassland with exposed

				rock and water in form of marshes, dams, streams. Endemic to SA and Lesotho.
Eptesicus hottentotus	Long-tailed serotine	High	LC	Crevice dweller and in buildings and caves/rock hollows
Myotis tricolor	Temminck's myotis	Medium	LC	Roosts gregariously in caves, no known caves close to the study site. But mountainous terrain may have caves.
Neoromicia capensis	Cape serotine	High	LC	Under bark of trees and roofs of buildings, crevices, very common species.

8.6.2 Surface rock, topography, climate, surface water and vegetation

The Noupoort site has a fairly high mean annual precipitation, and is also on a relatively high altitude. Numerous small streams and large streams are draining from the central area of the site. This central area is encircled by mountainous terrain capable of offering suitable bat roosts and the streams in the central area can offer drinking water as well as elevated insect numbers for foraging of insectivorous bats. From a vegetation point of view the natural vegetation of the site does not offer much roosting space.

8.7 Surface Water

8.7.1 Study Area Terrain and Topography and Land Cover

The topography and terrain of the study area has a strong influence on the type of drainage present in the study area. The wider area is set within the context of the Karoo landscape of the South African interior, which is characterised by extensive plains characterised by isolated relief in the form of often flat-topped koppies (mesas) and linear, low dolerite ridges. This is typical of the area to the west and north of Noupoort, but the areas to the south and the east (where the development site is located) mark a significant change in this topography. The area to the east of Noupoort is marked by higher-lying ground, with a number of koppies (mostly notably Oppermanskop) encircling a high-lying plateau in the central parts of the site. The presence of this hilly and incised topography entails that there are a number of much more incised valleys on the site, as described below.

Due to the nature of the topography, the terrain on many parts of the site is very rocky, with significant areas of rock outcropping occurring at the surface. This has had an impact on the substrate, soils on the site, with many parts of the site being characterised by very shallow soils. This is reflected in the predominant soil forms found on the site. The Soils and Agricultural Potential Study undertaken for this EIA (Barichievy, 2012) reports that the lithic soil type is dominant over many parts of the site. The Mispah soil form which is a lithic soil type where a shallow topsoil layer is underlain by hard rock dominates large areas of the study area particularly on the steeper slopes and koppies. The Glenrosa Soil Form which is similarly lithic and in which a shallow topsoil (A) horizon is underlain by a B horizon consisting of a high proportion of weathered rock is also found over large parts of the site.

Only on the higher plateau and in some of the river valleys do deeper soil profiles exist (this has implications for the development and formation of hydric soils and wetlands on the site, as discussed below). The nature of the substrate on the site has a big effect on the land use and concomitant land cover on the site; most of the site is unsuitable for cultivation of crops, and thus the land use which predominates on the site is livestock rearing in the form of sheep and cattle. Due to the predominance of this land use over most of the site, the natural vegetation has largely been retained, except in narrow bands along certain of the river valleys where sufficiently deep soils allow for the cultivation of crops. The predominance of this land use and the retention of much of the natural vegetation is believed to have retained a largely natural hydrological regime on the site.

An important component to the micro-topographical characteristics of the site is the much of the site is subject to high levels of erosion (Figure 12), and while this erosion is partly due to poor land management, there are characteristics inherent to the site which increase the erodibility of the soils on the site. Certain soils on the site are duplex in nature, which means that there is an enrichment of clay in the secondary B horizon. Duplex soils are highly erodible as clay dispersion tends to result in surface sealing leading to increased runoff. The presence of duplex soils, along with the presence of steep slopes on the site leads to a high erosion potential.

Figure 12. Highly eroded ground in the north-western part of the site

8.7.2 Catchments

As described above the study area lies close to the Great Escarpment, and thus the area is situated very close to the continental divide, i.e. the watershed that separates drainage into the Indian Ocean to the south and the east, and the Atlantic Ocean to the west. Thus although the study area falls within the Orange River primary catchment, it is located very close to a few of the upper quaternary catchments of the Fish River Basin. The study area is bisected by the divide between two quaternary catchments, with westward-drainage in the western part of the site (streams draining down the steep rising ground on the site to the flats to the east) falling into the D32G catchment (that of the Noupoort Spruit), and the remainder of the site falling into the D34B catchment (drained by the Oorlogspoort Spruit) (Figure 13). The Noupoort Spruit becomes a tributary of the perennial Seekoei River, which in turn flows northwards into the Upper Orange River. The Oorlogspoort Spruit itself is perennial and is a tributary of the Upper Orange. Over most of the site, drainage is to the east into the Diepkloof Spruit which rises on the site and drains through a highly incised valley on the site onto the flats to the east of the site where it joins the Oorlogspoort Spruit.

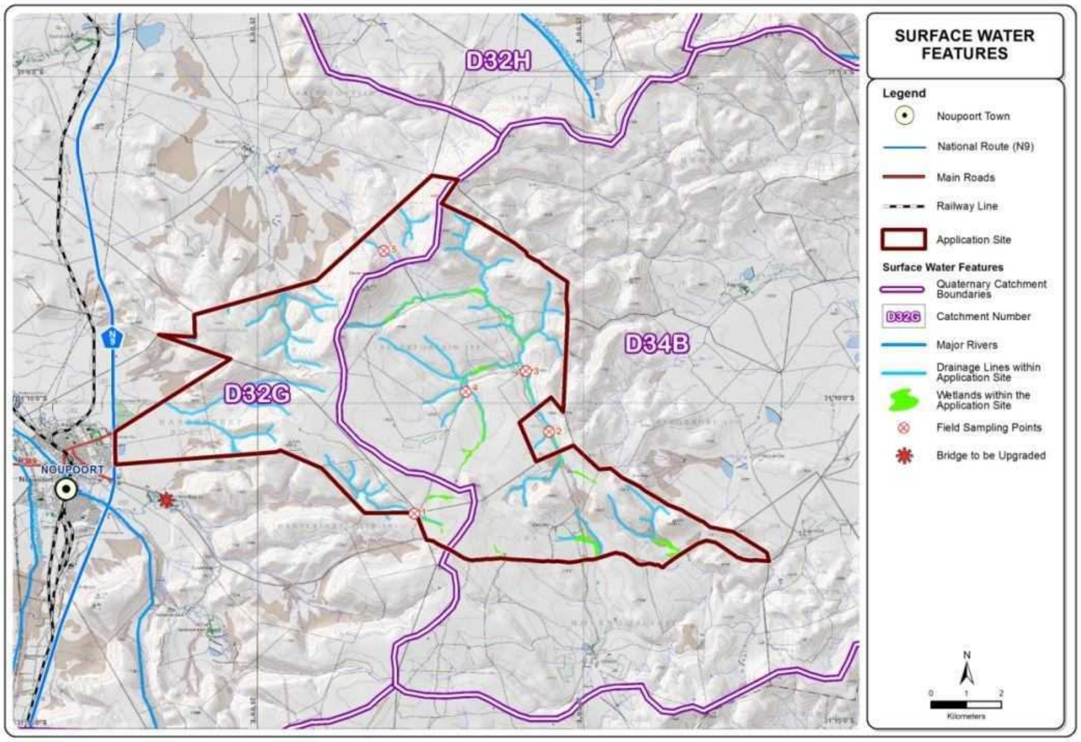

Figure 13. Map showing drainage and quaternary catchments on the Development Site

8.7.3 Surface Water Features on the Study Site

Due to the nature of the topography and terrain as discussed above, much of the surface water features on the site occur in the context of steep-sided very rocky valleys. In these settings, very narrow drainage lines tend to occur. These drainage lines are characterised by very little soil in terms of their substrate, with extensive rock outcropping at the surface. These types of steep-sided and longitudinally steep-profiled drainage lines or streams typically drain the higher lying and steeper areas on the site, especially on the slopes of the higher lying ground (relative to the plains to the west) in the western part of the site, on the slopes of the higher hills such as Oppermanskop, and in the incised terrain to the north-east of the Blydefontein Farmstead. The steeply rising ground on the western edge of the site is bisected by a number of steeply sided kloofs or valleys where shrubs and trees tend to occur. These rocky drainage lines are typically ephemeral, thus only ‘flowing’ for brief periods when rainfall occurs. However, on a couple of areas of the site, localised seepage areas at the head of these steep valleys were noted during a site visit at the start of summer prior to any rain having fallen. Thus there may be a small element of groundwater discharge or seepage into some of these systems (Figure 14).

Figure 14. Groundwater seepage into a rocky drainage line at the head of a steep valley in the north-western part of the site

The central and southern parts of the site are characterised by flatter terrain, and slightly different surface water features occur here. As described above, this part of the site is drained by the Diepkloof Spruit, and a number of small tributaries drain northwards into this steam. In areas where the terrain and valley cross sections are less incised and the valley longitudinal profiles are flatter, the surface water features take the form of narrow valley bottom wetlands, or streams, where the substrate is completely rocky. The head of the Diepkloof drainage system originates in a relatively gentle valley in the southern part of the site near the disused Glen Allan Farmstead. A narrow stream drains this valley; erosion is prevalent along much of its length and in places relatively deep soil profiles overlying bedrock (of up to 2m in depth) have been exposed along its banks. Two other 'tributary' stream / wetland systems drain from the south-western and north-western parts of the site. In both of these narrow relatively incised systems, water flow was noted, with localised presence of soil profiles.

The only surface water feature on the site that is closest to being a 'classic' palustrine wetland occurs on the southern boundary of the site, on the current main access road onto the Blydefonteiin farm. The wetland emanates in gently undulating grassland-dominated terrain before flowing into an increasingly incised valley that drops down into the upper parts of the Noupoort Spruit Valley along the Oorlogspoort Road. At the point at which the site access road crossed this system it occurs in the form of a narrow wetland characterised by hydromorphic sedge and grasses, with standing water noted along much of its width.

Although not on the development site, the upper reaches of the Noupoort Spruit along the Oorlogspoort unsurfaced road are relevant to this study, as the project engineers have indicated that the bridge across the Noupoort Spruit near the Aarbeidsgenot Farmstead mightneed to be upgraded or temporary supported. The Noupoort Spruit drains an incised valley to the east of the town up which the Oorlogspoort district road runs. At the point at which the Spruit is crossed by the road bridge, it takes the form of a well-developed perennial stream, with a distinct channel and riparian zone. The upper reaches of the Spruit are highly eroded, with very steeply cut banks evident. The stream evidently carries a high silt load during times of rainfall, as the low weir just upstream of the bridge was noted to have significantly silted up.

8.7.4 Characteristics of the Noupoort Stream at the Oorlogspoort Stream Crossing

The bridge over the Noupoort Spruit along the Oorlogspoort Road is proposed to be upgraded or temporarily supported if required to accommodate the vehicles that would need to access to the site.

In order to assess the potential impact of the possible bridge upgrading on the Noupoort Spruit, the existing characteristics of the affected watercourse reach need to be described.

The existing bridge crosses the Noupoort Spruit near the Aarbeidsgenot Farmstead. The stream drains the higher-lying ground to east and the north, with much of the catchment of the stream falling within the site. The upper parts of the catchment of the stream are thus very hilly and mountainous, being characterised by steep gradients. The gradient flattens out closer to the town and the stream in the vicinity of the bridge is located in this flatter area. The stream appears to be mostly perennial, with flow in the stream observed at the start of the summer season before any significant rain had fallen. The stream has a very well-defined channel in the vicinity of the crossing; upstream of the crossing the stream channel appears to be very incised and possibly subject to accelerated (unnatural) erosion. This has resulted in a high silt load having been deposited just upstream of the bridge behind a low causeway. The causeway appears to have completely silted up as a result. The causeway appears to take advantage of a localised drop in elevation of the stream bed, with the bed of the stream downstream of the bridge being approximately 2.5m lower than the level of the banks just upstream. The stream has a well-defined riparian zone, being characterised by both indigenous riparian trees and shrubs, as well as some exotic species, including the Weeping Willow *Salix babylonica*. The bed of the stream where it is crossed by the bridge is rocky, with outcropping of bedrock evident. A number of typical wetland (hydromorphic) grasses are found in the bed of the channel.

Figure 15. Existing bridge structure. Note the presence of wetland and riparian vegetation on the bed and banks

8.8 Soils and Agricultural Potential

8.8.1 Geology

The study area is predominantly underlain by mudstone parent material with a limited extension of tillite along the eastern boundary of the study area (Figure 16). Mudstone is a clastic sedimentary rock which is formed from the lithification of deposited mud and clay. Mudstone consists of a very fine grain size of less than 0.005 mm and unlike shale is mostly devoid of bedding. While tillite consists of consolidated masses of unweathered blocks and unsorted glacial till.

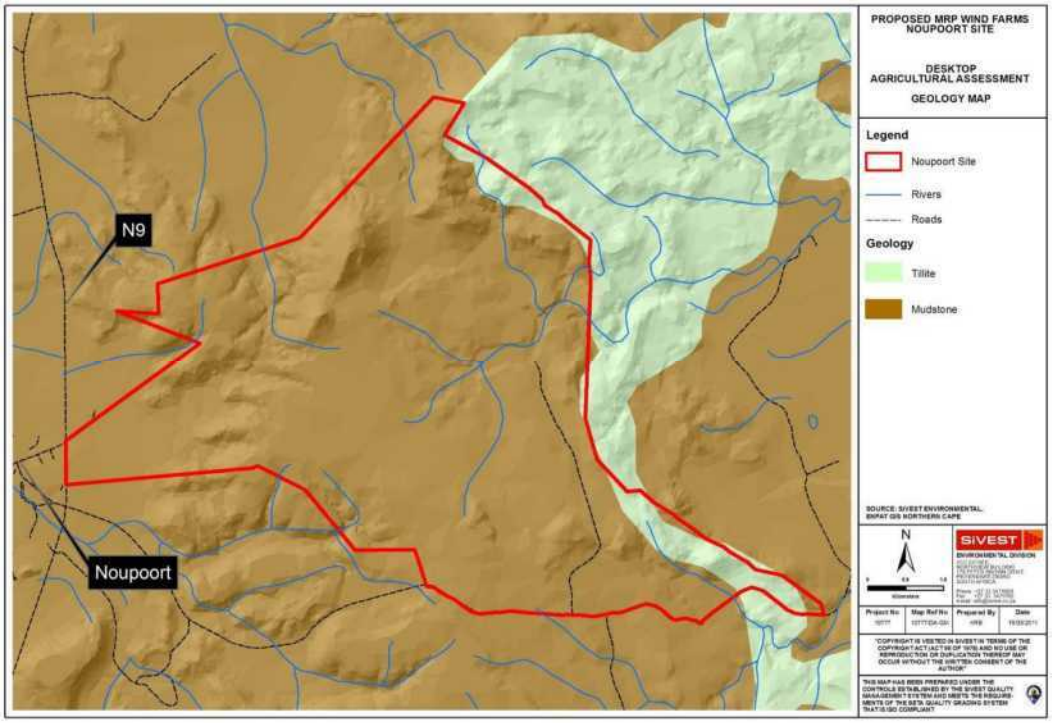

Figure 16: Geological map

8.8.2 Terrain

Slope or terrain is used to describe the lie of the land. Terrain influences climate and soils characteristics and thus plays a dominant role in determining whether land is suitable for agriculture. In most cases sloping land is more difficult to cultivate and usually less productive than flatland, and is subject to higher rates of water runoff and soil erosion (FAO, 2007).

The study area is almost completely framed by steeper slopes, valley lines and / or ridges while the central areas are characterised by flat and gently sloping topography with an average gradient of less than 10% (Figure 17). The flat topography encountered in the central portions of the study areas makes them suitable for arable agriculture with moderate potential for large scale mechanisation. These areas are also the most attractive for the proposed development.

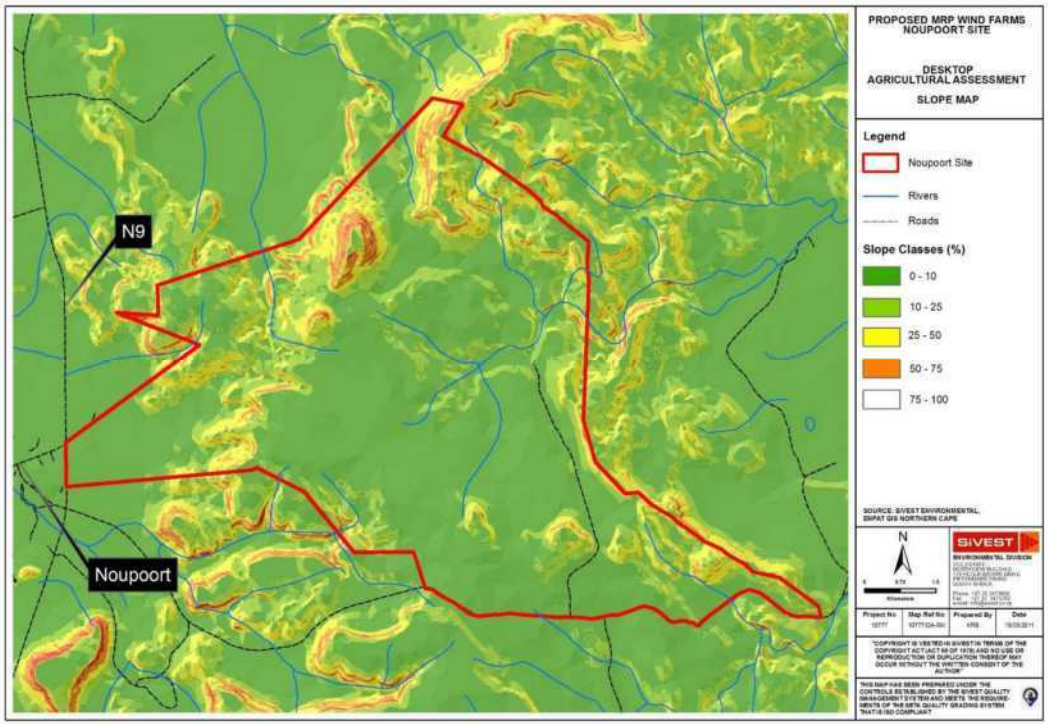

Figure 17: Slope Analysis of the study area

8.8.3 Land Cover

The study area consists of a mix of natural veld and unimproved grassland which is used as grazing land for cattle and sheep (Figure 18). Vast grazing land is interspersed between incised river channels which flow intermittently. There is however limited signs of formal agricultural fields near the eastern boundary of site. It is recommended that the proposed development does not influence this agriculturally productive area.

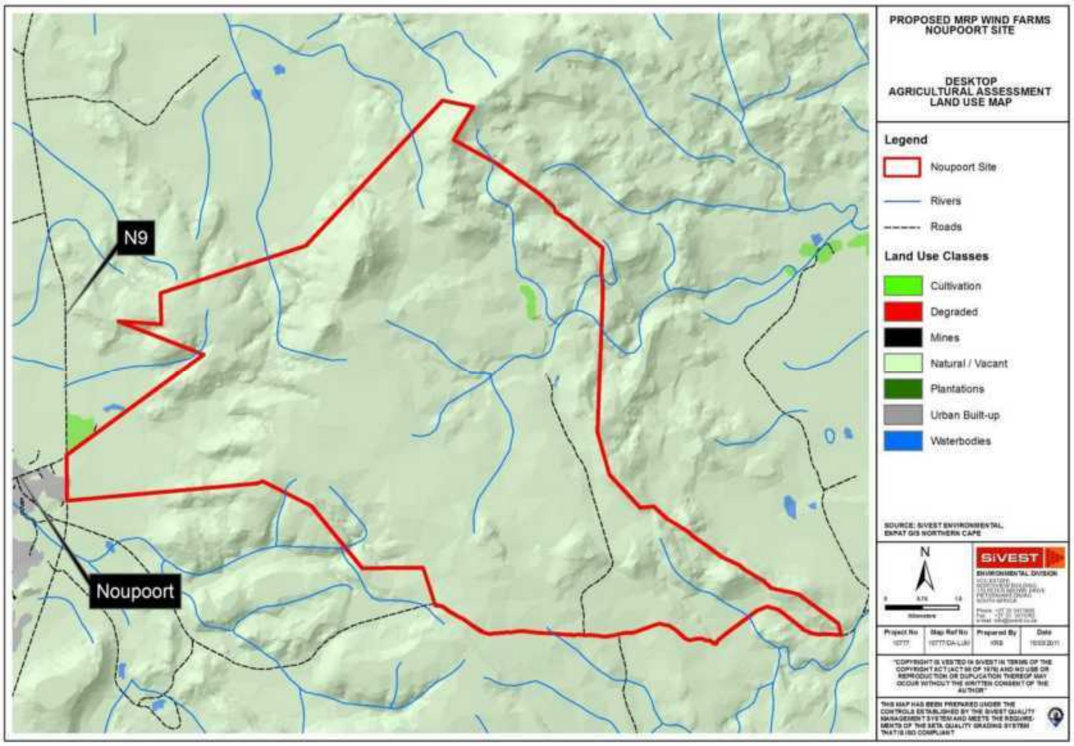

Figure 18: Land Cover Map

8.8.4 Soil Characteristics

According to the ENPAT database the site is dominated by mix of Glenrosa and Mispah soil forms (Figure 19). These soils develop where bands of weathering rock are found close to the soil surface. Glenrosa and Mispah soils generally have an inherently low agricultural potential due to a distinct lack of rooting depth (<0.45 m) (Figure 20) and also exhibit moderately high soil erosion hazard ratings; thus soil conservation practices such as minimum tillage and trash blankets should be employed. Stongly structured soils with cutanic rich horizons dominate the eastern corner of the study area.

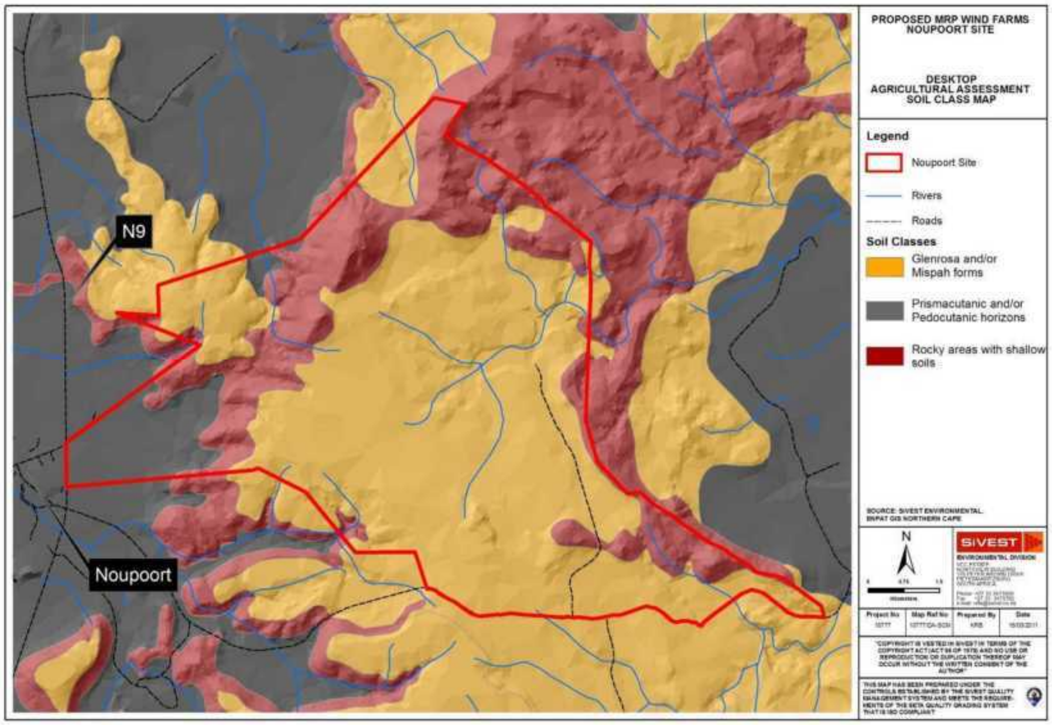

Figure 19: Broad soil type map

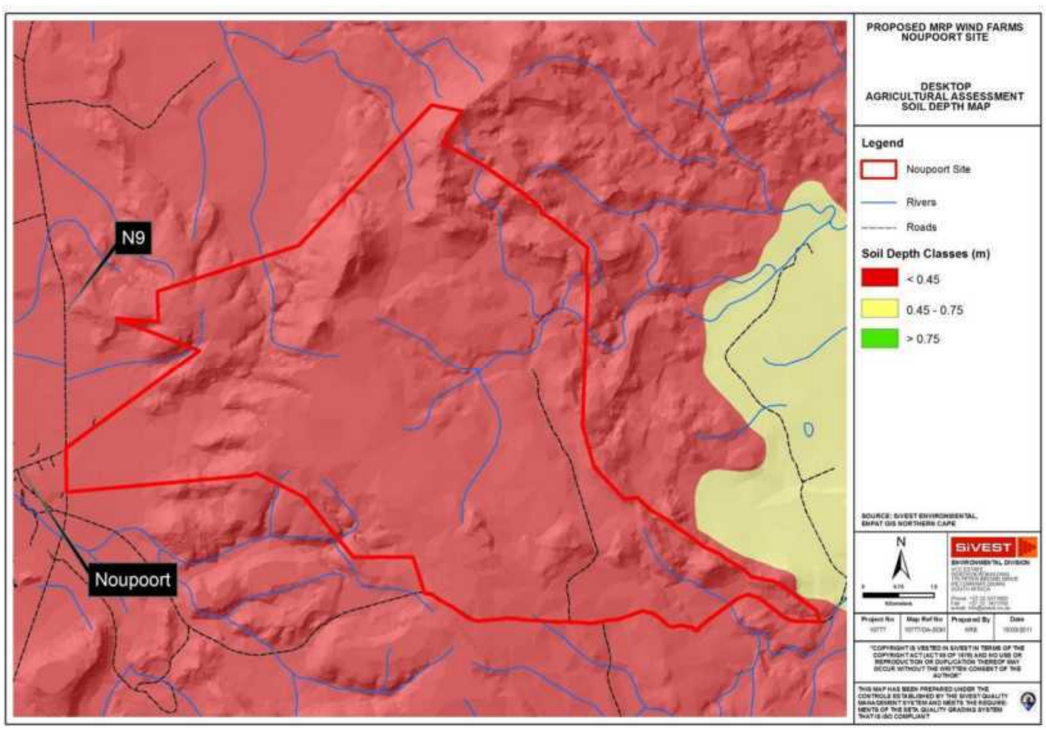

Figure 20: Soil depth map

The ENPAT Database also provides an overview of the study area's agricultural potential based on its soil characteristics, it should be noted this spatial dataset does not take *prevailing climate into account*. Restrictive climate characteristics, due to heat and moisture stress will further reduce the agricultural potential of the area under assessment. The study area is dominated by soils which are not suited for arable agriculture (Figure 21) but which can still be used as grazing land.

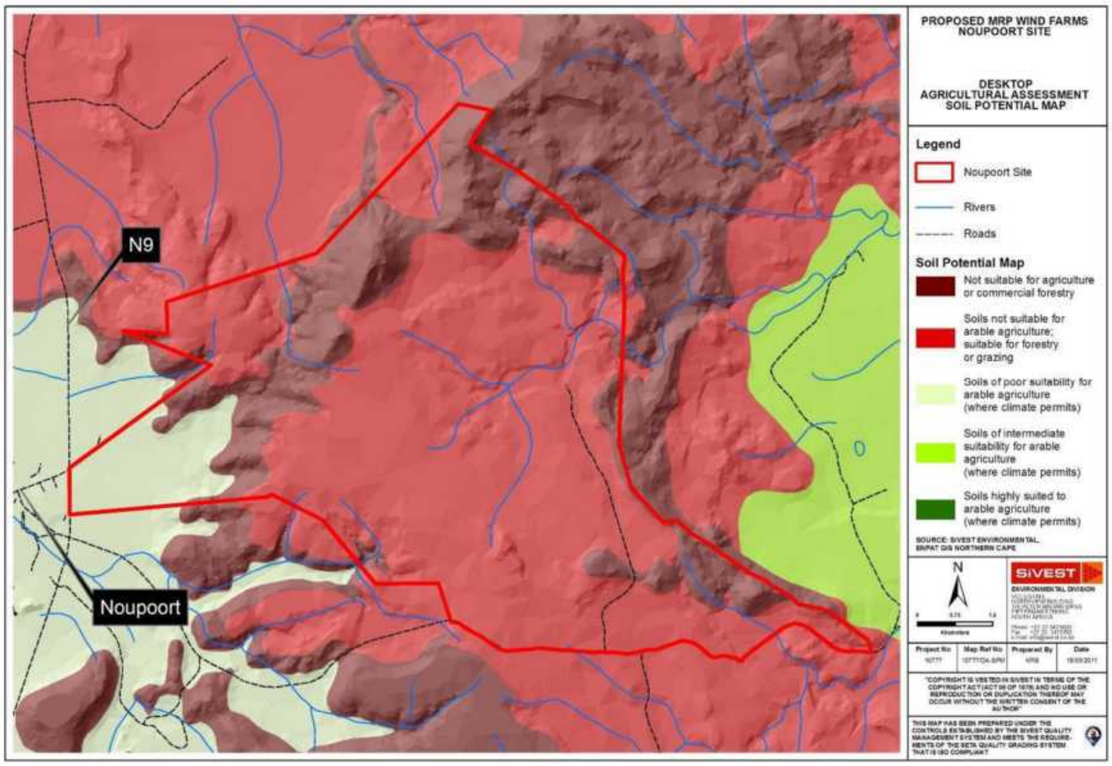

Figure 21: Soil Potential Map

8.8.5 Desktop Agricultural Assessment: Results Summary

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the study area is classified as being extremely low in terms of crop production while moderate to moderately low for grazing. This agricultural potential rating is primarily due to climatic and topographic limitations as well as marginal soil characteristics. The site is not classified as high potential nor is it a unique dry land agricultural resource.

8.9 Visual

8.9.1 Physical Landscape and Land use-related Characteristics and Visual Implications

Descriptions of the physical landscape characteristics of the study area, namely, topography, vegetation cover and land use, are included below as part of the visual characterisation.

The topography in the wider study area around the site is characterised by a mix of very flat plains (typical of much of the Karoo), as well as areas of much greater relief, including isolated dolerite-capped koppies and hilly terrain. The town of Noupoort (to the west of the site) lies in a valley flanked by hills / koppies to the east and the west. Generally the areas to the north and west of the town are characterised by flat Karoo plains and isolated koppies. The natural vegetation comprises of very low scrub vegetation due to the natural aridity of the area. These plains are interspersed with farmsteads, the only locations where tall trees have been established. To the south and east of the town, areas of much more hilly character exist; drivers along the N9 travelling south enter an area of much more incised topography after passing through the town. This hilly area around Carlton Heights extends into the area to the east of the town. The terrain to the east of the town (as traversed by the Oorlogskloof Road) rises up into a hilly landscape characterised by a mix of incised valleys and flatter, higher lying plateaux. These hilly areas similarly comprise of low scrubby vegetation, however the higher lying plateaux comprise naturally of open grassland, more typical of wetter grassland areas to the north-east of this area. Much of the development site is comprised by such a higher-lying plateau, which is flanked on most sides by hills and koppies which enclose the visual envelope of the area.

Due to the relatively arid nature of the area’s climate, and the presence of outcropping of rock at the surface in many parts of the area, livestock rearing (cattle and sheep) is the predominant rural land use in the wider area. Only very small areas of suitable substrate and water availability along valley bottoms have been cultivated (for the purpose of growing fodder for livestock). As such the natural vegetation has been retained across the vast majority of the study area.

The nature of the climate and corresponding land use which entails that stocking densities are low has resulted in relatively large farm properties across the area. Thus the area has a very low density of rural settlement, with only a handful of scattered farmsteads occurring across the area. Built form in the rural parts of the study area is thus limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines, fences and the remnants of old workers’ dwellings.

- Visual Implications

The mixed nature of the terrain across the study area has differing visual implications. Areas of flat relief (typical Karoo plains and higher-lying grassy plateaux) are characterised by wide ranging vistas, to the point at which surrounding hills / koppies enclose the visual envelope or local landscape (i.e. these hills form part of the horizon and areas beyond these hills cannot be seen). An example of this is from the town of Noupoort, where the hills that rise up from the plains to the east of the town frame the view, giving a relatively limited viewshed, whereas a much wider viewshed exists to the north of the town as the flat relief extends for quite a distance. Vistas in the hillier and higher-lying terrain can be more open or more enclosed, depending on the position of the viewer. Within some of the more incised valleys, the viewshed can be extremely limited, whereas from the higher-lying ridge tops or slopes, a much wider view or vista is available over a wide area. Importantly in the context of this study the same is true of objects placed in different elevations and landscape settings, with objects placed on high-elevation slopes or ridge tops being highly visible, and those placed within valleys or enclosed plateaux being visible from a much more restricted area.

The nature of land use in the rural parts of the area has been largely responsible for the area retaining a largely natural or ‘pastoral’ character, as the natural vegetation has been retained for grazing. The short, scrubby or grassy vegetation that occurs over the entire study area offers no visual screening in itself, and thus terrain is the most important factor in limiting vistas. The only exception to this situation exists at local farmsteads where trees and shrubs that have been planted over many decades around the farmstead have become established, and provide effective screening from the surrounding areas. This is discussed further in the ensuing sections.

8.9.2 Visual Character and the importance of the Karoo Cultural Landscape

As has been explained above, the physical and land use-related characteristics of the study area contribute to its visual character. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as electrical infrastructure. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a visual baseline in which there is little evidence of human transformation of the landscape. This is not to say that landscapes transformed by man are necessarily visually degraded, as many landscapes and visual settings around the world are a product of hundreds or even thousands of years of human influence, and thus represent a ‘natural visual baseline’. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being very different to a largely natural undisturbed landscape.

Built infrastructure within most of the study area is limited to a low density of gravel access roads, boundary fences, very few farm buildings and other farming infrastructure such as windmills. As explained above, the low density of human settlement and associated low level of change to the natural environment engenders the area with a largely natural visual character which can best be described as a rural or pastoral visual character.

The only divergence from this rural character is in the area around the town of Noupoort. Although it is a small town, Noupoort has a concentration of housing and other buildings such as schools, hospitals and churches, as well as relatively large railway shunting yards to distinguish it from the surrounding rural landscape. The town and its immediate surrounds thus have an urban visual character, which means that it is characterised more by anthropogenic objects (such as buildings and roads) than natural features. However it should be noted that the small population of the town, and its limited spatial extent entail that it is firmly set in a rural setting, and the rapid change from the edge of the town to rangeland or commonage contributes to the limited spatial extent of its particular visual character.

The greater study area can thus be considered to be typical of a Karoo or "platteland" landscape that would typically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa's dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Traditionally the Karoo has been seen by many as a dull, lifeless part of the country that was to be crossed as quickly as possible en route between the major inland centres and the Cape coast. However in the last couple of decades this has been changing, with the launching of tourism routes within the Karoo, and the promotion of tourism in this hitherto little visited, but large part of South Africa. In a context of increasing urbanisation in South Africa's major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published "Getaway Guide to Karoo, Namaqualand and Kalahari" (Moseley and Naude-Moseley, 2008) and the promotion of the Mid-Karoo Tourism Route (e.g. http://www.openafrica.org/route/Mid-Karoo-Route). The exposure of the Karoo in the national press during 2011 as part of the debate around the potential for fracking (hydraulic fracturing) mining activities has brought the natural resources, land use and lifestyle of the Karoo into sharp focus, with many potential objectors stressing the need to preserve environment of the Karoo, as well as preserving the 'Karoo Way of Life', i.e. the stock farming practices which are highly dependent on the use of abstracted ground water (e.g. refer to the Treasure Karoo Action Group website http://treasurethekaroo.co.za/).

These examples of how the Karoo is valued provide a good example of how the typical Karoo landscape can be considered a valuable 'cultural landscape' in a South African context. Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world; the concept of 'cultural landscape' is a way of looking at place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). The cultural landscape concept is a relatively new one in the heritage conservation movement across the world. In 1992 the World Heritage Committee adopted a definition for cultural landscapes:

Cultural landscapes represent the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

"a landscape designed and created intentionally by man";
an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The typical Karoo landscape of wide open plains, and isolated relief, interspersed with isolated farmsteads as well as windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The presence of the Karoo farmstead, as well as the ubiquitous windmill, fence line and herds of sheep is an important representation of how the harsh, arid nature of the environment of this part of the country has shaped patterns of human habitation and interaction with the environment in the form of the predominant land use and economic activity practiced in the area. The presence of, and spatial orientation of small Karoo towns, such as Noupoort, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such the Karoo landscape as it exists today has value as a cultural landscape in a South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, “continuing” landscape.

In the context of the study area, the various landscapes, as visible to the viewer, present excellent examples of such a Karoo cultural landscape. The N9 national road that is the main arterial route through the area, as well as the Oorlogskloof un-surfaced district road, presents a number of typical Karoo, as well as (importantly) highly scenic vistas within the study area. The presence of the hilly terrain to the south, east and west of the town of Noupoort greatly elevates the scenic value of the area, as the landscape is framed by the hills surrounding the town, adding great scenic value to the town and its environs. A significant change to this landscape has the potential to degrade its aesthetic quality and to change to threaten the conservation or preservation of this particular cultural landscape in a local context. In this context the significant potential visual intrusion posed by the proposed wind farm may have implications for the aesthetic quality and degradation of the visual character and thus the cultural landscape within the study area, although it is recognised that cultural landscapes are not necessarily static, but can be evolving. The potential for impact of the proposed wind farm on the Karoo cultural landscape in a local context is explored in more detail below.

Figure 22. A typical vista within the study area

8.10 Noise

8.10.1 Topography

Besides the small town of Noupoort to the west of the study area, the proposed WEF will be situated mostly in a rural area (Figure 23). The landscape is a mountainous terrain which undulates continuously in character. The town of Noupoort and the surrounding small holdings are situated on a more even terrain.

8.10.2 Roads

The N9 highway traverses north to south between the town of Noupoort and the various farm portions of the proposed WEF. A busy train station and line traverse the town of Noupoort running almost parallel with the N9 highway. The road and railway line is too far to contribute to ambient sound levels on the site.

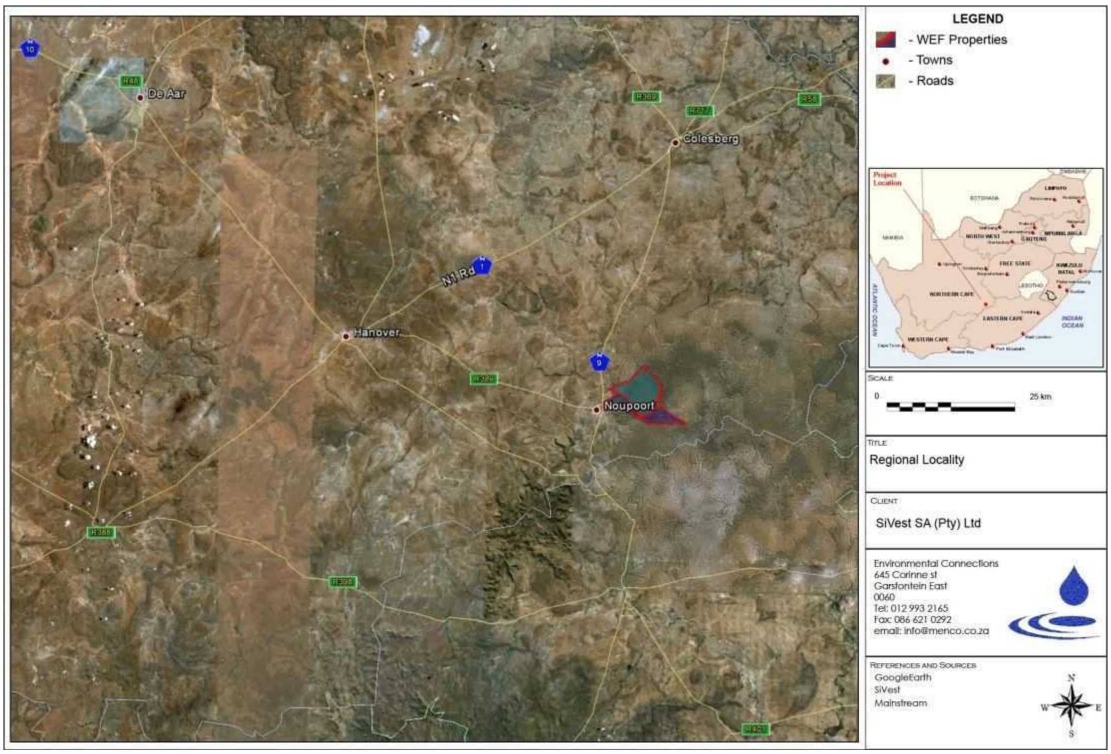

Figure 23: Site map indicating area proposed for the WEF

8.10.3 Land Use

Land use is mostly wilderness however various small agriculture activities are identified. Small residential small holdings can be seen surrounding the outskirts of the town of Noupoort, as well as the residential area of Noupoort itself (west of the proposed WEF).

8.10.4 Ground Conditions and Vegetation

The area consists mostly of low growing shrubs with hard ground conditions. The ground cover may offers little in the way of acoustical shielding.

8.10.5 Existing Background Ambient Sound Levels

The study area has a rural character in terms of the background sound levels.

8.10.6 Available Information

Apart from measurements collected during the compilation of the Scoping Noise Study for this project, no other information regarding the current soundscape is available.

8.10.7 Potential sensitive receptors (Noise Sensitive Developments)

Potentially Sensitive Receptors (PSRs), also known as Noise-Sensitive Developments (NSDs) were initially identified using Google Earth®, supported by a site visit to confirm the status of the identified dwellings.

Potential receptors in and around the proposed WEF were identified and are presented in Figure 24. The distances between the PSRs and the closest proposed Wind Turbine Generator (WTG) (as per the proposed preliminary second layout) are also defined (Table 8).

Table 8: Locations of the identified Noise-sensitive Developments (Datum type: WGS84 – Hartbeeshoek)

Noise-sensitive development	Description	Location Latitude	Location Longitude	Distance to closest Wind Turbine
NSD01	Residential	-31.185994°	24.964698°	> 2,000 m
NSD02	Residential/Guesthouse	-31.187577°	24.964406°	> 2,000 m
NSD03	Temporarily Residential	-31.190905°	24.978021°	> 2,000 m
NSD04	Residential	-31.195165°	24.963845°	> 2,000 m
NSD05	Residential	-31.200970°	25.138263°	> 2,000 m
NSD06	Residential	-31.158863°	25.067076°	860 m
NSD07	Residential	-31.180720°	25.126368°	> 2,000 m
NSD08	Residential	-31.198734°	25.075562°	980 m
NSD09	Residential/Commercial	-31.179160°	24.962479°	> 2,000 m

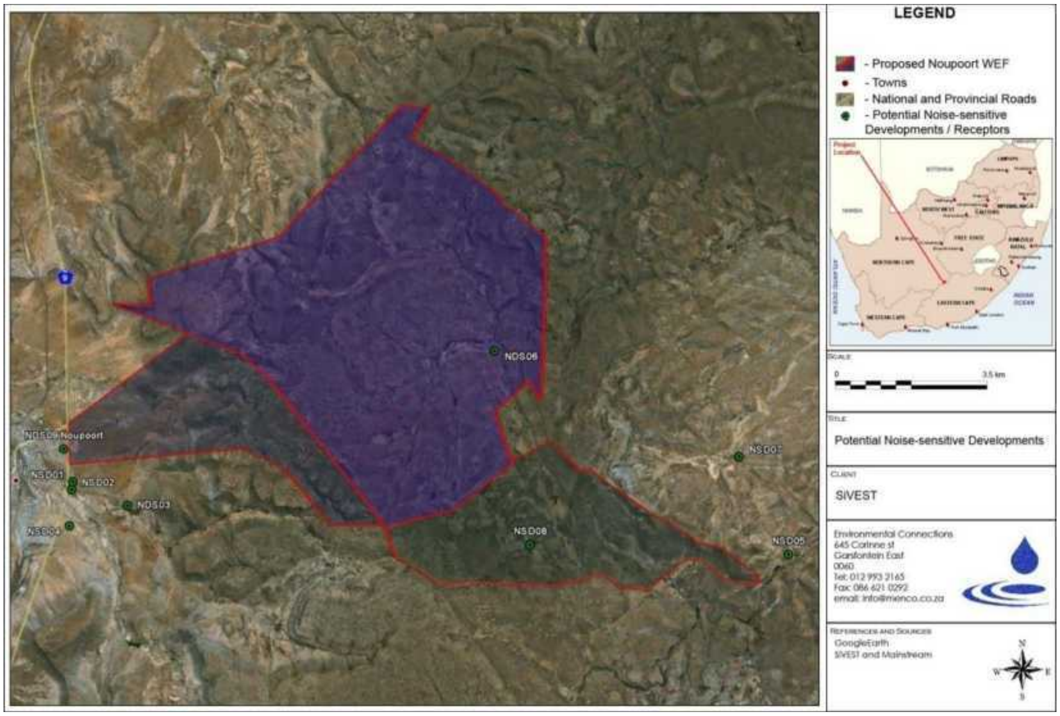

Figure 24: Aerial image indicating potentially sensitive receptors and property boundaries in the proposed WEF

8.10.8 Comments received from Interested or Affected Parties

Comments regarding the potential noise impact received during public participation process are summarized in Table 9.

Table 9: Noise Related Comments: Public Participation Process

Comment / Question	**Raised by**
Suggested sound pollution be investigated as part of the EIA process.	Mr. Donovan Hall Owner of The Don Guesthouse Fax: 17 August 2011

8.10.9 On-site Measurements

A number of 10 minute measurements were taken during the day and night of 10 and 11 June 2011. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA.

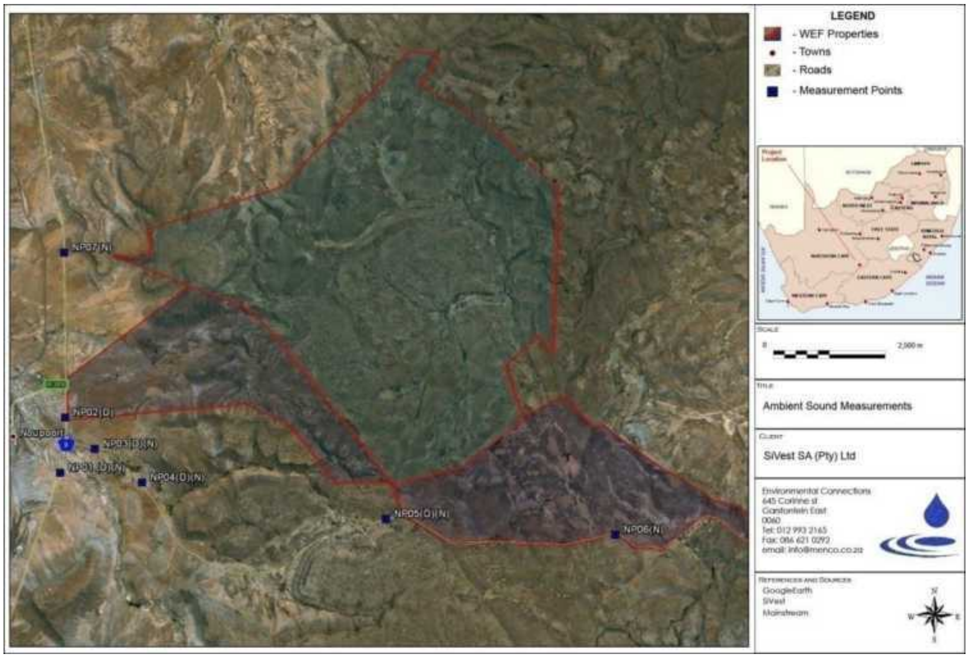

Figure 25: Monitoring points selected near the proposed facility (marked as blues squares)

The locations used to measure ambient (background) sound levels are presented in Figure 25. These points are considered sufficient to determine the ambient (background) sound levels in the area. The results are presented in Table 10 below.

During the period that measurements were collected sound levels in the area ranged from less than 18 dBA (LA90) upwards. During the period site measurements were conducted there were little wind, and only two ambient measurements were collected where the average wind speed exceeded 3 m/s.

All samples illustrate the rural character of the area during periods with light winds, with mainly natural sounds defining the acoustic character. The area is considered rural.

Table 10: Results of ambient sound level monitoring (Datum type: WGS 84, Decimal Degrees)

Point name	Location, Latitude	Location, Longitude	LAeq,T (dBA)	LA, max (dBA)	LA, min (dBA)	LA, 90 (dBA)	Wind speed Ave. (m/s)
NP01(D)	-31.193069°	24.961940°	31.2	47.7	18.5	20.3	2.2
NP02(D)(R)	-31.181884°	24.963176°	36.7	47.1	28.1	29.7	3.3
NP03(D)(Ref)	-31.188224°	24.970221°	65.1	72.9	52.9	56.1	1.3
NP04(D)	-31.195008°	24.981414°	56.1	72.5	33.2	41.5	0.5
NP05(D)(R)	-31.201964°	25.039155°	69.8	87.8	33.3	40.2	0.6
NP01(N)(R)	-31.193069°	24.961940°	33.6	42.7	23.6	26.0	1.8
NP02(N)(R)	-31.181884°	24.963176°	62.9	85.5	30.3	35.3	4.0
NP03(N)	-31.188224°	24.970221°	48.5	71.5	23.5	26.6	1.7
NP04(N)	-31.195008°	24.981414°	31.8	40.7	28.3	29.6	1.0
NP05(N)	-31.201964°	25.039155°	34.4	40.3	19.5	21.4	2.5
NP06(N)	-31.205186°	25.092967°	21.5	33.5	16.5	17.1	0.2
NP07(N)(R)	-31.148261°	24.962926°	70.8	89.6	28.2	30.2	0.7

Notes:

The Sound Level Meter was fitted with the WS-03 all-weather windshield during times when the average wind speed exceeded 3 m/s

(D) = Day, (N) = Night, (R) = Road

The Rion Sound Level Meter NL 32 minimum limit is 18 dBA (certified).

8.10.10 Influence of wind on Ambient Sound Levels

Unfortunately, current local regulations and standards do not consider changing ambient (background) sound levels due to natural events, such as can be found near the coast or areas where wind-induced noises are prevalent. This is unfortunately unfeasible with wind energy facilities, as these facilities will only operate when the wind is blowing. It is therefore important that the impact of wind-induced noises be considered when determining the noise impact of such as a facility. However, care should be taken when taking this approach due to other factors that complicate noise propagation from wind turbines.

Figure 26 illustrates this situation where the sound pressure levels associated with wind action increase as wind speeds increase. The actual sound levels measured (mainly wind impacting on the background ambient sound levels) is also indicated in this figure (in Yellow and Light Blue).

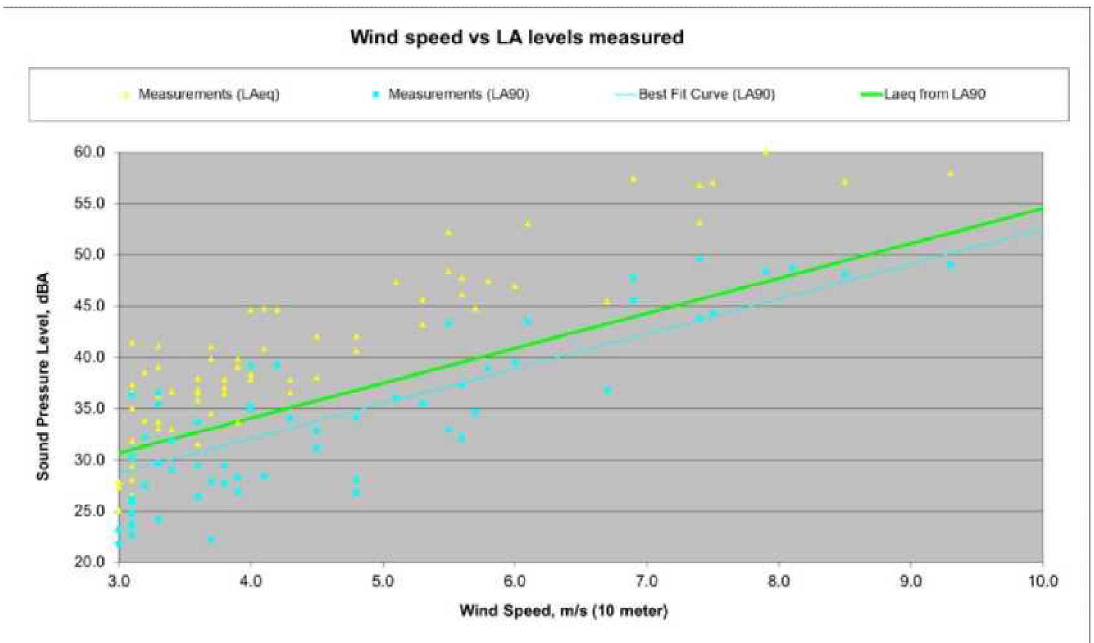

Figure 26: Ambient sound levels as wind speed increase

Due to the lack of an acceptable guideline in South Africa, the method proposed in the ETSU R97 (1996) will be adopted in this report. The curve developed is based on the noise measurements collected at a number of sites in South Africa. While these measurements are not site-specific, it relates to measurements collected in areas away from any anthropogenic noise sources, including measurements collected in areas considered semi-arid. It is presented to illustrate the concept that as wind speeds increase, ambient sound levels will also increase.

To develop appropriate ambient sound levels at various wind speeds, the best curve was fitted through the LA90 measurements.

It should be noted that most of these sound levels were measured at least 200 m away from any dwelling, and in most cases preferably more than 500 m[2]. In addition the points were selected to be away from structures (buildings, trees, etc.) that could significantly impact the ambient sound levels during periods when wind is blowing. During times when wind is blowing, ambient sound levels are generally higher near dwellings or other structures than at areas away from such structures. There is a number of factors that determine by how much ambient sound levels close to a dwelling might differ from the ambient sound level further away, including:

- Whether there are any wind pumps close to the dwelling;
- Type of trees around dwelling (conifers vs. broad-leaved trees, habitat that it provides to birds/animals, food that it may provide to birds/animals);
- The number, type and distance between the dwelling (measuring point) and trees. This is especially relevant when the trees are directly against the house (where the branches can touch the roof);
- The material used in the construction of the dwelling;
- How well the dwelling was maintained; and
- What type and how many farm animals are in the vicinity of the dwelling.

8.11 Heritage

8.11.1 Regional overview

- Stone Age

With one exception, little information is available on the Stone Age occupation of the region of the study area. Fortunately, Sampson (1985) did a very intensive survey of the Seacow River valley located some distance to the west. Although it should be acknowledged that environmentally it is somewhat different from that of the study area, it does supply us with a window into the human occupation of the larger region.

The earliest known occupants of the valley, referred to as the Auchelian industry (Early Stone Age), dates back to about 250 000 years ago. Their sites indicate a group of hunters passing regularly through the area on a large seasonal mobility pattern. Environmental indicators suggest

[2] It should be noted that this is different from the ETSU-R97 method, where the ambient sound measurements are conducted close to the dwelling of the potential noise-sensitive development. These measurement as such would be significantly (2 – 10 dBA) lower than if the measurements were to be collected next or close to a farm house.

that their occupation was ended by a cold-dry episode during which the valley was virtually abandoned.

The next period of occupation dated between 190 000 and 90 000 years ago (Middle Stone Age). Although their settlement pattern resembles that of the Auchelian, they concentrated more along river banks. Then there follow another cold-dry episode with another abandonment of the valley.

At the beginning of the Holocene period about 10 000 years ago the valley was repopulated by people represented by the Lockswood industry (Late Stone Age). Information suggests that they established camps at spring eyes and circulated from one spring to another on a seasonal round.

During the middle Holocene the Lockswood was replaced by the Interior Wilton. Their settlement pattern shows yet another change. Camps were now set back from the springs on an adjacent hill or ridge crest.

The final occupation before the arrival of white settlers in the area is reflected in the Smithfield industry. There is such a massive increase in site numbers after about 1 000 AD that it is suspected there was a population incursion into the valley. The Smithfield has a settlement pattern similar to that of the Interior Wilton.

Figure 27. Examples of typical stone tools (These stone tools are not from the region and are only used to illustrate the difference between Early (left), Middle (middle) and Later Stone Age (right) technology).

By the 19th century some Dutch speaking trekboers moved into the region, grazing their stock. As they depended on water for their live-stock, these farmers would have stuck close to available water sources and it was only during the wetter parts of the rain season that they might have accessed other areas for short periods of time.

An investigation of the Title Deeds of the farms under consideration indicated that they were surveyed during the early part of the nineteenth century, implying that they would have been occupied since then.

The farm Blydefontein 168 was originally granted in Quitrent to Hermanus Christophel Havinga on 15 March 1827. However, in May 1893 it became the property of H.C. van Zyl. For the last more than 40 years the farm has been in the possession of the Lessing family.

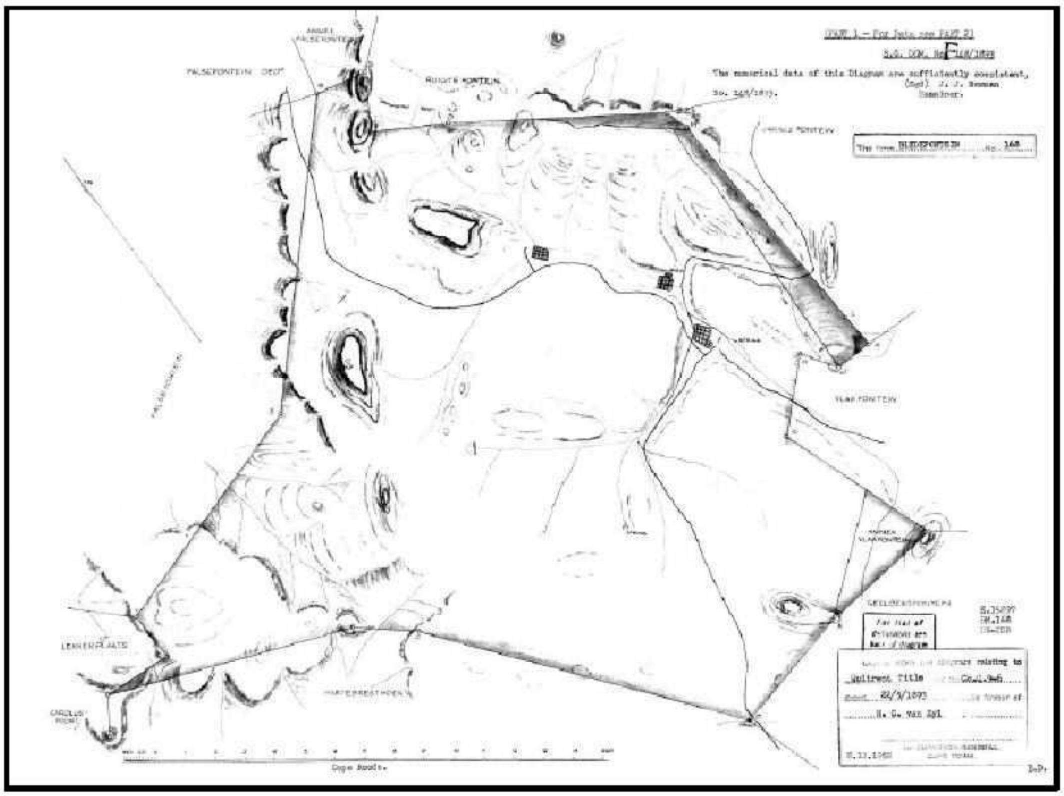

Figure 28. Copy of the Title Deed for Blydefontein.

The town of Noupoort (originally Naauwpoort) served as important railway junction, linking the lines from Port Elizabeth and East London, to that from Cape Town at De Aar. As a result of its importance, block houses were erected in the region during the Anglo Boer War (1899-1902), some of which are still standing. In 1911 the town had a population of 112 whites and 99 coloured (Playne 188.60-188.61:206).

Figure 29. Old Anglican Church in Noupoort.

8.12 Palaeontology

A specialist palaeonological impact assessment was undertaken by Dr. John Almond (Naturaviva) in the proposed development site. The full report can be found in Appendix 6K. The environmental baseline is provided below.

8.12.1 Geological background

The study area comprises highly dissected, mountainous terrain of the WSW-ESE trending Kikvorsberg range. This range reaches altitudes of 2050 to 2100m amsl at Oppermanskop and Kikvorsberg respectively, the latter lying outside the study area. The mountains are built of fairly flat-lying sediments of the Tarkastad Subgroup (= Upper Beaufort Group, Karoo Supergroup). These continental “red beds” are Early Triassic in age and contain numerous prominent-weathering, sheet-like sandstone packages. The Karoo succession is further reinforced by tough basic intrusions (horizontal sills and steeply-inclined dykes) of the Karoo Dolerite Suite. Weathering and erosion of these various resistant-weathering, subhorizontal rock layers has created a stepped mountainous landscape where flatter plateaux are incised by a complex, radial network of valleys with steep, rocky sides that are extensively mantled by rocky colluvium (i.e. scree, hill-wash and other slope deposits). These valleys reflect higher levels of erosional down-cutting under wetter climates of the Tertiary Era and are presently occupied by much smaller, intermittently flowing streams. Low-lying areas at elevations of 1500 to 1600 m amsl at the foot of the Kikvorsberg mountains are found towards the western and southern edges of the study area (on Portions 21/182 and 1/181 respectively). The gently-sloping terrain here is mantled with river alluvium as well as colluvial deposits (e.g. gravely alluvial fans and debris flows, finer-grained sheet wash) extending from the adjacent mountain slopes.

The geology of the study area to the east of Noupoort is shown on 1: 250 000 sheet 3124 Middelburg (Cole et al. 2004) (Figure 30) and has been briefly described in the geotechnical report by Bok (2011). Most of the area is underlain by Early Triassic (c. 250 Ma = million years old) fluvial sediments of the Katberg Formation (TRk; Tarkastad Subgroup, Upper Beaufort Group). A very small area of Karoo sediments assigned to the underlying Adelaide Subgroup (Pa) is mapped in the western foothills of the Kikvorsberg close to the N9 (Portion 21/182). It is likely that these rocks belong to the uppermost portion of the Adelaide Subgroup, namely the Palingkloof Member of Latest Permian to Earliest Triassic age. According to Cole et al. (2004) this succession consists largely of reddish mudrocks and has a thickness of only some 20m or so in the Noupoort area (Carlton Siding). Given their location at the foot of the Katberg escarpment, the Adelaide Subgroup rocks here are largely covered by colluvial debris. Furthermore, the map of the proposed wind turbine layout indicates that this part of the study area is unlikely to be directly impacted by the Noupoort wind farm development. For these reasons, the pre-Katberg rocks will not be treated in any detail in this report. It should be noted, however, that they are of considerable palaeontological significance elsewhere in the Main Karoo Basin since they record the catastrophic end-Permian mass extinction event and initial recovery among continental biotas (e.g. Smith & Ward 2001, Smith et al. 2002, Retallack et al. 2003 and 2006, Ward et al. 2005, Smith & Botha 2005, Botha & Smith 2007).

The Karoo Supergroup sedimentary rocks in the Nouport study area are extensively intruded by Early Jurassic (183 ± 2 Ma) igneous intrusions of the Karoo Dolerite Suite (Jd) (Cole et al. 2004, Duncan & Marsh 2006). The sills and dykes have thermally metamorphosed or baked the adjacent sediments. Levels of tectonic deformation in this region are low, as shown by recorded dips here of only two to three degrees within the Tarkastad Subgroup. Steeper northward dips were noted in Katberg sandstones along the western flank of the Langberg (Blydefontein 168) where possible low angle thrusting may have occurred. In most parts of the study area, including both the flatter-lying plateaux and vlaktes as well as steeper hillslopes, the Mesozoic bedrocks are mantled with a variety of superficial deposits of probable Late Caenozoic (Quaternary to Recent) age. However, apart from the more extensive areas of river alluvium in lower lying areas in the west and south, most of these geologically youthful deposits such as stream alluvium, scree and hill-wash are not mapped (Figure 30).

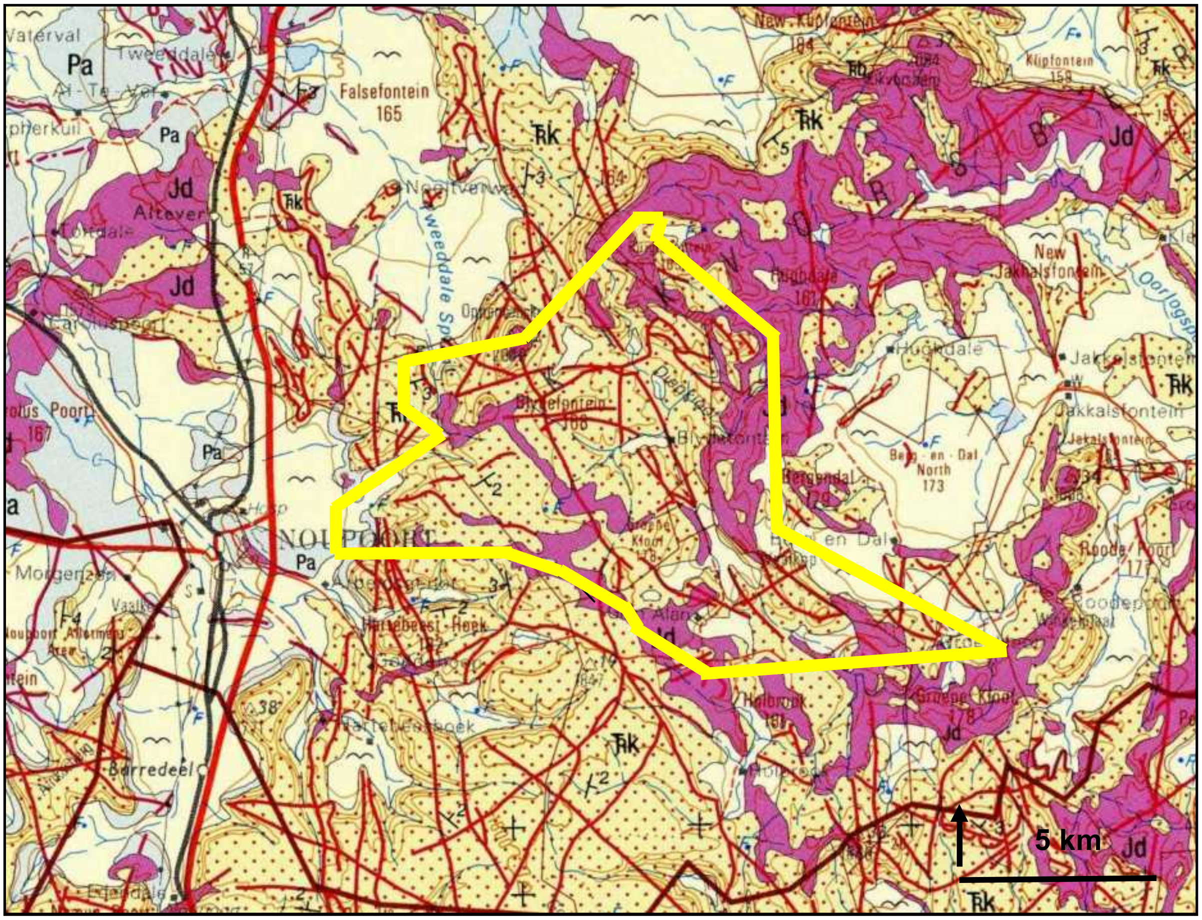

Figure 30. Extract from 1: 250 000 geology sheet 3124 Middelburg (Council for Geoscience, Pretoria) showing approximate outline of the study area to the east of Noupoort (yellow polygon). The main geological units represented here are:
Pa (pale blue) = Late Permian to Earliest Triassic Adelaide Subgroup (Lower Beaufort Group, Karoo Supergroup)
TRk (pale orange with red dots) = Early Triassic Katberg Formation of the Tarkastad Subgroup (Upper Beaufort Group, Karoo Supergroup)
Jd (purple) = Early Jurassic Karoo Dolerite Suite
White areas with “flying bird”symbol = Quaternary to Recent alluvium
N.B. Other Caenozoic superficial deposits such as colluvium (scree etc), soils and surface gravels are not depicted here.

- Katberg Formation

Useful geological descriptions of the Katberg Formation are given by Johnson (1976), Hancox (2000), Johnson et al. (2006), Smith et al. (2002) and for the Middelburg sheet area in particular by Cole et al. (2004). The more detailed sedimentological accounts by Stavrakis (1980), Hiller and Stavrakis (1980, 1984), Haycock et al. (1994), Groenewald (1996) and Neveling (1998) are also relevant to the Noupoort study area.

The Katberg Formation forms the regionally extensive, sandstone-rich lower portion of the Tarkastad Subgroup (Upper Beaufort Group) that can be traced throughout large areas of the Main Karoo Basin. In the Middelburg sheet area it reaches a maximum thickness of some 400m, but close to Noupoort thicknesses of 240-260m are more usual. The predominant sediments are (a) prominent-weathering, pale buff to greyish, tabular or ribbon-shaped sandstones up to 60m thick that are interbedded with (b) recessive-weathering, reddish or occasionally green-grey mudrocks. Up to four discrete sandstone packages can be identified within the succession. In the Noupoort area the overall sandstone:mudrock ratio is close to 1:1. Katberg channel sandstones are typically rich in feldspar and lithic grains (i.e. lithofeldspathic). They build laterally extensive, multistorey units with an erosional base that is often marked by intraformational conglomerates up to one meter thick consisting of mudrock pebbles, reworked calcrete nodules and occasional rolled fragments of bone. While the basal Katberg succession is often marked by a major cliff-forming sandstone unit, in the Noupoort area there is a transitional relationship with the underlying Adelaide Subgroup that is marked by an upward-thickening series of sandstone sheets. Internally the moderately well-sorted sandstones are variously massive, horizontally-laminated or cross-bedded and heavy mineral laminae occur frequently. Sphaeroidal carbonate concretions up to 10 cm across are common. The predominantly reddish Katberg mudrocks are typically massive with horizons of pedocrete nodules (calcretes), and mudcracks. Mudrock exposure within the study area is very limited due to extensive mantling of these recessive-weathering rocks by superficial sediments.

Sandstone deposition was mainly due to intermittently flooding, low-sinuosity braided river systems flowing northwards from the rising Cape Fold Belt mountains in the south into the subsiding Main Karoo Basin (Figure 31). Mudrocks were largely laid down by suspension settling within overbank areas following episodic inundation events, while other fine-grained sediments are associated with lakes and temporary playas in lower-lying areas on the arid floodplain, especially in the northern Katberg outcrop area and its lateral correlatives in the Burgersdorp Formation. Palaeoclimates inferred for the Early Triassic Period in the Main Karoo Basin were arid with highly seasonal rainfall and extensive periods of drought. This is suggested by the abundant oxidised ("rusty red") mudrocks, desiccation cracks, and palaeosols associated with well-developed calcretes. Arid settings are also supported by taphonomic and behavioural evidence such as pervasive carbonate encrustation of fossil bones, mummification of postcrania, bone-bed death assemblages associated with water holes and the frequency of burrowing habits among tetrapods, including large dicynodonts like Lystrosaurus (Groenewald 1991, Smith & Botha 2005, Viglietti 2010).

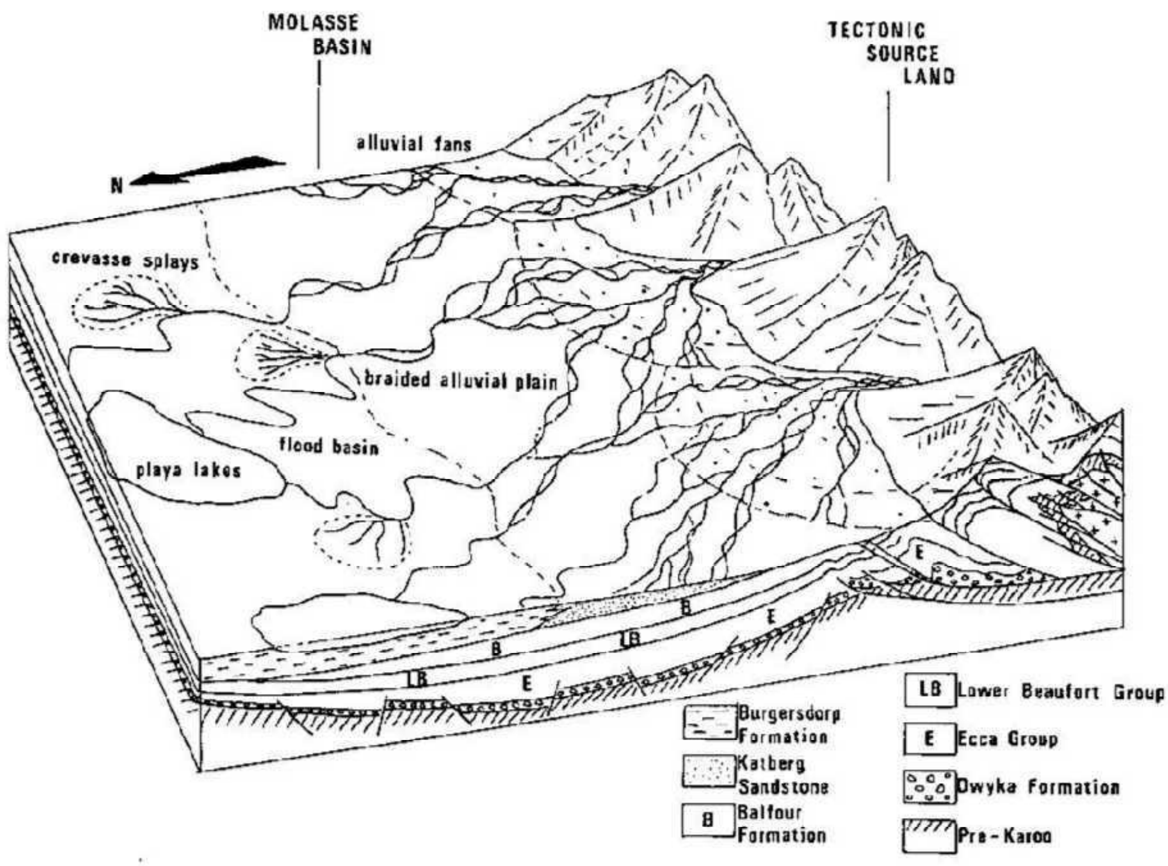

Figure 31. Reconstruction of the south-eastern part of the Main Karoo Basin in Early Triassic times showing the deposition of the sandy Katberg Formation near the mountainous source area in the south.

- Karoo Dolerite Suite

Basic igneous intrusions intruding the Beaufort Group north of the Great Escarpment are referred to the Karoo Dolerite Suite of Early Jurassic age (c. 182 Ma) and are associated with crustal stretching that preceded the final break-up of Gondwana (Duncan & Marsh 2006). Major subhorizontal, broadly conformable sills occur within the Katberg succession within the study area which is also traversed by numerous narrow, inclined dykes (thin red lines in Figure 30). Close to the margins of these intrusions the country rocks have been thermally metamorphosed or baked to form tough, splintery quartzites and hornfels (derived from sandstones and mudrocks respectively). Thermal metamorphosis and accompanying metasomatism (chemical alteration by hot migrating fluids) has led to the extensive secondary ferruginisation of Katberg carbonates (pedocrete nodules, calcrete conglomerates) and the formation of locally abundant ferruginous carbonate and siliceous nodules within sandstone facies. In some areas (e.g. Loc. 436) the reworked calcrete clasts within channel conglomerates have been dissolved to leave empty vugs (cavities), and this was probably the fate of any accompanying fossil bones or teeth.

Because the Karoo dolerites are igneous rocks that are not of direct palaeontological significance, they will not be treated in detail here. An excellent overview of the Karoo dolerites in the Middelburg sheet area is given by Cole et al. (2004). Prominent mountains such as Oppermanskop are capped by relicts of a once-extensive dolerite sill.

- Late Caenozoic superficial deposits

Various types of superficial deposits ("drift") of Late Caenozoic (Miocene / Pliocene to Recent) age occur widely throughout the Karoo study region. They include minor pedocretes (e.g. calcretes), colluvial slope deposits, stream and alluvium, as well as spring and pan sediments (cf Partridge et al. 2006). Useful geological overviews of talus deposits, alluvium and calcrete occurrences in the Middelburg sheet area are given by Cole et al. (2004). As a result of superficial sediment cover, surface exposure of fresh Beaufort Group rocks within the Noupoort development area – especially the recessive-weathering mudrocks - is generally very poor indeed, apart from stream beds, dongas and steeper hill slopes and artificial exposures in road and railway cuttings. The hill slopes are typically mantled with a thin layer of colluvium or slope deposits (e.g. sandstone and dolerite scree or talus deposits, sheetwash, surface gravels). Thicker accumulations of sandy, gravelly and bouldery alluvium of Late Caenozoic age (< 5Ma) are found in stream and river beds. In the Karoo these colluvial and alluvial deposits are often extensively calcretised (i.e. cemented with soil limestone or calcrete), especially in the neighbourhood of dolerite intrusions where groundwaters are enriched in dissolved carbonate, although this phenomenon was not observed during the present field study.

According to the Geotechnical Report for the Noupoort Wind Farm project prepared by Mainstream Renewable Power, Engineering and Construction (2012, 24 pp), test pits within the "buildable areas" within the land parcels concerned encountered superficial sands and silts up to one metre or more thick overlying sandstone and bouldery gravels.

Rusty-brown areas seen on satellite images probably represent dolerite-rich colluvial gravels. Alluvial areas in the western and southern portions of the study area are extensively affected by gulley erosion, as indicated by dark patches on 1: 50 000 topographic maps (See also Bok, 2011). Karoo Supergroup bedrocks are also exposed in these areas, at the base of the deeper dongas.

8.13 Socio-economic

The baseline profile mostly focused on the local municipal area, but reference was made to the district and the province, where deemed necessary. The profile was structured according to the following social change processes:

- Geographic Processes: land use patterns;
- Demographic Processes: the composition of the local community;
- Economic Processes: the way in which people make a living and the economic activities in the local societies;
- Institutional and Legal Processes: the role and efficiency of local authorities and other service providers in the area in terms of their capacities to deliver services to the local areas; and
- Socio-Cultural Processes: how the local population behaves, interacts, and how in-groups relate to each other, their environment, and the belief and value systems that guide these interactions.

8.13.1 Geographical Processes

Geographical processes relate to the land use patterns and established and planned infrastructural developments in an area. Land use is defined as ”… the human modification of the natural environment or wilderness into a built environment such as fields, pastures, and settlements.” This subsection therefore describes the current and future land use in the project area (baseline profile).

The Umsobomvu Local Municipality (ULM) is one of 8 category B municipalities within the Pixley Ka Seme District Municipality (PDM). It occupies the East-South-Easterly portion of The Northern Cape Province and is bordered by 2 respective provinces – The Free State to the North and North-East and The Eastern Cape to the East and South-East, while also being bordered by Renosterberg and Emanjeni Local Municipalities (also Northern Cape) to the West and South-West respectively. The ULM consists of 5 respective wards, occupies an area of 6 819km2 and has Colesberg as its seat.

The largest National Route in South Africa, the N1, runs right through this municipality and directly past the main settlement of Colesberg. It bisects the ULM in a North-East to South-West direction towards Cape Town, while the N9 splits off from the N1 at Colesberg and progresses southwards through the ULM. In the southwest the N10 also weaves its way through the ULM for a short period.

The ULM is located quite centrally within the arid heartland of South Africa but has large economic potential which may be tapped by making use of the National Routes and main railways which run through it towards large cities such as Cape Town and Port Elizabeth.

The proposed site is located along the eastern banks of the N9, east of and directly adjacent to the town of Noupoort. With reference to Figure 32, the area surrounding the site is largely devoid of structures, apart from a number of scattered/clustered houses and structures, of which seven are on site: two structures are located at number (1) and five structures at number (2).

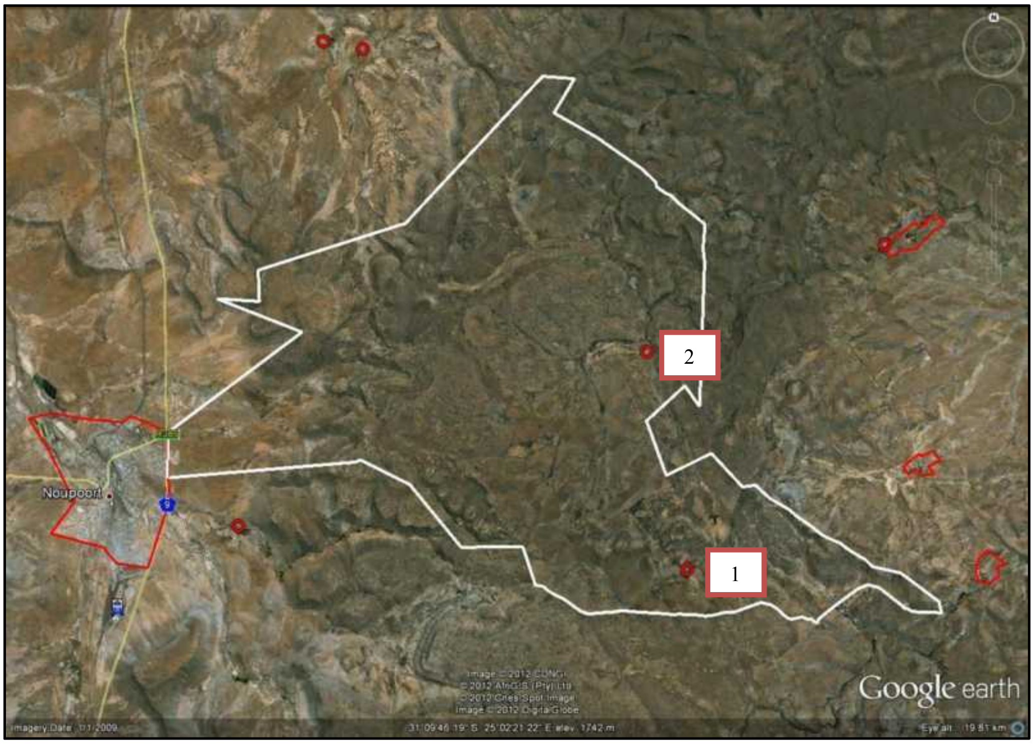

Figure 32: On-site Sensitivities

8.13.2 Demographical Processes

Demographical processes relate to the number of people and the composition of a community. This includes an overview of the population size, the race, age, gender and educational profile of a population as well as household compositions.

- Population Size & Growth

The ULM is a sparsely populated area considering its size, and in 2007 the population size stood at approximately 21,995 – a reduction of 2,647 persons from the 2001 population of 24,642. According to CS 2007 data, the population density locally would be 3.2 persons per km². This is higher than the district density of 1.6 people per km² and the provincial population density of 2.8 people per km2, but much lower than the national average of 41 people per km².

Table 11: Population size and change in ULM (Census 2001 & CS 2007)

Area	2001 Population	2007 Population	Annual Average % Change	2011 Estimate
ULM	24 642	21 995	-1.8%	20 453
PDM	161 238	166 845	+0.6%	170 885
N. Cape	991 919	1 058 057	+0.01%	1 062 295

For a more detailed analysis on the population, growth and size of the community, please refer to the Socio-economic Specialist Study in Appendix 6.

- Race, Gender, & Age

The gender profile has remained quite similar with 2001 statistics placing it at 47.8% male and 52.3% female, and 2007 statistics showing it to be exactly 48% male and 52% female (Figure 33). The ULM is predominantly made up of Black African, followed by Coloured, then White, and finally a small Indian/Asian community.

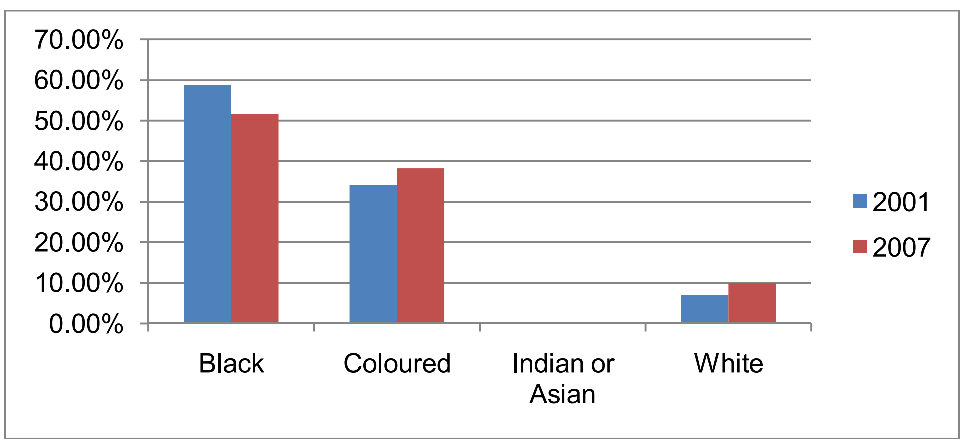

Figure 33: Racial profile of ULM – 2001 vs. 2007 (Census 2001 & CS 2007).

As regards age distributions in ULM, it is perhaps pertinent to compare 2001 data with that of 2007 in order to track chronological changes which may have occurred. Figure 34 illustrates this.

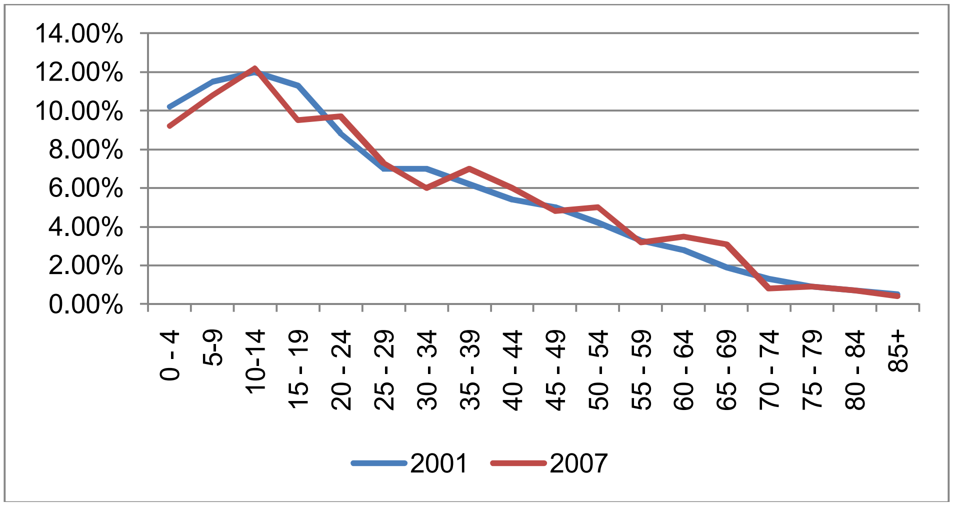

Figure 34: Age profile for ULM – 2001 vs. 2007 as a percentage of population (Census 2001 & CS 2007).

For a more detailed analysis on the race, age and gender of the community, please refer to the Socio-economic Specialist Study in Appendix 6.

- Housing & Household Status

The number of households in the ULM decreased from 2001 to 2007 by some 333 homes, a figure congruent with the population decrease mentioned above. Table 12 below shows this trend and indicated that the ULM suffered a greater household decline than the province or the district.

Table 12: Number of households in ULM – 2001 vs. 2007 (Sources: Census 2001 & CS 2007).

	Number of Households	
Area	**Census 2001**	**Community Survey 2007**
Northern Cape Province	259 611	262 887
Pixley Ka Seme District	41 915	43 235
Umsobomvu Local Municipality	5 909	5 576

Figure 35 below shows the proportion of formal to informal dwellings in the ULM in 2007 and 2001.

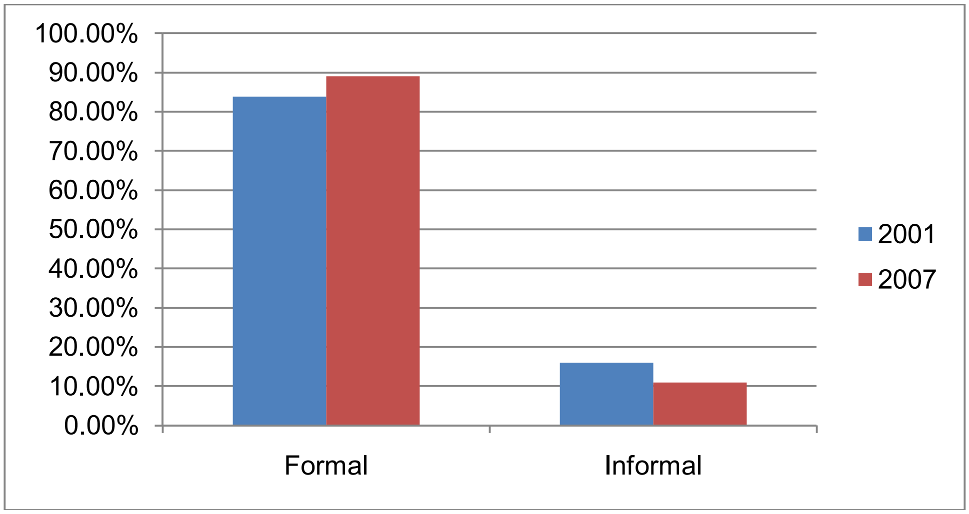

Figure 35: Proportion of formal: informal dwellings in ULM – 2001 vs. 2007 (Sources: Census 2001 & CS 2007).

8.13.3 Economic Processes

This section will focus on levels of education, employment levels, skills, income distributions, and access to and usage of social grant services.

- Levels of Education

Education is an all-important indicator for the ULM as it is linked to skills, income, and potential macro-economic contributions. Although there has been a reduction in the percentage of people who had no schooling between 2001 and 2007 by 6%, fewer people had completed primary or high school in 2007 and fewer residents had higher tertiary education degrees. The only other major positive outcome was the number of people who had attained certificates/diploma. Figure 36 below provides a breakdown of education levels for those aged 20 and above in ULM.

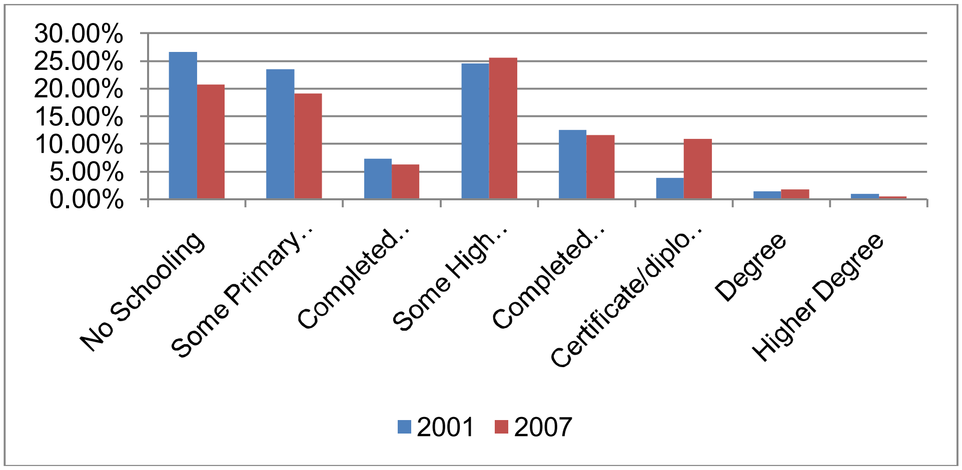

Figure 36: Education levels in ULM for those aged 20+ (Sources: Census 2001 & CS 2007).

- Skill Levels

Skill levels are quite low in the ULM, a fact shown by the occupations held by the residents in 2007. While the distribution of persons involved in the first 8 categories of Table 13 (below) would show that there are few extreme discrepancies in occupational involvements, it is the 9th category (elementary occupations) that reveals the low level of skills locally. Almost a quarter of all employed people in the ULM were involved in elementary occupations in 2007, a factor which is congruent with the education profiles shown above. With education levels being low, skills attainment is directly affected such that a large number of people are left to be involved in elementary occupations.

Table 13: Skill levels in ULM as a % of 2007 population (CS 2007).

Level/Type of Skill	**% of Population in 2007**
Legislators, senior officials, managers	12%
Professionals	15%
Technicians & associated professionals	6.4%
Clerks	8.4%
Service workers, shop, and sales workers	11.6%
Skilled agricultural and fishery workers	7.9%
Craft & related trades workers	10.9%
Plant and machine operators & assemblers	4.5%
Elementary occupations	23.2%

- Employment

The local employment statistics act as a follow on from the skills and education levels discussed above. In line with those figures employment remains low in the ULM, although certain increases and improvements can be seen from 2001. Overall, there were more employed people, fewer unemployed people and slightly more economically inactive people.

Table 14: Official employment status in ULM, PDM, and the Northern Cape (Census 2001 & CS 2007).

	ULM		**Pixley DM**		**N. Cape**	
	2001	2007	2001	2007	2001	2007
Employed	28.9%	33.7%	36.10%	38.30%	35.60%	40.30%
Unemployed	31.1%	24.7%	21.20%	21.60%	19.70%	18.10%
Not economically active	40%	41.4%	42.60%	40.10%	44.70%	41.60%

By gender, 40% of all males were employed, while only 27.8% of all females were employed.

Of those people who are formally employed Table 15 shows the particular industries which provide that employment, as these figures will provide insight into the micro- and macro-economic sectors of significance.

Table 15: % of employed people in ULM working in each local industry in 2007 (Source: CS 2007).

Industry	**% of working population in this industry**
Agriculture, hunting, forestry, fishing	**25.4%**
Mining & quarrying	**0%**
Manufacturing	**8.6%**
Electricity, gas, and water supply	**1.1%**
Construction	**8.5%**
Wholesale & retail trade	**16.5%**
Transport, storage & communication	**4.2%**
Financial, insurance, real estate, and business related	**10.1%**
Community, social, personal services	**25.%**

For a more detailed analysis on the employment status of the community, please refer to the Socio-economic Specialist Study in Appendix 6.

- Income Levels

Figure 37 shows that the PDM and ULM are closely matched as regards the higher income categories although not on the lower levels. The ULM shows that it has a greater proportion of people with no income and a greater proportion of people in the two lowest income categories than its district. While the PDM is a poor district it may be said that ULM is a very poor LM within PDM.

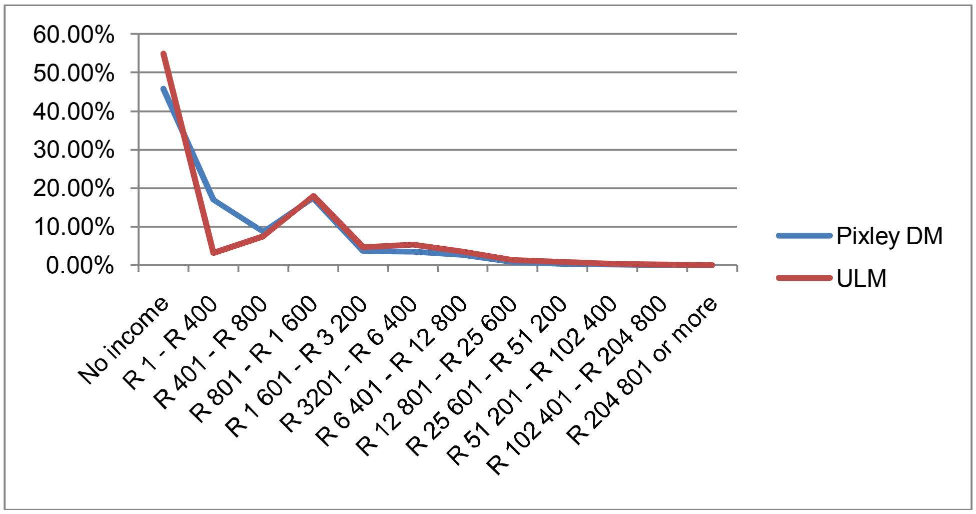

Figure 37: Monthly income per person in ULM and PDM in 2007 (Source: CS 2007).

For a more detailed analysis on the income levels of the community, please refer to the Socio-economic Specialist Study in Appendix 6.

A better indicator of income levels, and possible poverty, is household income. In the developing world this statistic is often more revealing as people frequently assist relatives who may be indigent, disabled, or economically inactive but who live within the same dwelling. As was mentioned previously, the dependency ratio locally is high. The Census of 2001 provides the most comprehensive data regarding annual household income, summarised in Table 16.

Table 16: Household income in ULM in 2001 per month (Source: Census 2001).

Income increment (Annual)	% of households within annual income category
No income	19.70%
R 1 – R 400	9.80%
R 401 – R 800	27.40%
R 801 – R 1600	20.20%
R 1601 – R 3200	11.20%
R 3201 – R 6400	6.20%
R 6401 – R 12800	3.40%
R 12801 – R 25600	1.50%
R 25601 – R 51200	0.40%
R 51201 – R 102400	0.20%
R 102401 – R 204800	0.10%
R 204801 or more	0.01%

For a more detailed analysis on the household income status of the community, please refer to the Socio-economic Specialist Study in Appendix 6.

8.13.4 Institutional & Legal Processes

Institutional and Legal processes refer to the role and efficiency of the local authority and other service providers in the area in terms of their capacity to deliver a quality and uninterrupted service to local communities.

This section focuses on service availability and service delivery, i.e. access to water and lighting, sanitation conditions, waste removal services and so on. The main focus here is on the Umsobomvu Local Municipality, although reference will be made to the PDM IDP (2010/2011).

- Water & Sanitation

In 2007 a total of 95.8% of people received piped water and 86.6% of them did so from an access point within the dwelling or the yard (Figure 38).

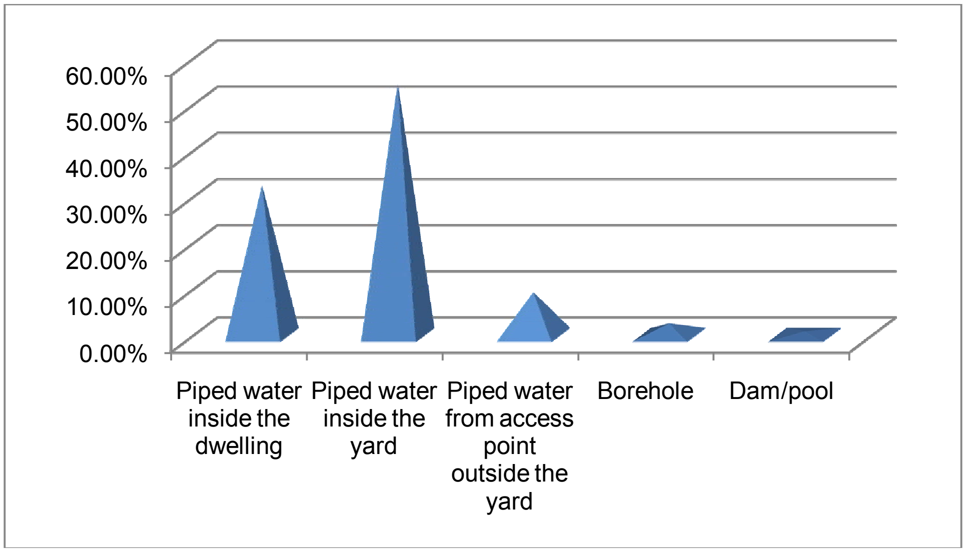

Figure 38: Water access by household in 2007 (CS 2007).

A better depth view of water access levels is provided by Table 17 which shows water access levels in 2001 and 2007 (in ULM, PDM & The Northern Cape) in line with RDP standard. RDP standard maintains that individuals must have access to piped water no further than 200m from the dwelling.

Table 17: Access to water in ULM, PDM and The Northern Cape regarding RDP standard in 2001 and 2007 (Census 2001 & CS 2007).

Water Access in ULM, PDM, & Northern Cape (2001 & 2007)						
RDP Standard	2001 ULM	2007 ULM	2001 PDM	2007 PDM	2001 N. Cape	2007 N. Cape
Above RDP	89%	86.6%	89.8%	95.8%	82.5%	80.8%
Below RDP	11%	13.4%	10.1%	4.2%	16.5%	19.2%

For a more detailed analysis on the status of water accessibility of the ULM, PDM and Northern Cape, please refer to the Socio-economic Specialist Study in Appendix 6.

Table 18 below outlines the state of sanitation facilities in ULM, PDM, and The Northern Cape and once again does so according to RDP standard. RDP standard states that all persons should have access to at least a VIP system with ventilation.

Table 18: Sanitation levels in ULM, PDM, and The Northern Cape (Sources: Census 2001 & CS 2007).

Sanitation in ULM, PDM, & Northern Cape (2001 & 2007)						
RDP Standard	2001 ULM	2007 ULM	2001 PDM	2007 PDM	2001 N. Cape	2007 N. Cape
Above RDP	54%	84.2%	67.5%	82.5%	76.7%	87.7%
Below RDP	46%	15.8%	32.5%	17.5%	23.3%	12.3%

For a more detailed analysis on the status of sanitation of the ULM and PDM, please refer to the Socio-economic Specialist Study in Appendix 6.

- Refuse Removal

Refuse removal is a vital part of modern day human settlements as it is important to remove waste products in order to prevent disease, maintain hygiene levels, avoid various forms of vermin, and uphold the aesthetics of the region (Figure 39). In 2007 81.9% of all refuse was collected and removed by authorities/private companies at least once a week. Only 1.4% of all people had no refuse removal whatsoever.

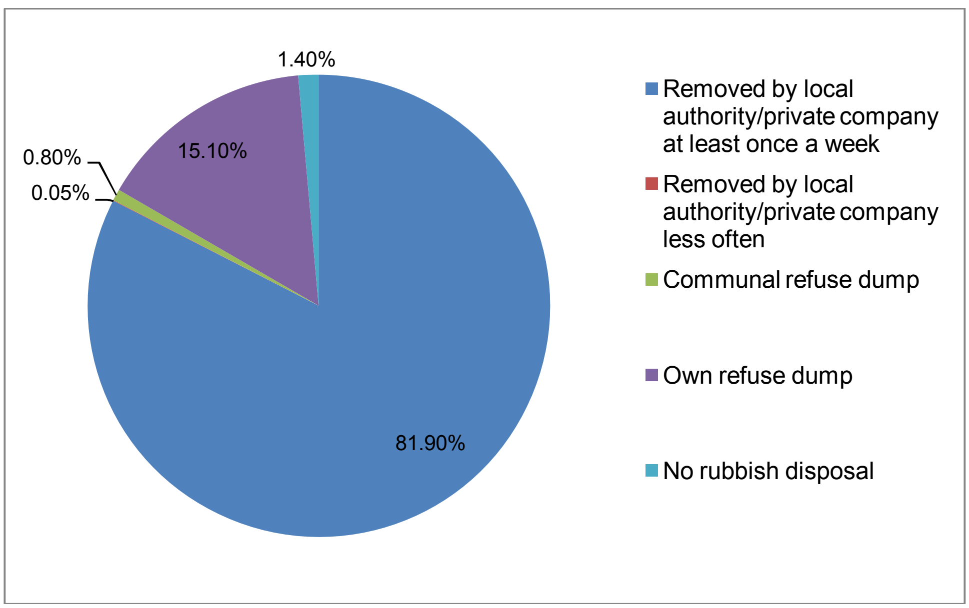

Figure 39: Refuse removal in ULM in 2007 (CS 2007).

- Energy Usage & Sources

In this section we will begin with an analysis of the proportion of people who are using electricity as an energy source for three basic functions – lighting, cooking, and heating. ULM's residents made greater use of electricity as an energy source for these 3 main functions in 2007 than in 2001. The biggest increase was for cooking as a 23.5% increase was witnessed. Electricity usage for lighting increased to a respectable 85.2% of residents, while the statistics for heating stagnated. This information is summarised in Table 19.

Table 19: Proportion of people in ULM using electricity for lighting, cooking, and heating in 2001 & 2007 (Sources: Census 2001 & CS 2007).

Region	Lighting		Cooking		Heating	
	2001	**2007**	**2001**	**2007**	**2001**	**2007**
ULM	80%	85.2%	45.3%	68.8%	41.3%	41.5%
PDM	75.4%	87.4%	55.4%	78%	46.1%	59.4%
N. Cape	73.3%	86.8%	55.4%	77.4%	50.8%	66.4%

- Social Infrastructure

The following sub-sections focus on the status of educational infrastructure (Table 20), health infrastructure (Table 21), emergency safety and security infrastructure (Table 22) and crime statistics (Table 23). For a more detailed analysis on the aforementioned criteria, please refer to the Socio-economic Specialist Study in Appendix 6.

  - Educational Infrastructure

Table 20: Education facilities in ULM

Education in ULM	
Facility	**Numbers**
Primary Schools	3
Secondary Schools	2
Combined Schools	2
Universities	None
Technical universities	None
Adult learning centres	None Listed

- Health Infrastructure

Table.21: Health facilities in ULM

Health in ULM	
Facility	Numbers
Hospitals – Manne Dipico Hospital; Noupoort Hospital.	2
Healthcare Clinics – Love Life Centre AIDS Clinic; Public Clinic (Noupoort); Chumani Rehabilitation Centre.	3

- Emergency, Safety & Security Infrastructure

Table 22: Emergency, safety and security infrastructure in ULM

Emergency, Safety & Security Infrastructure		
Type	**Number**	**Location**
Fire Brigade	1	Colesberg
Police Stations & Prisons	4 Police Stations; 1 correctional facility	Noupoort; Colesberg; Kuyasa; Norvalspont. 1 correctional facility in Colesberg.
Traffic Police	1	Colesberg traffic department, testing station, and traffic police.

- Crime Statistics

The crime statistics provided below (Table 23) have been sourced from the SAPS official statistics per police station, with raw numbers of crimes being added to provide information on the number of crimes over a 7 year period. All information, per applicable Umsobomvu Local Municipality police station, has been sourced from official SAPS statistics[3].

Two major issues have been outlined in the PDM IDP of 2010/2011, i.e. high levels of family and child abuse, and the high level of alcohol abuse.

[3] http://www.saps.gov.za/statistics/reports/crimestats/2010/provinces/n_cape/northern_cape.htm.

Table 23: Crime statistics in Noupoort over a 7 year period

Crime in Noupoort	No of Crimes between 2003/04 and 2009/10	Relevant Trend
Contact Crimes		
Murder	18	Relatively Stable
Sexual Crimes	99	Erratic
Attempted Murder	5	N/A
Assault-attempt to do grievous bodily harm	616	Relatively Stable
Common Assault	438	Declining
Common Robbery	47	Erratic
Robbery with Aggravating Circumstances	10	Relatively stable
Contact-related Crime		
Arson	11	Declining
Malicious damage to property	218	Relatively Stable
Property-related Crime		
Burglary	462	Recent Increase
Theft of Motor Vehicle	5	N/A
Stock Theft	155	Declining
Crime heavily dependent on police action for detection		
Illegal possession of fire arms & ammunition	6	N/A
Drug-related crime	70	Declining
Driving under the influence of alcohol/drugs	12	Erratic
Other serious crime		
Other theft	391	Relatively Stable
Commercial Crime	19	Erratic
Shoplifting	23	Relatively Stable
Subcategories of aggravated robbery		
Hijacking	0	N/A
Robbery at residential Premises	1	N/A
Robbery at non-residential premises	1	N/A
Other crimes		
Culpable homicide	12	Relatively

Crime in Noupoort	**No of Crimes between 2003/04 and 2009/10**	**Relevant Trend**
		Stable
Public violence	2	N/A
Crimen injuria	23	Relatively Stable
Neglect and ill-treatment of children	7	N/A
Kidnapping	3	N/A

In Noupoort only burglary appears to be increasing significantly, with the most prevalent crimes being assaults, damage to property, burglary and general theft. A good number of crimes are declining and several others are almost non-existent (a good sign) but it is mostly assault and thefts which have to be tackled over all other offences. What must be borne in mind for Mainstream and any incoming construction teams and contractors is that exacerbating the local substance abuse problems (as mentioned by authorities and evidenced by crime statistics) must be avoided at all costs. Furthermore, awareness of theft and vandalism, as well as implementing appropriate avoidance and security measures against these, is recommended.

8.13.5 Socio-Cultural Processes

Socio-cultural processes relate to the way in which humans behave, interact and relate to each other and their environment, as well as the belief and value systems which guide these interactions.

The closest town to the wind farm site is Noupoort. For this reason Noupoort will receive particular historical attention in this baseline, while the Local Municipality will also be focused upon in terms of contemporary human factors.

- Noupoort

Noupoort can be found 53km southeast of Colesberg and 55km southwest of Hanover. "It is a town which revolved principally around the railways and is still used as traction change-over facility from diesel to electric locomotives on the Noupoort-Bloemfontein line. It was serviced by Midlandia, a locomotive complex a few kilometers to the south of town, especially during the diesel era up to the late 1900s. Nowadays it links up with the electric line to De Aar, part of the main artery for iron ore and manganese exports from the Northern Cape through Port Elizabeth Harbour on the south coast"[4].

[4] http://en.wikipedia.org/wiki/Noupoort

“In 1881 the railway line from Port Elizabeth ended on the farm Carlton. With the diversion of the railway line to Colesberg in 1882/4 a station was built on part of the farm Hartebeeshoek of Mr Barend Kruger. The station was named Naauwpoort after the adjacent farm. In 1963 the name was changed to Noupoort”[5].

In addition Noupoort was the site of a large engagement during the Anglo-Boer War. Particularly on the 21st May 1901, while the most idiosyncratic of all of the blockhouses from that era is to be found in the town (Chronology of the Boer War).

- The People of Umsobomvu

As has been noted previously in this baseline profile, the people of ULM are predominantly of the Coloured (40%) and Black/African (50%) racial groups while the common spoken languages are Afrikaans (77%) and IsiXhosa (17%). For a detailed description of the historical baseline of these racial groups please refer to the Socio-economic specialist study in Appendix 6.

9 PUBLIC PARTICIPATION PROCESS

Public participation is the cornerstone of any EIA. The principles of NEMA as well as the EIA Regulations govern the EIA process, including public participation. The Public Participation Process (PPP) for the proposed development has been conducted according to Guideline 4 of the EIA Regulations. These guidelines include the provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment. The guidelines also ensure the participation of previously disadvantaged people, women and the youth.

The public participation process is primarily based on two factors. Firstly, ongoing interaction with the environmental specialists and the technical teams are required in order to achieve integration of technical assessment and public participation throughout. Secondly, public participation is conducted to obtain the bulk of the issues to be addressed early on in the process, with the latter half of the process designed to provide environmental and technical evaluation of these issues. These findings are presented to stakeholders for verification. Any issues raised in relation to the findings are then captured and made available for further comment.

Input into the public participation process by members of the public and stakeholders can be given at various stages of the EIA process. Registration on the project can take place at any time during the EIA process up until the final EIA report is submitted to DEA. There are however set periods in which comments are required from Interested and / or Affected Parties (I&APs) in order

[5] http://www.northerncape.org.za/getting_around/towns/Noupoort/

to ensure that these are captured in time for the submission of the various reports. The comment periods during the EIA phase will be implemented according to Guideline 4 of the NEMA (107/1998), Environmental Impact Assessment Regulations in terms of section 24(5).

The EIA regulations emphasise the importance of public participation. In terms of the EIA regulations, registered interested and/or affected parties –

- may participate in the application process;
- may comment on any written communication submitted to the competent authority by the applicant or environmental consultant;
- must comment within the timeframes as stipulated by the EIA Regulations;
- must send a copy of any comments to the applicant or Environmental Assessment Practitioner (EAP) if the comments were submitted directly to the competent authority; and
- Must disclose any direct business, financial, personal or other interests that the person has in the application being granted or refused.

The following actions were taken upon receiving comments/ queries/ issues:

- The contact details provided were entered into the project database for use in future notifications.
- Confirmation of receipt of comments.
- Addressed comments in the Issues & Response Report.

9.1 Overview of the Public Participation Process to date

The public participation process that was followed during the Scoping Phase of the project was initiated on the 12th August 2011. The stages that formed part of the public participation process to date (Scoping Phase)for this proposed project are reflected in the Figure 40 below:

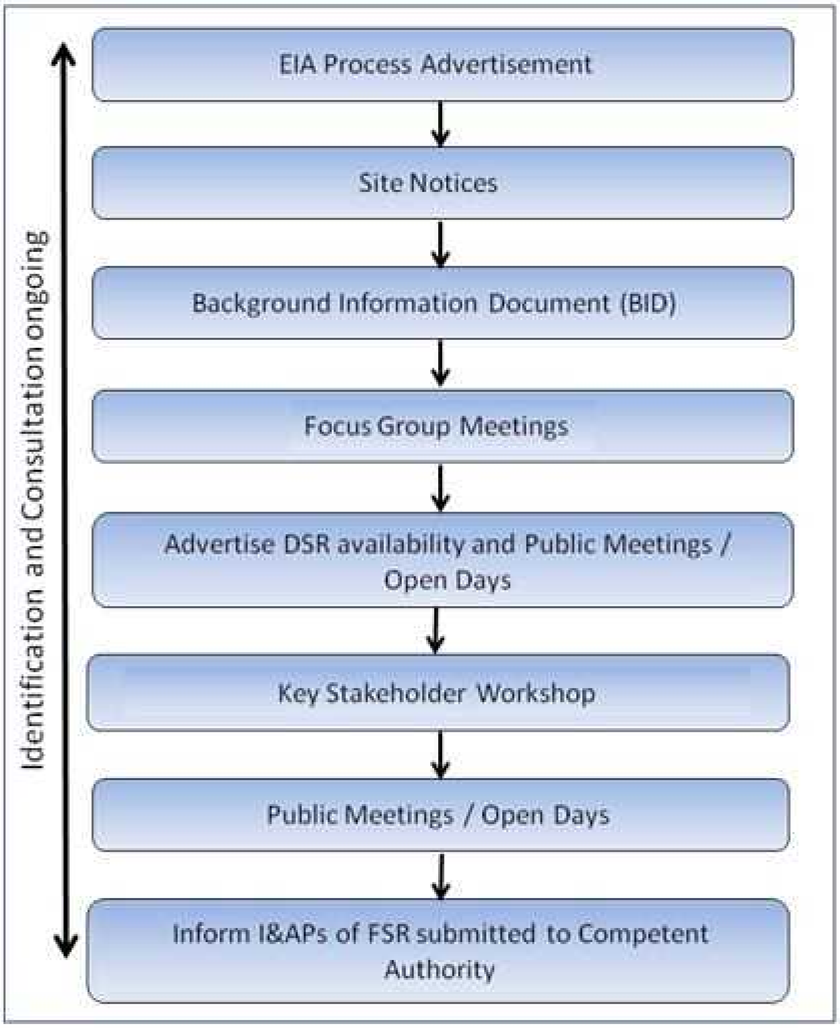

Figure 40: Public Participation Process

Members of the public who wished to be registered on the database as an I&AP were able to do so via telephone, fax, email, mail or SiVEST's website (www.sivest.co.za).

On-going consultation with key stakeholders (e.g. provincial, district and local authorities, relevant government departments, local business etc.) and identified surrounding landowners (Figure 41) and I&APs ensured that I&APs were kept informed regarding the EIA process. Networking with I&APs effectively continued throughout the scoping phase of the project until the Final Scoping Report and EIA Plan of Study was submitted to DEA. Where required, stakeholders and I&APs were engaged on an individual basis.

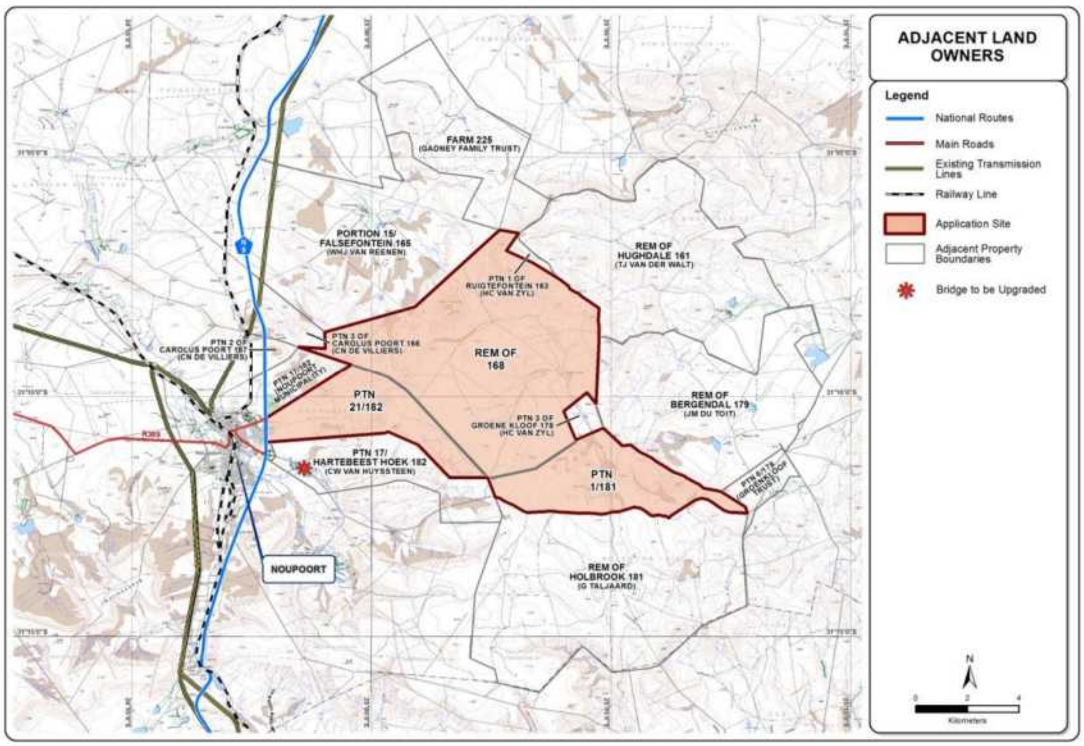

Figure 41: Surrounding landowners map.

During the environmental studies, consultations were held with individuals, businesses, institutions and organisations, and the following sectors of society have been identified and were afforded the opportunity to comment (the full stakeholder database list is included in Appendix 5):

- National Authorities
- Provincial Authorities
- Pixley ka Seme District Municipality
- Umsobomvu Local Municipality
- Government Structures such as SAHRA, SANRAL, Telkom, etc
- Agriculture Associations

- Regional and local media (advertisements and public documents e.g. BID)
- Business and commerce
- Environmental bodies / NGOs
- Community representatives, CBOs, development bodies
- Landowners

After the specialist studies were completed, comments from all I&APs were integrated into the Final Scoping Report which was submitted to the DEA. Approval of the Final Scoping Report and Plan of Study was received on the 21st February 2012.

Continuation of the EIA phase was therefore undertaken after receipt of the approval of the Final Scoping Report and Plan of Study. The EIA phase round of specialist studies commenced during which consultation with the public continued. The activities undertaken in the EIA phase include the following:

9.2 Consultation and Public Involvement

As in the scoping phase, telephonic discussions and focus group meetings were held with key stakeholders and other relevant I&APs in order to identify key issues, needs and priorities for input into the proposed project for the EIA phase. Special attention was given to the consultation with possibly affected landowners and communities within the study area to try and address their main concerns.

An advertisement was placed in the Graaff Reniet Advertiser (in English and Afrikaans) on the 2nd March 2012 to advertise the public meeting and availability of the Draft Environmental Impact Report and notification of the public review and comments period (Appendix 5B). The venues where the DEIR was available are shown in Table 24.

Table 24: Venues where DEIR could be accessed.

VENUE	STREET ADDRESS	HOURS	CONTACT NO
Noupoort Library	Shaw Street, Noupoort	Mondays – Fridays 10:00 – 16:30	049 843 1056
Middelburg Library	47 Van Reenen Street, Middelburg	Mondays – Fridays 09:00 – 16:30	049 842 1104 x 1389

Site notices were also placed within the town of Noupoort notifying the public of the public meeting and availability of the report. An Afrikaans executive summary has also been provided (Appendix 5A).

9.3 Proof of Notification

Appendix 5 includes all the proofs of notification and correspondence with Interested and Affected Parties:

- Public Meeting and Draft Environmental Impact Report (DEIR) poster text (Appendix 5A);
- EIA Newsletter (Appendix 5B);
- Proof of advertisements in the newspapers (Appendix 5C); and
- Correspondence to and from registered I&APs and key stakeholders (Appendix 5D).

9.4 Focus Group Meetings

The South African SKA was notified of the proposed project, provided with the opportunity to comment on the project and a meeting was held with SiVEST, the project proponent and the South African SKA on Friday 14th October 2011.

During the scoping phase (17 November 2011) comments were received from the Southern African SKA, noting that a high-level impact assessment of the proposed construction of a wind farm on SKA stations located nearest the proposed site was to be undertaken. This was undertaken and addressed in the specialist visual impact assessment report in Appendix 6F.

Three Focus Group Meetings (FGM) were arranged for March 2012, during the review period of the DEIR. FGMs are smaller meetings with specific groups or organisations who have similar interests in or concerns about the project. The details pertaining to the focus group meetings are listed in Table 25 below.

Table 25: Focus Group meetings

Venue	Interested Parties	Date	Time
AGS Church Hall	Representatives from Residents Association, Local Business Community, Noupoort Christian Care Centre	Monday 19 March 2012	17:00 to 19:00
Public Library, Committee Room, 21A Church Street Colseburg	Municipal Manager, Officials and Councillors of Umsobomvu Local	Monday 19 March 2012	14:00 – 15:00

Venue	Interested Parties	Date	Time
	Municipality		
Boardroom, Pixley Ka Seme, Culvert Street, De Aar	Municipal Manager, Officials and Councillors of Pixley ka Seme District Municipality	Tuesday 20 March 2012	10:00 – 12:00

Minutes of these meetings were compiled and forwarded to all attendees (Appendix 5E). The primary aim of these meetings was to:

- disseminate information regarding the proposed development to I&APs;
- provide I&APs with an opportunity to interact with the EIA team and the Mainstream Renewable Energy representatives present;
- supply more information regarding the EIA process;
- answer questions regarding the project and the EIA process; and
- receive input regarding the public participation process and the proposed development.

9.5 Key Stakeholder Workshop

A Key Stakeholder Workshop was arranged for the 2nd April 2012 within the review period of the DEIR. The Key Stakeholder Workshop is to be held in order to provide commenting authorities and key stakeholders with additional information regarding the proposed development, to present the environmental findings of the impact-phase studies and to invite stakeholders to submit their comments on the EIR as well as to raise any further comments and/or concerns that they may have. Details pertaining to the Key Stakeholder Workshop are provided in Table 26 below.

Table 26: Key Stakeholder Workshop

Venue	Date	Time
La Casa Mia 27A Carters Road, Hadison Park Kimberley	2nd April 2012	10:00am to 12:00am

The key stakeholders that were invited to the Key Stakeholder Workshop are contained in Table 27.

Table 27: List of Key Stakeholders invited to the Key Stakeholder Workshop

Name	Organisation
Mr Abrahams	Dept of Water Affairs: Northern Cape

Ms. Ah Shene-Verdoorn	Birdlife South Africa
Ms. Anderson	WESSA: Northern Cape
Mr. Auret	Namakwa District Municipality
Ms. Bester	Telkom
Mr. Botes	Dept of Environment & Nature Conservation
Mr. Bruiners	Telkom SA (Ltd)
Mr. Cloete	Transnet Freight Rail
Mrs. Collett	Dept of Agriculture, Forestry & Fisheries
Mr. Crous	Namakwa District Municipality
Ms. De Kock	SANRAL: Western Region
Mr. Diokpala	Pixley Ka Seme District Municipality
Mr. Fiff	Transnet
Mr. Fortuin	Namakwa Distrik Munisipaliteit
Ms. Galimberi	SAHRA: Head Office
Mr. Gibbons	EWT: African Crane Conservation Programme
Mr. Gopichund	ATNS
Mr. Gresse	Transnet Rail Freight (Iron Ore Line)
Mr. Herrmann	Dept of Environment & Nature Conservation
Mr. Isherwood	SA Civil Aviation Authority
Mrs. Kibi	Pixley Ka Seme District Municipality
Mr. Koen	Dept of Environment & Nature Conservation
Mr. Leask	Eskom
Mr. Loubser	Namakwa District Municipality
Mr. Maccollan	Pixley Ka Seme District Municipality
Mr. Molefe	Pixley Ka Seme District Municipality
Mr. Mutyorauta	Dept of Environment & Nature Conservation
Mr. Schoeman	Transnet Freight Rail
Mr. Shaw	Telkom
Mr. Sinthumule	Dept of Heritage: Northern Cape Province
Mr. Snyders	Dept of Water Affairs: Northern Cape Province
Ms. Stroh	SA Civil Aviation Authority
Dr. Tiplady	Square Kilometre Array
Mr. Van Schalkwyk	ATNS
Mr. Woolf	Alkantpan

The draft minutes from the Key Stakeholder Workshop were compiled and forwarded to all attendees and are included in the FEIR for submission to the Competent Authority (Appendix 5G).

9.6 Public Meeting

A Public Meeting was held during the review period of the DEIR. The meeting took take place on the 20th March 2012. Details pertaining to the Public Meeting are provided in Table 28 below.

Table 28: Public Meeting / Open Day

Venue	Date	Time
JJ Claasen Community Hall, Protea Street, Eurekaville, Noupoort	Tuesday 20 March 2012	18:00 - 20:00

This meeting was advertised in the Graaff Reniet Advertiser on the 2nd March 2012 and invitation letters were also sent via postal service and e-mail to all registered I&APs on the project's database.

Furthermore, posters advertising the Public Meeting were displayed at the public venues (as advertised) as well as various public places frequented by the public i.e. hotel, cafés etc. Proof of the poster are included in Appendix 5A.

The Public Meeting was held in order to provide I&APs with information regarding the proposed development, present the impact phase environmental findings and invite I&APs to raise any further comments and/or concerns that they may have.

Draft minutes of this meeting were compiled and forwarded to all attendees and the minutes have been included in the FEIR for submission to the Decision making Authority (Appendix 5G).

9.7 Public review of Environmental Impact Report

The DEIR was made available for review, for a period of 30 days as required by legislation, at the following venues from 2 March 2012 to the 2 April 2012:

- Noupoort Library
- Middelburg Library

Table 29: Venues where Draft Environmental Impact Report was made be publically available.

Venue	Street Address	Hours	Contact No.
Noupoort Library	Shaw Street, Noupoort	Mon – Friday 10:00 – 16:30	049 843 1056
Middelburg Library	47 Van Reenen Street, Middelburg	Mondays – Fridays 09:00 – 16:30	049 842 1104 x 1389

All comments received on this report were incorporated into the Issues and Response Report which is attached in Appendix 5D in the FEIR.

The following stakeholders identified in Table 30 were sent copies of the report and a round of telephone calls was undertaken between March and April 2012 to determine if comments would be received.

Table 30: Authorities follow up consultation

Representative	Department	Response
Ms. Ah Shene-Verdoorn	Birdlife South Africa	No official comment received.
Ms. Anderson	WESSA: Northern Cape	No official comment received.
Mr. Cloete	Transnet Freight Rail	See Appendix 5C.
Mrs. Collett	Dept of Agriculture, Forestry & Fisheries	See Appendix 5C.
Ms. De Kock	SANRAL: Western Region	No official comment received.
Mr. Fiff	Transnet	No official comment received.
Ms. Galimberi	SAHRA: Head Office	Via email. No official response received after official public review period. See Appendix 5C
Mr. Gibbons	EWT: African Crane Conservation Programme	See Appendix 5C.
Mr. Gopichund	ATNS	No official comment received.
Mr. Isherwood	SA Civil Aviation Authority	Approval received from SA CAA (attached in appendix 5C)
Mr. Koen	Dept of Environment & Nature Conservation	No official comment received.
Mr. Leask	Eskom	No official comment received.
Mr. Schoeman	Transnet Freight Rail	See Appendix 5C.
Mr. Sinthumule	Dept of Heritage: Northern Cape Province	No official comment received.
Mr. Snyders	Dept of Water Affairs: Northern Cape Province	See Appendix 5C.
Mr C Underwood	SA Civil Aviation Authority	CAA approval received (can be found in Appendix 5C)
Dr. Tiplady	Square Kilometre Array	No official comment received.

9.8 Issues and response report

Issues, comments and concerns raised during the public participation process are captured in the Issues and Response Report (I&RR) – Appendix 5E. The I&RR provides a summary of the issues raised, as well as responses which were provided to I&APs. The information was used to feed into the evaluation of all the specialist studies.

10 SPECIALIST STUDIES

The following specialist studies were undertaken as per the Plan of Study for EIA that was submitted to the DEA and which was accepted:

- Biodiversity (flora and fauna) Assessment (Liesl Koch – SiVEST)
- Avifauna Assessment (Chris van Rooyen)
- Bat Assessment (Werner Marais – Animalia)
- Surface Water Impact Assessment (Paul da Cruz – SiVEST)
- Agricultural Potential (Kurt Barichievy – SiVEST)
- Noise Impact Assessment (Morne de Jager – M^2)
- Visual Impact Assessment (Paul da Cruz – SiVEST)
- Heritage Assessment (Johnny van Schalkwyk)
- Palaeontological Assessment (John Almond – Naturaviva)
- Socio-economic Impact Assessment (Including tourism; Nonka Byker – MasterQ)

The findings of these studies are presented below.

10.1 Biodiversity (including Fauna and Flora)

10.1.1 Flora in the study area

A list of plant species including Red Data species (SANBI) can be found in the Biodiversity Specialist Report in Appendix 6.

The vegetation types in question have approximately 24 endemic species.

All vegetation noted on the site during site visits is included can be found in the Biodiversity Specialist Report.

According to Mucina *et al.* (2006), the proposed wind farm site in Noupoort falls within the following vegetation types: Karoo Escarpment Grassland; Tarkastad Montane Shrubland and Eastern Upper Karoo (Figure 42). While the Karoo Escarpment Grassland and Tarkastad Montane Shrubland are classified Grassland Biome, the Eastern Upper Karoo is classified under the Nama Karoo Biome (Mucina *et al.* 2006) (Figure 42). In terms of the conservation status, all vegetation types are considered Least Threatened (Mucina *et al.* (2006).

According to Esler *et al.* (2006), vegetation cover in the study area ranges from 20% to 40% which is relatively low compared to other parts of the country further east. Vegetation cover refers to the percentage of soil overshadowed by plants (Esler *et al.* 2006).

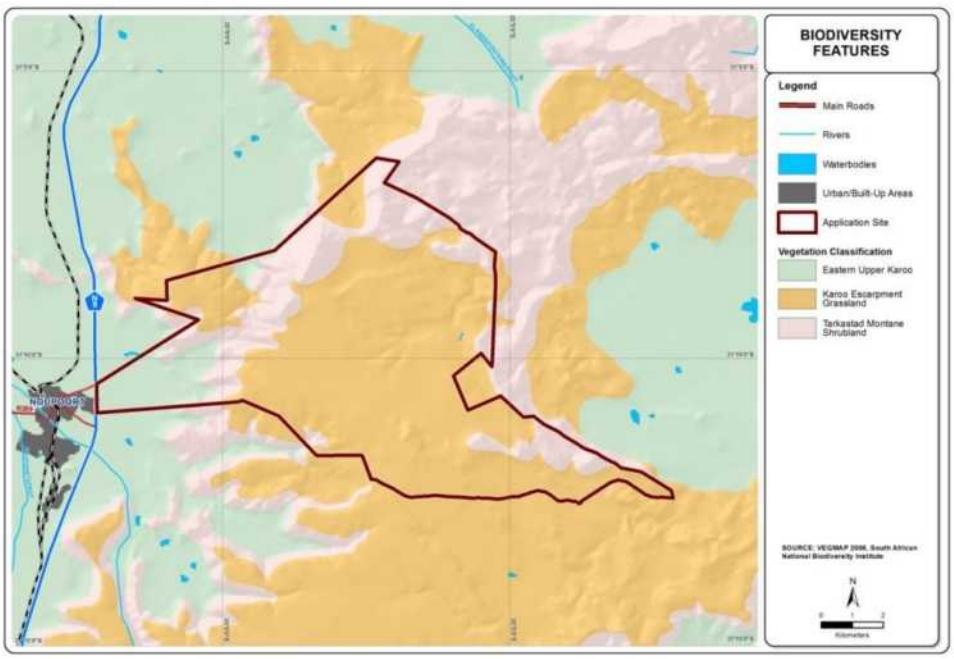

Figure 42: Vegetation of the study area

The Karoo Escarpment Grassland vegetation type is characterised by graminoids such as *Aristida congesta*, *Ehrharta calycina*, *Eragrostis chloromelas* and *Themeda triandra;* herbs such as *Berkheya pinnatifida*, *Dianthus caespitosus* and *Senecio asperulus;* Low shrubs such as *Chrysocoma ciliata*, *Elytropappus rhinocerotis* and *Erica caespitosa.* It is considered to be Least Threatened and only 3% is conserved in statutory conservation areas (Mucina *et al.* 2006).

The Tarkastad Montane Shrubland is characterised by succulent trees namely *Aloe ferox*; small trees such as *Acacia karroo* complex; tall shrubs such as *Diospyros austro-africana*; C*adaba aphylla* and *Ehretia rigida*; succulent shrubs namely *Lycium schizocalyx*, *Pachypodium succulentum* and *Sarcocaulon camdeboense*; graminoids such as *Aristida adscensionis* and

Eragrostis chloromelas; herbs including *Commelina africana* and *Hibiscus pusillus* among others. The vegetation type is considered Least Threatened and about 1-2% is conserved in statutory conservation areas (Mucina *et al.* 2006). Approximately 2% of the vegetation type is transformed for cultivation or building of dams (Mucina *et al.* 2006).

The Eastern Upper Karoo is characterised by tall shrubs namely *Lycium cinereum*, *L. horridum* and *L. oxycarpum*; low shrubs such as C*hrysocoma ciliata*, *Pentzia globosa* and *Felicia muricata*; succulent shrubs such as *Euphorbia hypogaea* and *Ruschia intricate*; Herbs namely *indigofera alternans, Pelargonium minimum* and *Tribulus terrestris*; graminoids which include *Aristida congesta*, *Cynodon incompletes* and *Eragrostis bergiana* (Mucina *et al.* 2006). This vegetation unit is also regarded Least Threatened (Mucina *et al.* 2006). Unspecified portions of the vegetation unit are conserved in statutory conservation areas (Mucina *et al.* 2006).

10.1.2 Floral environment

The floral survey undertaken during the scoping phase was further supplemented with fieldwork and more detailed study conducted in December 2011.

Several sample areas were randomly selected within the site and the following quantitative data was collected:

- Species present
- Dominant species
- Overall site status
- Ground cover

Searches were undertaken specifically for Red List plant species (according to SANBI 2006) and any other species with potential conservation value within the study area. Furthermore vegetation types and flora therein was identified through SANBI (Precis data) as well as Mucina and Rutherford 2006. Mucina and Rutherford (2006) was also used to describe the various vegetation units.

Exotic species categorised as alien invaders or weeds (as listed in amendments to Conservation of Agricultural Resources Act, 1983, Act No. 43 of 1983) were recorded where they were observed within the study site.

The presence of Critical Biodiversity Areas in terms of a Bioregional Plan was also investigated.

Table 31 below presents a list of endemic species in the study area.

Table 31: Endemic species documented within the study area

Species	Threat status	SA Endemic
Strumaria gemmata Ker Gawl.	LC	Yes
Heteromorpha arborescens (Spreng.) Cham. & Schltdl. var. arborescens	LC	Yes
Xysmalobium gomphocarpoides (E.Mey.) D.Dietr. var. gomphocarpoides	LC	Yes
Athanasia minuta (L.f.) Källersjö subsp. minuta	LC	Yes
Helichrysum pumilio (O.Hoffm.) Hilliard & B.L.Burtt subsp. pumilio	LC	Yes
Marasmodes undulata Compton	CR	Yes
Pentzia punctata Harv.	LC	Yes
Eumorphia dregeana DC.	LC	Yes
Helichrysum rutilans (L.) D.Don	LC	Yes
Lasiospermum pedunculare Lag.	LC	Yes
Osteospermum leptolobum (Harv.) Norl.	LC	Yes
Euphorbia caterviflora N.E.Br.	LC	Yes
Drimia macrantha (Baker) Baker	LC	Yes
Daubenya comata (Burch. ex Baker) J.C.Manning & A.van der Merwe	LC	Yes
Moraea crispa Thunb.	LC	Yes
Syringodea bifucata M.P.de Vos	LC	Yes
Hermannia pulverata Andrews	LC	Yes
Cynodon incompletus Nees	LC	Yes
Chaenostoma macrosiphon Schltr.	LC	Yes
Selago albida Choisy	LC	Yes
Selago dolosa Hilliard	LC	Yes
Selago glabrata Choisy	LC	Yes
Manulea plurirosulata Hilliard	LC	Yes
Gnidia wikstroemiana Meisn.	LC	Yes

In terms of GN 1187 published under the National Environmental Management: Biodiversity Act on the 23rd of February 2007 none of the species documented within the study area are considered to be protected in terms of this legislation.

A species which has been listed as Critically Endangered (Raimondo *et al*), *Marasmodes undulata Compton* has been recorded within the study area. Considering that Renosterbos (*Dicerothamnus rhinocerotis*) the presence of this species being present is possibly however unlikely. The species is extremely rare and was not noted on the site.

Very few exotic species were noted on the site. Those identified were located around the farmsteads that are present and areas closer to town. Essentially the areas located adjacent to anthropogenic activities. Species noted include *Populus nigra* var *italica.*

10.1.3 Fauna in the study area

The fieldwork component of this survey was conducted in December 2011.

Various sample areas (sites) were randomly selected in the study area based on varying habitat type in order to sample the small population.

The following faunal groupings were investigated:

- Mammals
- Reptiles
- Amphibians

Searches were undertaken specifically for Red data species and any other species with potential conservation value.

Potential species lists have been compiled with attention given to protected and endangered species in terms of the IUCN Red Data List.

The presence of Critical Biodiversity Areas in terms of a Bioregional Plan was also investigated.

- Mammals

Various mammal species are likely to occur within the study area. The list of mammals that are likely to occur in study area with the assigned level of threat facing each particular species can be found in the Biodiversity Specialist Report. A map was used to correlate the occurrence of the Red Data species with their approximate occurrence within the study area. According to Friedman & Daly, (2004), the majority of species within the study area are listed as species of least concern. Species such as the Black Rhinocerous *Diceros bicornis bicornis* which is listed as Critically Endangered, the Spotted-necked Otter *Lutra maculicollis* and Geoffroy's Horseshoe Bat *Rhinolophus clivosus* which are listed as Near Threatened have been recorded for the area. Larger mammal species are however not present due to the presence of a working cattle and sheep farm.

Faunal species across the site were noted to be diverse given the variety of habitats that are present. It is likely that the Spotted-necked Otter could be present on the site as evidence of otter activity was noted. Smaller mammal species were very active on the site, particularly in the more rocky areas. Evidence of porcupines (*Hystrix africaeaustralis*) was prominent across the site.

The mammal species of concern is the bats which are present within the area due to the risks of barotrama. A separate assessment has however been undertaken of this faunal grouping.

- Amphibians

According to Du Preez and Carruthers, (2009), all amphibian species previously recorded in the study area considered are Not Threatened (Table 32). The habitat for amphibian species is anticipated to be present along several drainage systems present within the study area. Although the mean annual rainfall of the study area is relatively low (i.e. approximately 357 mm), amphibian numbers are expected to be low. Various amphibian species and tadpoles were noted within the water bodies which were present within the study area. Several specimens of Common Platanna (*Xenopus laevis*) were noted throughout the site.

Table 32: Amphibian species in the study area

Scientific name	Common name	Category
Amietophrynus rangeri	Raucous Toad	Not threatened
Poyntonophrynus vertebralis	Southern Pygmy Toad	Not threatened
Vandijkophrynus gariepensis	Karoo Toad	Not threatened
Kassina senegalensis	Bubbling Kassina	Not threatened
Cacosternum boettgeri	Boettger’s Caco	Not threatened
Amietia fuscigula	Cape River Frog	Not threatened
Amietia angolensis	Common River Frog	Not threatened
Pyxicephalus adspersus	Giant Bullfrog	Near threatened
Xenopus laevis	Common Platanna	Not threatened
Tomopterna tandyi	Tandy's Sand Frog	Not threatened

- Reptiles

Several reptile species are present in the study area. Table 33 highlights these species (Branch 1998). According to the current Red Data information, none of these species are currently Red Listed (McLachlan, 1978). The Red Data book is currently being updated.

The rocky areas present on the site provide ideal habitat for reptile species.

Table 33: Reptiles in the study area

Common name	Scientific name
Leopard Tortoise	*Geochelone pardalis*
Marsh or Helmeted Terrapin	*Pelomedusa subrufa*

Common name	Scientific name
Delalande's Beaked Blind Snake	*Rhinotyphlops lalandei*
Brown House Snake	*Lamprophis fuliginosis*
Spotted House Snake	*Lamprophis guttatus*
Cape Wolf Snake	*Lycophidion capense*
Mole snake	*Pseudoaspis cana*
Sundevall's Shovel-snout	*Prosymna sundevallii*
Spotted or Rhombic Skaapsteker	*Psammophylax rhombeatus*
Karoo Sand Snake or Whip Snake	*Psammophis notostictus*
Cross-marked or Montane Grass Snake	*Psammophis crucifer*
Common or Rhombic Egg Eater	*Dasypeltis scabra*
Herald or Red-lipped Snake	*Crotaphopeltis hotamboeia*
Coral Snake	*Aspidelaps lubricus*
Cape Cobra	*Naja nivea*
Puff adder	*Bitisarietansarietans*
Cape skink	*Mabuya capensis*
Burchell's Sand Lizard	*Pedioplanis burchelli*
Spotted Sand lizard	*Pedioplanis lineoocellata pulchella*
Cape Girdled Lizard	*Cordylus cordylus*
Rock or White-throated Monitor	*Varanus albigularis*
Karoo Girdled lizard	*Cordylus polyzonus*
Southern Rock Agama	*Agama atra*
Bibron's Thick-toed Gecko	*Pachydactylus bibronii*
Cape Thick-toed Gecko	*Pachydactylus capensis*
Marico Thick-toed Gecko	*Pachydactylus mariquensis mariquensis*

10.1.4 Sensitive areas

A negative mapping exercise was undertaken to determine where the turbines could be located without affecting the sensitive biodiversity of the site.

It was determined that the rocky outcrops and cliffs on the site are sensitive as species diversity (both floral and faunal) in these areas is greater than the surrounding areas.

In addition the wetlands and drainage areas on the site have been determined to be sensitive as these areas provide unique habitat for floral species as well as several amphibian species. Species from surrounding areas also depend on these areas as a food and water source.

The placement of turbines in the mountainous areas would have a significantly greater impact than on flatter areas. The development of access roads to turbine positions would require cutting into the mountain sides resulting in an increase in erosion risks in these areas as well as affecting the sense of place that these mountainous areas provide. The total footprint of these turbines would thus be greater as roads will have to zigzagged up steep slopes whereas the shortest route can be used on the flatter areas. Mountainous areas surrounding the Noupoort site have thus been determined to be sensitive as these areas have not been affected by anthropogenic activities and thus represent pristine examples of the vegetation type. It is thus of national interest to protect these areas.

The map below highlights (Figure 43) these areas. It is recommended that no turbines and associated road infrastructure be placed within these areas.

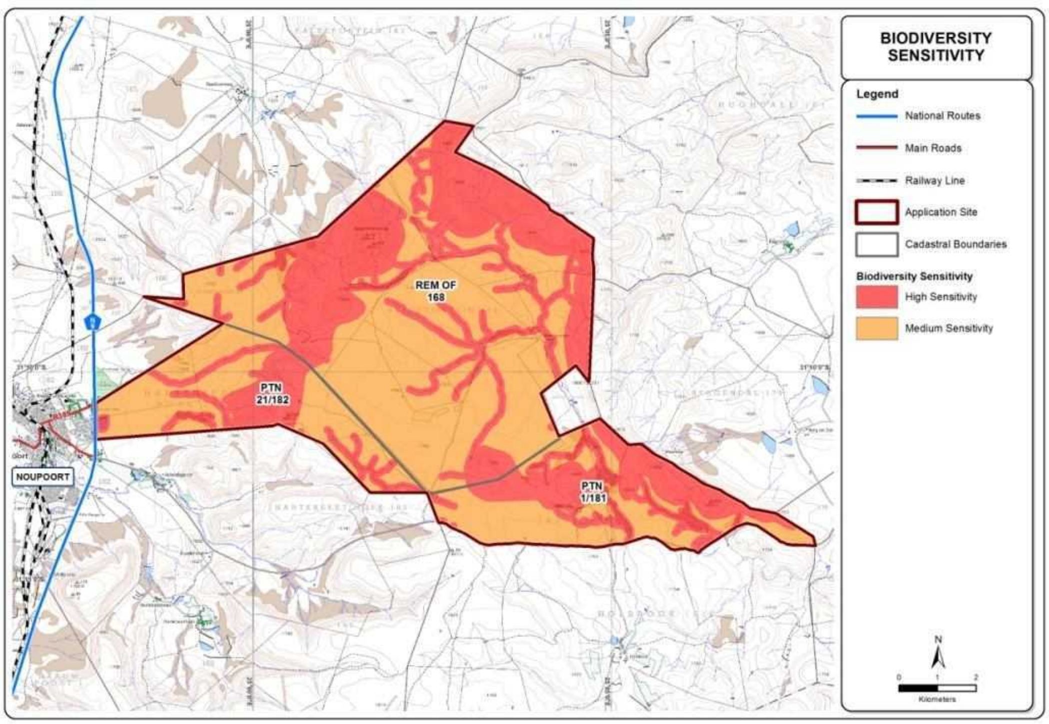

Figure 43: Sensitive areas

10.1.5 Potential Impacts of the Proposed Development During Construction

The potential impacts of the proposed development mainly related to loss of habitat for red data and general species; potential loss of species richness, edge effect and erosion. The impact of the proposed development will be limited to the turbine construction areas and the associated infrastructure such as roads. Surrounding vegetation will remain intact and will not be impacted upon. As such the impact is localised and if the mitigation measures are implemented, the overall impact can be reduced.

During the construction phase the following impacts are predicted in terms of each of the biodiversity groupings.

- Flora

A number of potential impacts could be associated with the proposed wind farm. The clearing for the wind farm and associated infrastructure is likely to result in loss of vegetation and more importantly natural vegetation. This can also result in habitat fragmentation due to loss of ecological linkages which may be present across the site. The clearing of vegetation could also result in the introduction of exotic species into the study area.

The impacts associated with the floral environment relate to the removal of vegetation and associated loss of habitat for endemic and Red Data species, particularly those which have been highlighted above. This could result in loss of species richness and increase the edge effect. The edge effect implies an increase of alien species into the area thus affecting the local species.

It is thus critical that the sensitive areas identified above are avoided during construction.

The construction of the wind turbines does not result in clearing of all vegetation i.e. a large amount of vegetation will remain between the turbines.

It is important that all the mitigation measures are implemented to reduce vegetation clearing and ensure no go areas are avoided.

- Mammals

The proposed wind farm could potentially result in the destruction of the habitat available for these species. The impact of the turbines is likely to be higher during construction as displacement will occur as a result of foundations and road construction.

The mountainous areas provide habitat for a wide diversity of mammal species, particularly the smaller species due to the diversity of habitat type in these areas. Building in these areas would thus have an adverse impact on the mammal population. These areas have thus been highlighted as no go zones.

- Reptiles

The proposed wind farm could potentially result in habitat destruction for these reptile species. The area has been determined to be rich in reptile species as these species adapt well to the arid environment. The impacts associated with reptiles relate, as with other faunal groupings, to habitat loss. Rocky areas on the site are ideal habitat for the majority of reptile species and construction in these areas would adversely impact the reptile species. Cumulatively however, a large amount of habitat surrounding the site is present into which these species can move during construction. These species will also be able to re-colonise the vegetation under the Wind turbines during operation.

- Amphibians

Construction within drainage lines would affect the amphibian population on the site as they depend on these species for breeding. These areas have thus been determined to be sensitive. Keeping construction out of wetlands and drainage areas would protect these breeding sites.

10.1.6 Potential Impacts of the Proposed Development During Operation

No significant impacts on vegetation and habitat are expected during the operation phase of the proposed development, as long as rehabilitation of the impacted surrounding areas has taken place.

10.2 Avi-fauna

10.2.1 Methodology

The investigation of potential impacts on birds caused by wind farms is a new field of study in South Africa, and has only been the focus of much attention since the middle of 2010. The concept of wind energy suddenly and rapidly gained momentum in South Africa in the latter part of 2010, resulting in a plethora of proposed wind farm applications which caught the ornithological community completely by surprise. The pace of new developments is such that both developers and specialist ornithological consultants struggled (and are still struggling) to come to grips with the enormity of the task ahead, namely to ensure that scientifically robust studies are implemented at all proposed development sites to assess the potential impact on avifauna. The basic approach to this study is to present findings and recommendations based on the knowledge which is currently available in a South African context, while acknowledging that there is still much to learn in this field. As the results of pre-and post-construction monitoring programmes which currently are being implemented become available, those results will be applied to future developments in order to predict with increasing confidence what the likely impact of a particular wind farm development will be on avifauna. At present it has to be acknowledged that there is much to be learnt and this situation is likely to continue for some time. In circumstances where there is uncertainty and the precautionary principle may be relevant, evidence, expert opinion, best practice guidance and professional judgement was applied to evaluate what is ornithologically likely to occur if the development is authorised.

Right at the onset it must be noted that pre-construction monitoring has commenced at the site, but will only be completed later in 2012. The conclusions in this report should therefore be viewed as preliminary. The conclusions of this report was supplemented by the results of the pre-construction monitoring programme which is currently available (i.e. one season of data), but the final results of the monitoring will only be available later in 2012 (see Jenkins et al. 2011).

10.2.2 Avifauna

To date, 121 species have been recorded by SABAP2 in 3125AA and 3124BB. Of these, 32 are included in the latest version of the BLSA list of priority species (Retief, 2011). At the turbine site and control site, 60 species have been recorded to date during the pre-construction monitoring programme, of which 17 are currently classed as priority species (the number is likely to grow as additional monitoring takes place in seasons to come). It is estimated that at least 89 species could potentially occur at the site. The priority species potentially occurring at the site can be broadly classified in four groupings namely large terrestrial species, soaring species, waterbirds and small birds:

- Large terrestrial species: Medium to large birds that spend most of the time foraging on the ground. They do not fly often and then generally short distances at low to medium altitude, usually powered flight. Some species undertake longer distance flights at higher altitudes, when commuting between foraging and roosting areas. At the wind farm site, cranes, bustards, francolins and Secretarybirds are included in this category.
- Soaring species: Species that spend a significant time on the wing in a variety of flight modes including soaring, kiting, hovering and gliding at medium to high altitudes. At the wind farm site, these are mostly raptors, but Blue Cranes and Secretarybirds are also included in this category.
- Waterbirds: These are species that are generally associated with aquatic habitats. At the wind farm site, these comprise mostly ducks and herons.

- Small birds: At the wind farm site these are mainly several species of passerines. These species generally spend most of the time on the ground or calling from perches, but display flights at medium height are also undertaken by some species, and swallows spend most of the time flying. Sandgrouse undertake long distance flights.

For the list of species that may potentially occur on the site, based on the results of the pre-construction monitoring and various other sources (SABAP1, SABAP2, Young *et al*. 2003, Young 2008, Young 2009a, Young 2009b, Young 2010a, Young 2010b, Hockey *et al*. 2007, personal observations, pre-construction monitoring), please refer to the Avi-faunal specialist report in Appendix 6.

10.2.3 Identification of Issues and Impacts

The effects of a wind farm on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present. With so many variables involved, the impacts of each wind farm must be assessed individually. Each of these potential effects can interact, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss causes a reduction in birds using an area which might then reduce the risk of collision). The principal areas of concern are:

- Mortality due to collision with the wind turbines (operation phase);
- Displacement due to disturbance (construction and operation phase);
- Habitat loss due to the footprint of the wind farm (construction and operation phase); and
- Mortalities due to collision with associated power line infrastructure (operation phase).

10.3 Bats

10.3.1 Methodology

The site was visited from the 14th to the 17th of December 2011. The site was inspected during the day for any possible roosting sites. At dusk and during the night, the sky was monitored for visual observation of bats and bat activity. Mist nets were erected at strategic positions of the farm for physical detection and identification of bat species present in the area. The main method of bat detection involved the use of a vehicle-mounted bat detector to record bat echolocation calls on a continuous basis throughout most of the night while traversing the study area. Only sections of the site that were accessible by vehicle were traversed. The direction of transects were reversed on consecutive nights to control for fluctuating bat activity patterns throughout the monitoring period.

10.3.2 Bat detection and roost scouting

A large number of bat calls were recorded during vehicle based monitoring within the site boundary (Figures 44). An abundance of roosting opportunities exist for both species of bats detected on site. Egyptian free-tailed bats (*Tadaridaaegyptiaca*) commonly roost in rock crevices and these were extremely common at the Noupoort site (Figures 45 & 46). Upon inspection of some of the rock crevices on site, bat faecal pellets were found, confirming their use by bats for roosting. The Cape serotine bat (*Neoromiciacapensis*) can also utilize rock crevices for roosting but are more commonly found roosting under the bark of trees and roofs of buildings.

Bat activity measurements may have been even higher if some of the inaccessible areas of the site could have been monitored. However, from the activity patterns recorded, it is safe to assume that all areas with rocky outcrops and rock crevices are areas of high bat activity and roosting space.

A bat call consists of a series of ultrasonic sound pulses, with each species calling at a characteristic sound frequency (Figure 47). It is used for navigational and hunting purposes, comparable to but more sophisticated than modern sonar. Pulses within a bat call may also vary by means of their sound frequency and characteristics, although this variation is within a certain range restricted to a specific bat species. Certain call parameters are used to identify a bat species from its echolocation call. These include pulse length, pulse bandwidth, pulse interval and pulse dominant frequency (loudest frequency), of which dominant frequency is the most commonly used parameter. The dominant frequencies of the three loudest pulses recorded were chosen since the loudest pulse is produced when the bat is in close proximity to the bat detector, limiting the ramifications the Doppler Effect has on the results of sound waves emitted by a moving bat. A feeding buzz is the common term used to describe the change in echolocation call when a bat is approaching its prey. A feeding buzz is a series of very short pulses that dramatically become more rapid as the bat is closing in on the insect prey, giving it a clear image of the prey. A feeding buzz is proof of bats actively foraging. Species identification with the use of echolocation is less accurate when compared to morphological identification, nevertheless it is a very certain and accurate indication of bat activity and their presence.

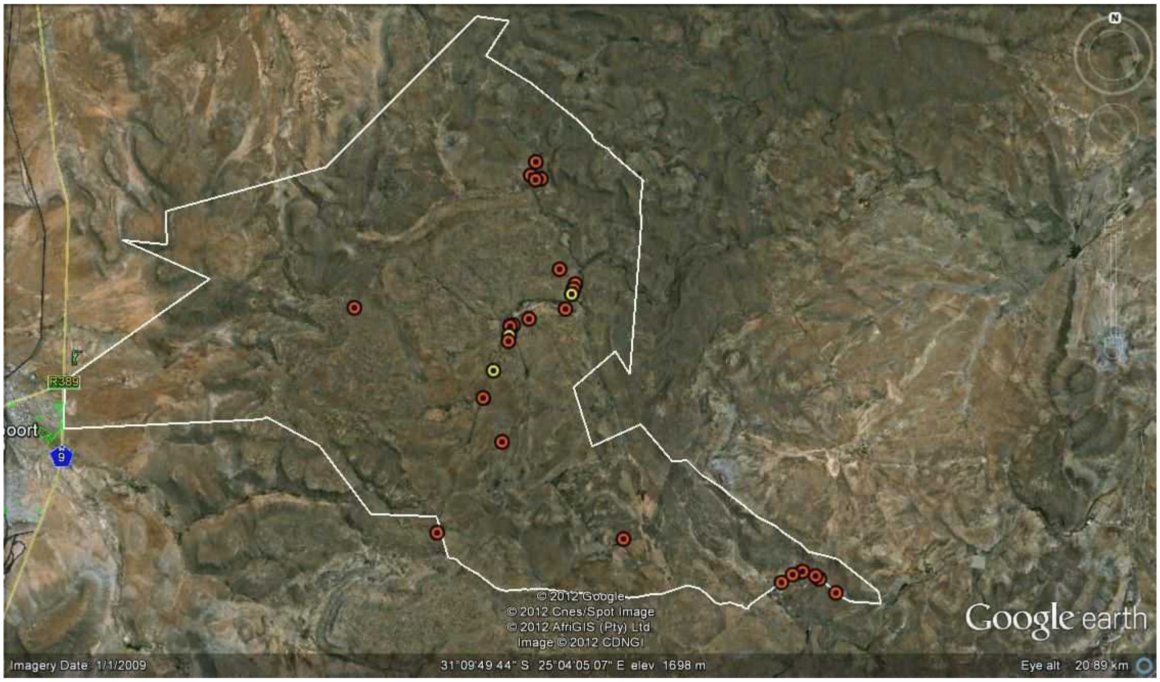

Figure 44. Bat species and activity detected during vehicle monitoring on site, showing high levels of activity in rocky areas. Orange circles indicate where Egyptian free-tailed bats (*Tadaridaa egyptiaca*) were detected and yellow circles indicate where Cape serotine bats (*Neoromicia capensis*) were detected.

Figure 45. Typical rock crevices on site, used by bats for roosting on site.

Figure 46. Typical topography of site showing rock crevices as roosting opportunities for bats on the site.

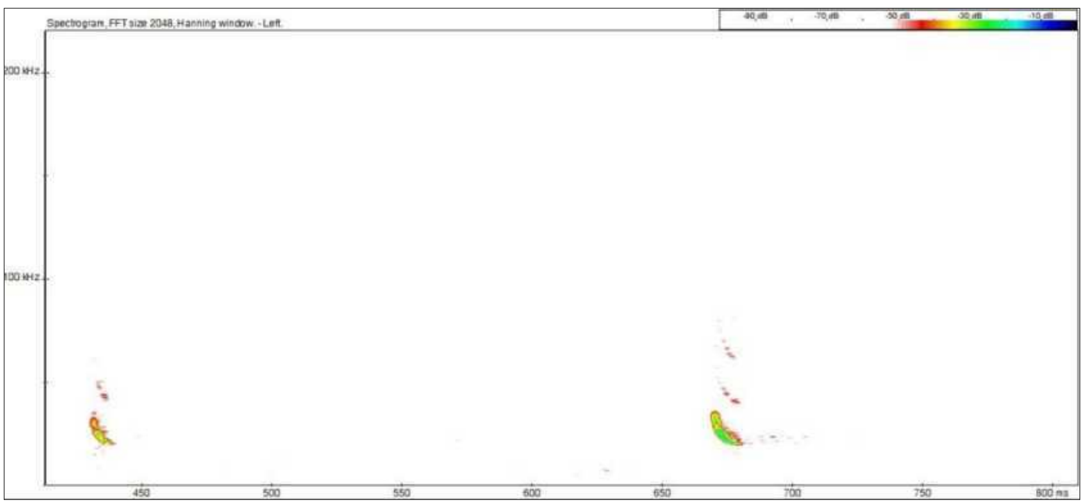

Figure 47. Spectrogram of pulses from *Tadaridaae gyptiaca* (Egyptian Free-tailed bat) call.

10.3.3 Sensitivity map

The sensitive area indicated on the map (Figure 48) shows an area where rocky outcrops and their associated rock crevices are very abundant. Rock crevices were found to be used by bats for roosting and bat foraging activity was higher in these areas than in the open grasslands. For the purpose of this study a buffer of 100 meter around inland water bodies and 200 meter around rivers (for foraging purposes) is appropriate, these are the same buffer distances used to determine the buildable area data supplied by the client, and is therefore not indicated in a sensitivity map in this report (as to avoid duplicate work).

It is probable that bats use low-lying areas between rocky outcrops for foraging and drinking as water accumulates in streams here.

Bats may also use buildings and trees for roosting.

Although there are no South African guidelines for the consideration of bats in relation to wind farm developments, however, international guidelines such as the Eurobats Guidance and the Natural England Technical Note (Mitchell-Jones & Carlin 2009) give some indication of buffer zones which may be applicable. The Eurobats Guidance (Rodrigues *et al*. 2008) proposes a minimum distance of 200m to forest edges where tree felling is necessary to establish a wind farm. The Natural England Interim Guidance suggests a 50meter buffer from blade tip to the nearest feature important to bats.

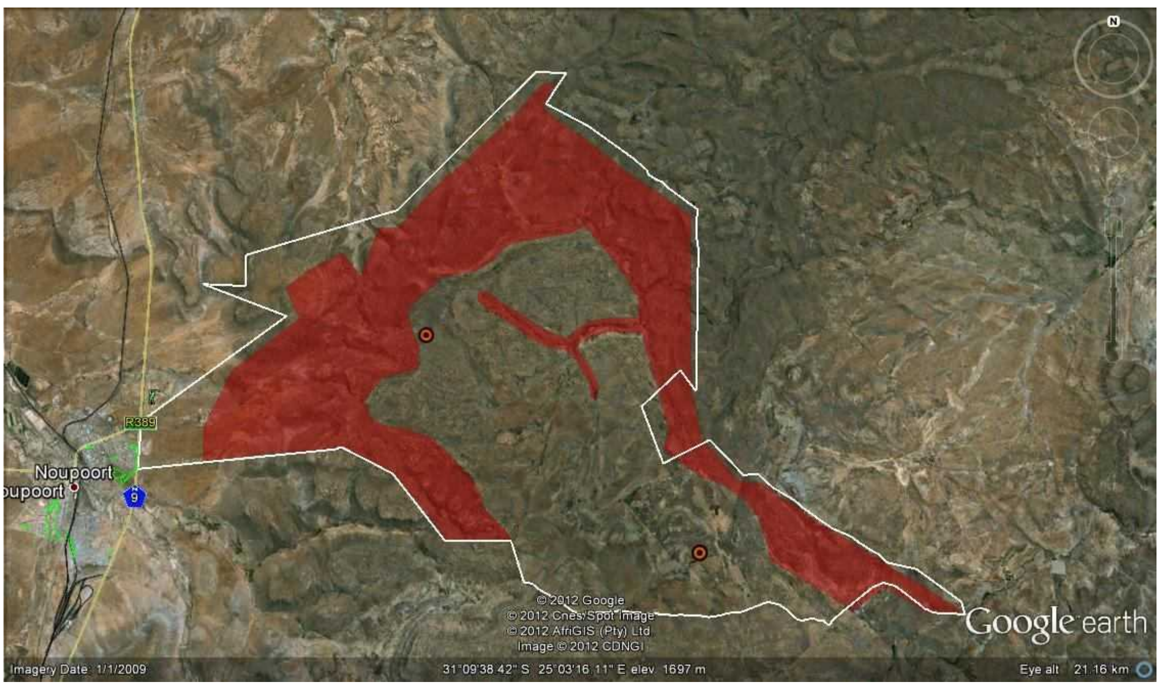

Figure 48. Map indicating the highly sensitive area in red.

10.4 Surface Water

10.4.1 Methodology

The first step of the EIR-phase study was to conduct a preliminary desktop analysis of the study area using available information. Primarily, this was undertaken using Geographic Information Software (GIS). The software ArcGIS (version 9.3) developed by ESRI was used. The use of colour satellite imagery (sourced from Google Earth) was made to identify wetlands.

The potential occurrence / non-occurrence of wetlands and wetland (hydric) soils on the site (where assessed in the field) have been assessed according to the method contained within the DWAF guideline, “A practical field procedure for the identification and delineation of wetlands and riparian areas” (DWAF, 2005). According to the DWAF guidelines for the delineation of wetlands (DWAF, 2005), soil wetness indicators (i.e. identification of redoximorphic features) are the most important indicator of wetland occurrence. The wetlands that were assessed and delineated in-field were therefore based primarily on soil wetness indicators. Three other indicators (vegetation, soil form and terrain unit) were used in combination with soil wetness indicators to supplement wetland findings. Where soil wetness and/or soil form could not be identified, information and professional judgment was exercised using the other indicators to determine what area would represent the outer edge of the wetland.

In the actual delineation and assessment process, soil samples were drawn using a soil augur at depths between 0.50-1.5 metres in the soil profile, or a where easily able to be accessed a soil profile on a bank or similar feature was freshly exposed to determine the soil types associated with the particular wetland and to generally establish where the outer edge of the wetland is located. A conventional handheld Global Positioning System (GPS) was used to record the points taken in the field. The GPS points were then imported into a GIS system to map the identified zones. The GPS is expected to be accurate up to 5 metres.

10.4.2 Results of Desktop-based wetland delineation of the site

Figures 49 and 50 shows the spatial distribution of wetlands on the site. It should be noted that the wider drainage network is much wider than the wetland occurrence as indicated on the map; the layer as indicated on the map shows areas of wetland habitat on the site. The delineation of wetland areas was undertaken using GIS software, and was refined based on the field investigations as reported on below, as well as on the in-field findings of the soils and agricultural potential study which undertook a mapping exercise of the soil forms on the site. A buffer around all wetland areas has been delineated.

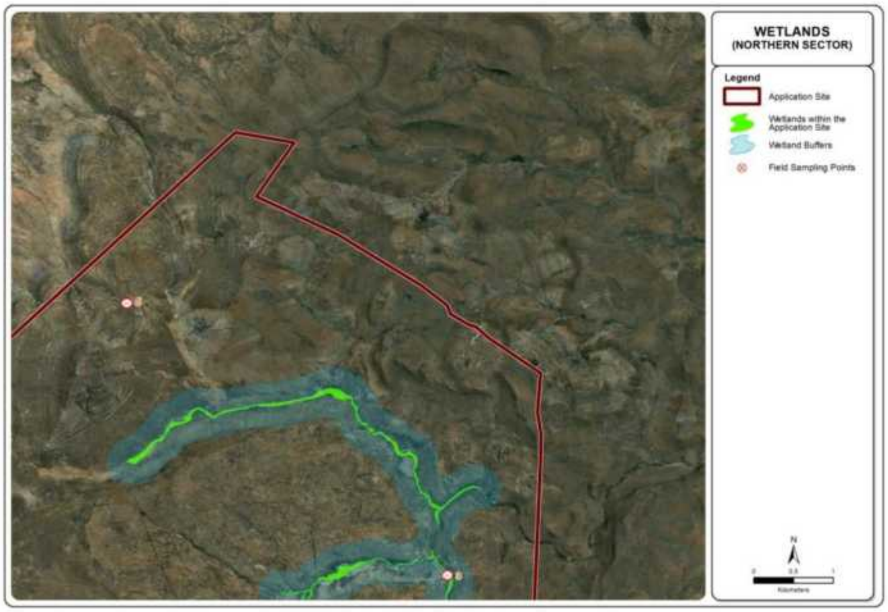

Figure 49. Wetlands and associated buffers in the Northern part of the Development Site

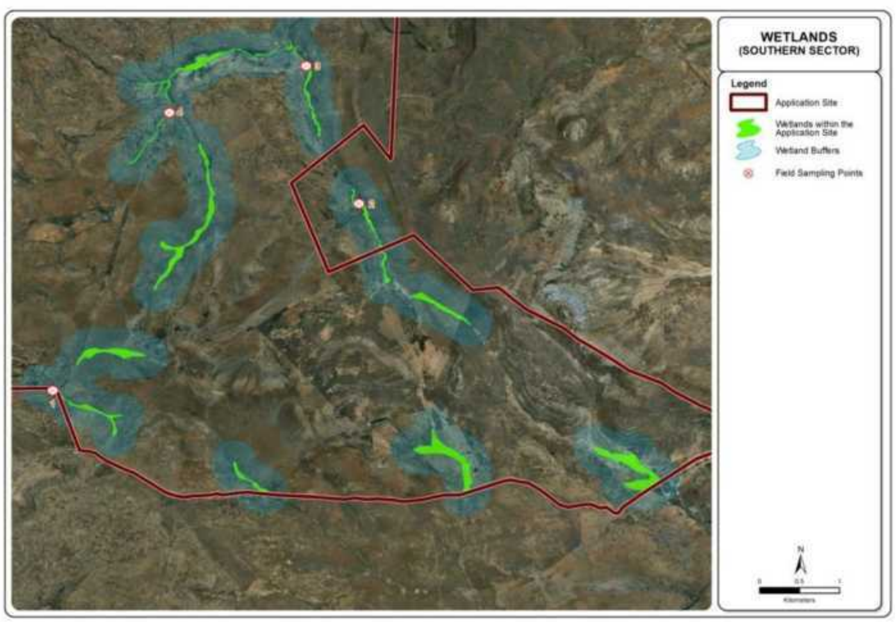

Figure 50. Wetlands and associated buffers in the Southern part of the Development Site

10.4.3 Results of in-field wetland assessment

A number of sites were assessed in the field to determine the characteristics of the surface water feature in terms of its:

- Hydrology
- Vegetative Composition
- Morphology
- Associated Sensitivity

The in-field analysis also allowed the ground-truthing and refinement of the desktop-based wetland area delineation on the development site. Overall, the desktop analysis combined with the field work verification identified that several wetlands occurred on the proposed development in the form of channelled valley bottom wetlands and valley head seepage wetlands. Many of the wetlands identified were hydrologically connected with the greater drainage network via channels in several areas of the study site, expanding and narrowing along the drainage network length in various locations. Others were more isolated, particularly those stemming from valley head seeps which flowed off-site.

10.4.4 Surface Water Sensitivity and Sensitive Areas

The above findings allow the sensitive parts of the site in the context of surface water features to be identified. It should be noted that all surface water features, as defined by this study are to be treated as sensitive features, however small or ephemeral these are. However different types of surface water features can be given differencing degrees of sensitivity based on their characteristics. Importantly, this differing degree of sensitivity can be expressed in terms of differing extent of buffers that could be applied to these features, as discussed below.

10.4.5 Creation of buffers around surface water features

At present there are no official requirements for buffer zones in the Northern Province. However the construction of the components of the proposed development, and elements of their operation could have indirect impacts on the surface water feature that could degrade the feature. In this context the use of a buffer zone to protect the surface water feature from indirect impacts related to the construction activities of the project is necessary.

A buffer of 250m around all wetlands on the site has been recommended. In terms of the management of this buffer, it is strongly recommended that no turbines be located within this buffer zone. In addition, it is strongly recommended that associated infrastructure, such as cable trenches, roads and power lines be kept out of these buffers. While this will not be completely possible due to the need to cross wetland features to access parts of this site, this recommendation with respect to associated infrastructure should be adhered to as far as possible.

In the context of non-wetland surface water resources, a buffer of 50m should be maintained. Similar recommendations as the buffer for wetlands are in force for the surface water buffer.

10.4.6 Potential Impacts associated with the Proposed Development

There are a number of impacts that could affected the identified surface water resources on the study site. These include the following:

- Impacts associated with turbines
- Impacts related to roads
- Impacts related to underground cabling
- Impacts relating to power lines
- Impacts associated with the potential upgrading of a bridges and culverts

For a full explanation of the individual impacts related to the proposed development with respect to surface water resources please refer to Appendix 6 for the specialist Surface Water Report.

10.5 Soils and Agricultural Potential

10.5.1 Soil Survey and Field Verification

Due to the size of the site local agricultural activities (unimproved grazing land) and the nature of the proposed activities, an exploratory soil survey was performed. At each survey point the soil was described to form and family level according to "Soil Classification - A Taxonomic System for South Africa" (Soil Classification Working Group, 1991) and the following properties were noted:

- Estimation of ‘A’ horizon clay content,
- Permeability of upper B horizon,
- Effective rooting depth,
- Signs of wetness,
- Surface rockiness,
- Surface crusting,
- Vegetation cover, and
- Detailed description of the particular area such as slope.

10.5.2 Soil Descriptions

The major soil forms encountered during the soil survey include the following:

- Mispah Form
- Glenrosa Form
- Swartland Form
- Bonheim Form

Other soils encountered during the field verification, which were recorded very sparsely across the site include:

- Sepane
- Inhoek
- Willowbrook

A more detailed description of the major soil forms along with the site-specific descriptions of each soil form and other less common soil types found within the study site can be viewed in the Soils and Agricultural Specialist Study in Appendix 6.

10.5.3 Soil Summary

The soils identified on the PDA are predominantly shallow and rocky with a low agricultural potential. Lithic soils (Mispah and Glenrosa Forms) cover 87% of the surveyed area (Figure 52). Virtually all the soils encountered on site contained at least one layer that was limiting to plant growth and these layers included rock and Lithocutanic horizons.

The location and description of the sample points are provided in Soils and Agricultural Specialist Study in Appendix 6. This information was used to create a verified soil map showing homogeneous soil bodies (Figure 51). Combining the effective depth information (i.e. depth to root limiting layer) and Inverse Distance Weighting one is able to obtain a generalised soil depth for the PDA (Figure 53). Soils with an effective depth of greater than 50 cm were rarely observed during the soil survey with most soils exhibiting an effective soil depth of less than 30 cm.

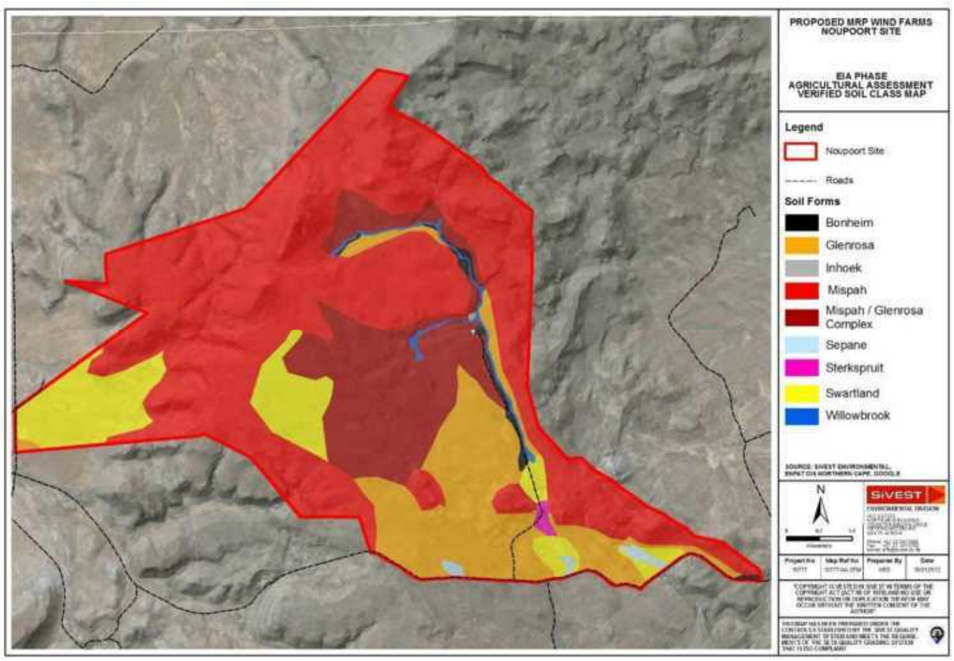

Figure 51: Verified Soil Map for the Plateau East North Site

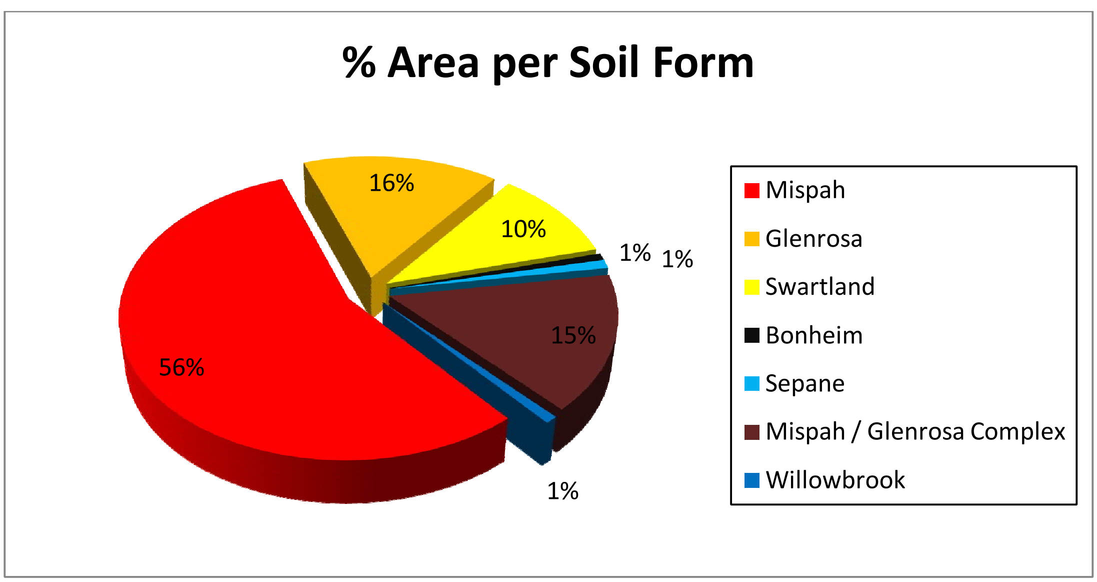

Figure 52: Graph showing the percentage area per soil form for the Noupoort Site

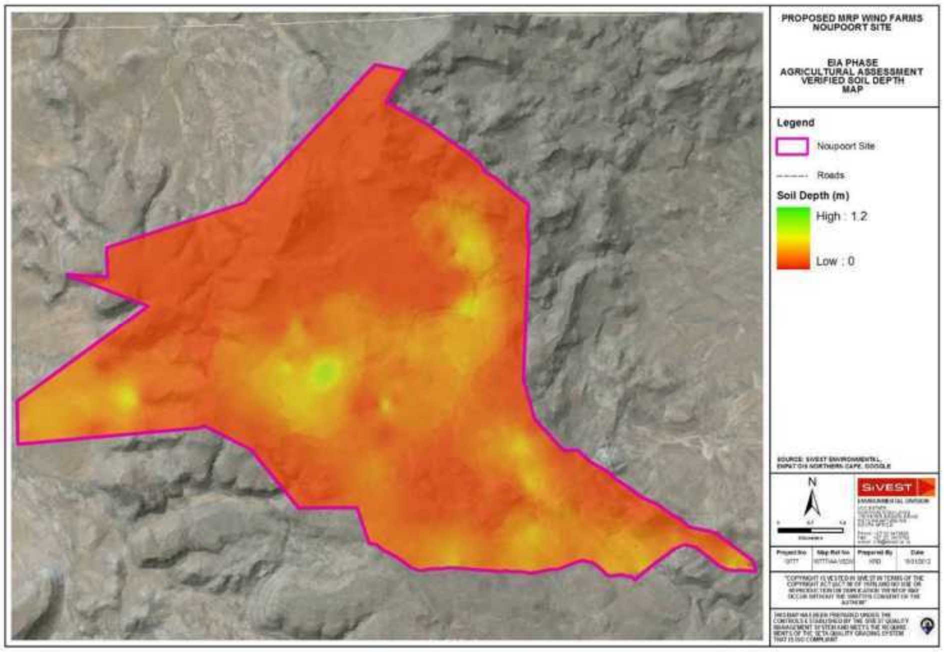

Figure 53: Verified Soil Depth Map

10.5.4 Agricultural Potential Assessment

In terms of this study, agricultural potential is described as an area's suitability and capacity to sustainably accommodate an agricultural land use with this potential being benchmarked against crop production.

10.5.5 Current Situation

- Remainder of the Farm No.168, Colesberg, Noord Kaap

Remainder of the Farm No.168, Colesberg, Noord Kaap, which constitutes the largest portion of the assessment area is currently used as extensive grazing land for an intensive beef heifer enterprise as well as low intensity sheep production (**Figure 19**). Stocking rates for are estimated at around 1:14 LSM (1 large stock unit per 14 hectares). Cultivated fields of Lucerne are located in valley bottom wetlands near the eastern border of farm (**Figure 20**). These areas generally correspond to deeper melanic soils. The Lucerne is bailed in summer and used as winter fodder for the beef heifers. Even though these soils are not ideal for Lucerne production, cultivation is possible in the valley bottoms as the soils tend to be deeper with higher soil moisture contents and water availability.

- Portion 1 of the Farm No. 181, Colesberg Noord Kaap

Portion 1 of the Farm No. 181, Colesberg, Noord Kaap is currently used as extensive grazing land for free range sheep production (Figures 54 to 56). The site does not currently accommodate any centre pivots, irrigation schemes or active agricultural fields. Seasonal pans and valley bottoms tend to have the highest grazing potential due to the increased plant available water. Drinking water for the animals is sourced from groundwater resources.

  - Portion 21 of the Farm No. 182, Colesberg Road, Noord Kaap

Portion 21 of the Farm No. 182, Colesberg, Noord Kaap is found on the western side of the assessment area. This farm is also dominated by un-improved grazing land. There are however limited subsistence agricultural fields near the western corner of the farm portion. These fields are tended by the Siphila Ngokuzenzela farming CC and produce vegetables for the household. These fields are watered from groundwater resources.

Figure 54: Part of the beef heifer herd

Figure 55: A field of Lucerne on Remainder of the Farm No.168, Colesberg, Noord Kaap

Figure 56: A small flock of sheep grazing on the Noupoort site

10.5.6 *Verified Agricultural Potential*

Overall agricultural potential is based on assessing a number of inter-related factors including climate, topography, soil type, soil limitations and current land use. In this area climate and topography are the overriding limiting factors to sustainable agricultural production. The combination of low rainfall and an extreme moisture deficit means that sustainable arable agriculture cannot take place without some form of irrigation / water source. These results were confirmed during the site visits where the restrictive soil (shallow, rocky) and climate characteristics (low rainfall and frost) contributed to an extremely low agricultural potential in terms of crop production. The majority of the site consists of vast grazing land which can be seen as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development. Cultivation, in terms of Lucerne, is possible in valley bottoms were the soils tended to be deeper with higher soil moisture contents due to topographic position.

Shallow lithic soils (Mispah and Glenrosa Forms) cover approximately 87% of the total survey area. Virtually all the soils encountered had a layer that was limiting to plant growth and effective soil depth rarely exceeded 50cm. Steep topography also will certainly limit any future agricultural development. A map indicating agricultural potential in terms of crop production for site is provided in Figure 57. The majority of the site has been classified as having low potential for crop production due to an arid climate, steep topography and restrictive soil characteristics. The site is not classified in terms of registering a high agricultural potential and they are not a unique dry land agricultural resource. The PDA is considered to have a moderate value when utilised as grazing land, its current use.

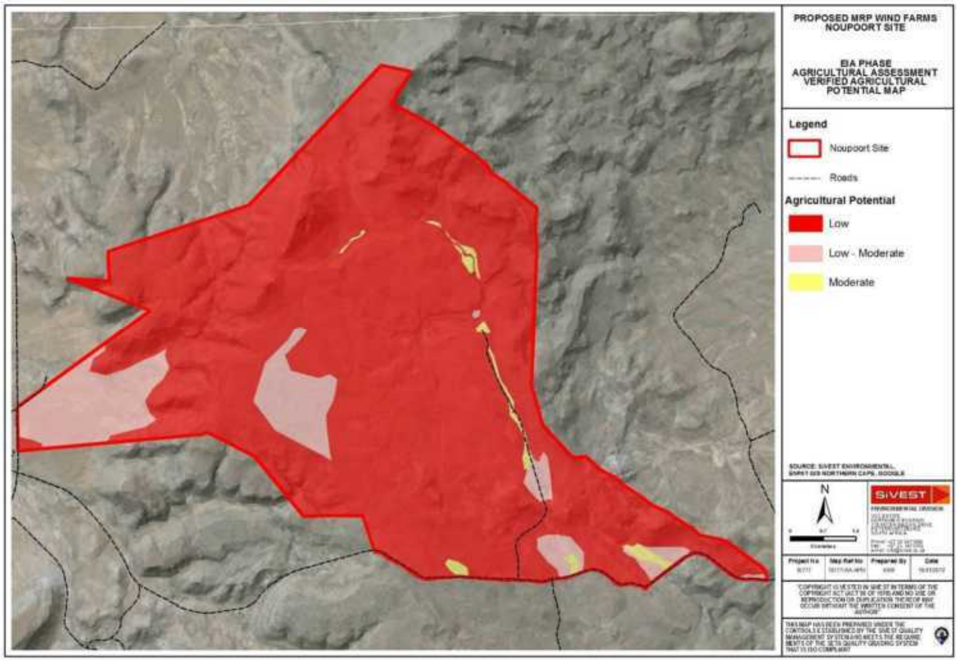

Figure 57: Agricultural Potential Map for the PDA

10.5.7 Potential Impacts associated with the Proposed Development

The primary concern with regards to soil and agricultural in terms of loss of agricultural land and production. For a full explanation of the potential impacts related to the proposed development with respect to the loss of agricultural land and production please refer to Appendix 6 for the specialist Soils and Agricultural Potential Report.

10.6 Visual

10.6.1 Methodology

- Assessment of Study Area Visual Character

An assessment of the Study Area's visual environment is included in this report to contextualise the assessment of potential visual impacts and associated sensitivity. The summary includes a description of the physical characteristics of the Study Area that affect the visual environment, as well as an assessment of visual sensitivity. The concept of a cultural landscape in the context of the visual character of the study area is also explored.

- Identification of Sensitive Receptor Locations

The visual study included the refinement of the identification of sensitive receptors considered during the EIA phase of the study from those identified in the Scoping Phase.

All potential receptor locations have been listed in tabular format, with the receptor name, nature of the receptor (e.g. farmstead, accommodation facility etc.) and the current location of the receptor (in the context of distance banding buffers from the site) presented. A similar table listing roads or railways that could be considered to be visually sensitive is also presented.

- Visual Impact Rating Matrix

In order to assess the impact of the proposed wind farm on the sensitive receptor locations in the study area a matrix that takes into account a number of factors that have a bearing on visual impact is applied to each receptor location within a 5km radius of the development site. The matrix has been based on a number of factors relevant to the experiencing of visual impacts, and thus provides a combined assessment of the likely visual impact that would be experienced at each receptor location.

- Visualisation Modelling

An important aspect of any Visual Impact Assessment is the ability to visualise the proposed development within the context of the local landscape. This requires a clear understanding of the likely shape, size, alignment and location of the proposed development.

In order to visualise the proposed turbines comprising, it was necessary to provide some form of graphic representation or simulation of the proposed development in the relevant landscape. This involved the compilation of three dimensional, scale models of the wind turbines and power lines using 3D modelling software. Using GIS software and Google Earth, the models were then positioned geographically within selected sections of the proposed wind farm which then allowed for the models to be superimposed on photographs taken from identified sensitive receptor points.

Although this process is not 100% accurate, it provides a useful means of visualising the project for professional teams and for interested and affected local communities.

10.6.2 Visual Sensitivity

The visual character of the study area engenders the study site with a certain level of visual sensitivity. This sensitivity can be defined in the context of change of the visual environment, and the potential for the resource quality to be degraded by a proposed development (such as the proposed development) which could result in change in the visual character of the area. As described above, the visual character of the area is strongly linked to its natural and rural characteristics, with a strong scenic component. A very important factor contributing to the scenic quality of the site is the presence of elevation in terms of the site topography. As described above, the hills on the site mark a distinct landform change from the surrounding plains and flats; due to this distinction these areas will be the parts of the site most visible to surrounding areas, especially as they will tend to draw the focal attention of the viewer when looking onto the site as they mark a contrast from the flatter areas surrounding them. These factors of increased elevation and thus increased visibility, as well as the increased scenic component associated with these landscape features engenders these features with a strong degree of visual sensitivity.

In the context of the wider area there are relatively few anthropogenic objects within the landscape, and those that are present are typically associated with the rural landscape typical of the area. An important component of visual sensitivity is the presence, or absence of visual receptors that may value the aesthetic quality of that landscape. As described below, a number of receptor locations that are potentially sensitive receptors are present in the study area. Although no formal protected areas or leisure / nature-based tourism activities exist within the study area, the context of the study area as a rural area with a low density of human change and influence in the landscape provides the landscape with a certain level of visual sensitivity. In this context, the potential visual impact of the proposed wind farm on the visual environment of the study area must be examined.

10.6.3 Visually sensitive areas on the site in the context of wider environmental sensitivity

During the latter stages of the EIR phase, all project specialists were requested by the Environmental Assessment Practitioners (EAPs) to indicate environmentally-sensitive areas within the development site. Additionally, comments received from the Square Kilometre Array (SKA) requested that a line of sight analysis be undertaken to determine the potential of electromagnetic noise influencing proposed SKA radio telescope stations, taking into account the surrounding topography and to help identify potential impacts and mitigation measures (see Appendix 5 for correspondence). This exercise was therefore undertaken to allow a GIS-based spatial analysis of sensitive parts of the site to be undertaken to feed into the design of the draft final turbine layout.

The findings of the analysis reveal that no visual receptors are located within the development site, the visual assessment of sensitive areas on the site therefore had to be undertaken in a reverse manner. The aim of the assessment was to identify those parts of the site where locating turbines or other infrastructure would be associated with the greatest chance of visual impacts on surrounding areas. Although not specifically sensitive from a visual perspective (as the surrounds of a receptor location would be), these areas are important in a spatial assessment of visual sensitivity as sensitive areas where it is preferred that turbines should not placed.

A number of different spatial characteristics were utilised to identify these areas. Firstly as all of the sensitive receptors are located outside of the site and not within it, there would be no sensitive areas located around these receptor locations within the site.

As indicated in Figure 58 and 59 below, sensitive receptor locations are located around the site, but a cluster of sensitive receptors is located to the west and south-west of the site in the vicinity of the town of Noupoort. The N9 highway, viewed as a sensitive receptor road also runs to the west of the site. Due to the nature of the topography of the area, the higher ground on the site rises up as a series of hills from the flatter ground in the vicinity of Noupoort and the N9 highway. Viewed from these areas, the site forms an escarpment-like feature, with the highest points of the hills masking the slightly lower elevation plateau to the east of this 'escarpment'. Any infrastructure placed to the west of this 'escarpment' (on the town-side or western-facing aspects of this rising ground) would be highly prominent and thus potentially obtrusive due to the nature of the topography. Using GIS analysis and in-field observations, the rough limit of the viewshed from the town and N9 (i.e. the top of the rising ground or 'escarpment edge') was delineated in GIS. All areas of the site to the west of, and of lower elevation than the 'escarpment edge' were delineated as no-go or exclusion areas. In addition, due to the potential height of the turbines that would be visible from the flats on ground to the east of this 'escarpment edge', a further buffer of 1km to the east of this line was included as a sensitive area, as indicated in the figure below; the blue line represents the escarpment edge, with the light blue shaded areas representing the no-go areas west of this line and the pink areas the 1km sensitive buffer to the east of the escarpment edge.

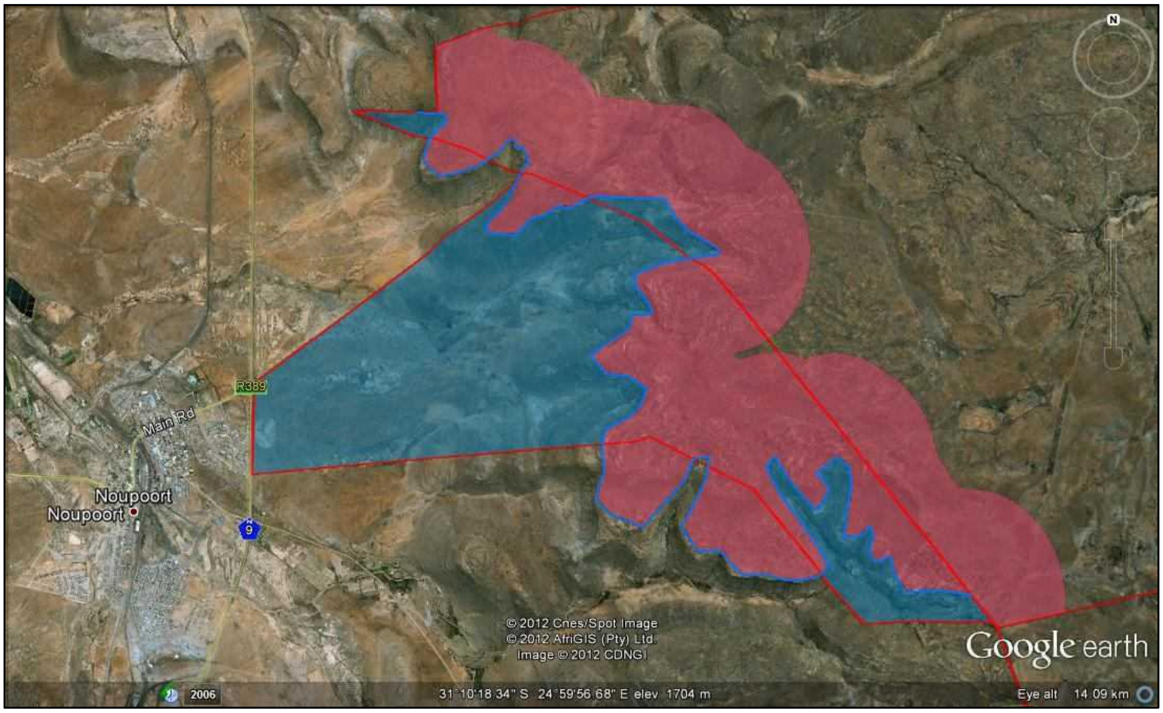

Figure 58. Aerial View in Google Earth of the Visual Buffer Zones west and east of the escarpment edge

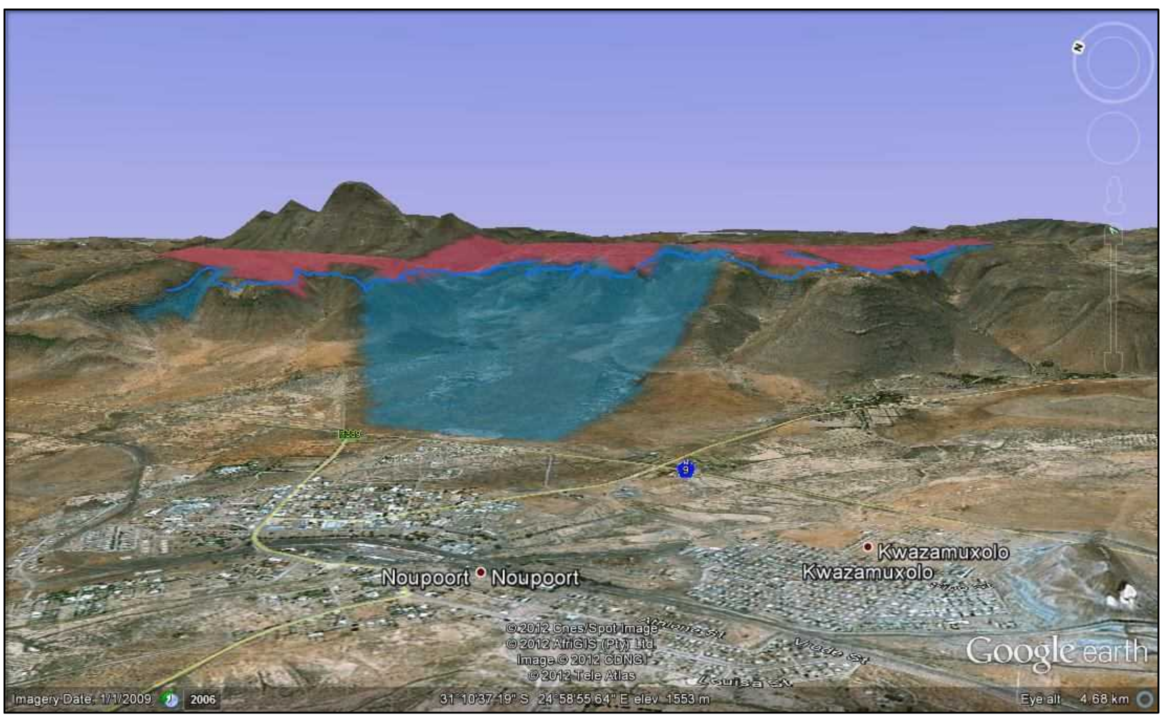

Figure 59. Google Earth Image of Visual Buffers and Exclusion Zones within the development site (note the terrain elevation factor has been exaggerated for effect and the viewpoint was elevated to display the pink sensitive areas)

The figure above indicates a number of high points on the development site that are highly visible due to their elevation. These high points, in particular Oppermanskop, another high ridge in the northern-most part of the site and a north-south-running ridge in the eastern part of the site are prominent topographical features on the site that are highly visible from large areas in every direction from the site. Analysis of the site reveals that most of these elevated areas are above a contour of 1800m a.s.l. Due to the elevated position and visual prominence, any infrastructure, in particular turbines, placed above this elevation would be highly prominent and also potentially visually intrusive. As such all parts of the site above an elevation of 1800m have been marked as no-go areas from a visual perspective, as indicated in the map below.

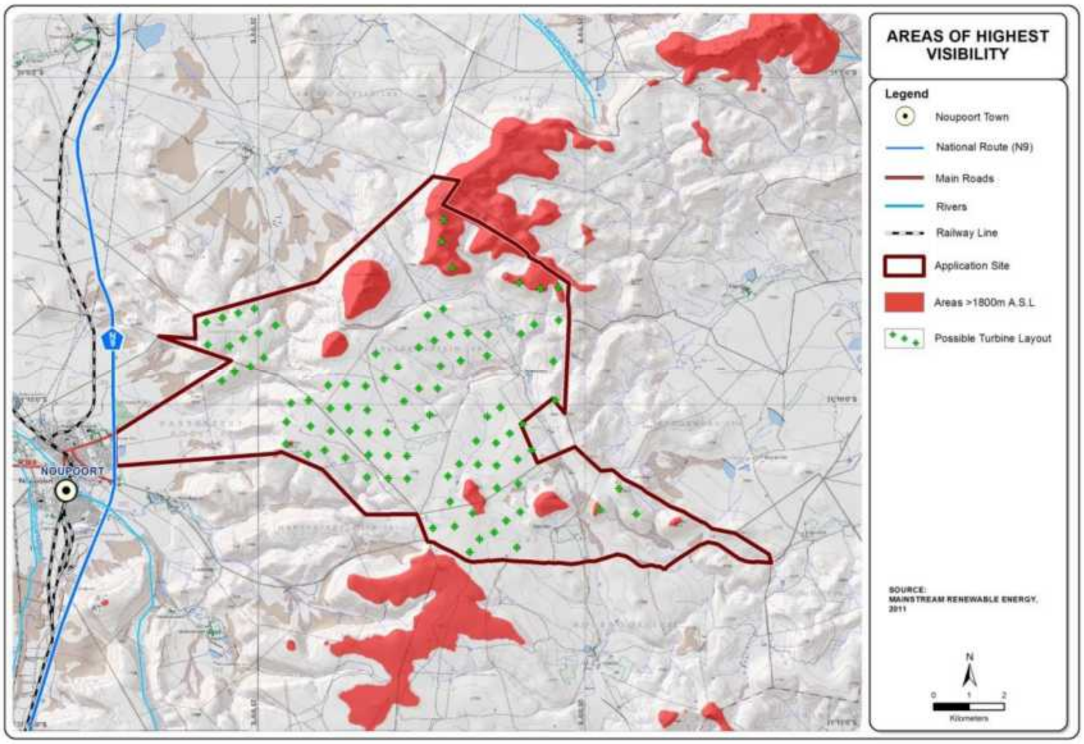

Figure 60. Exclusion areas of an elevation greater than 1800m a.s.l

Lastly, the Oorlogspoort Road runs very close to the southern boundary of the site. As mentioned earlier in this report the road climbs up into the hilly ground to the east of Noupoort and is highly scenic. For this reason the road has been designated as a sensitive receptor road. In order to reduce potential intrusion of turbines within the viewshed of the road, a 500m sensitive area buffer has been created within the part of the site that lies adjacent to the road.

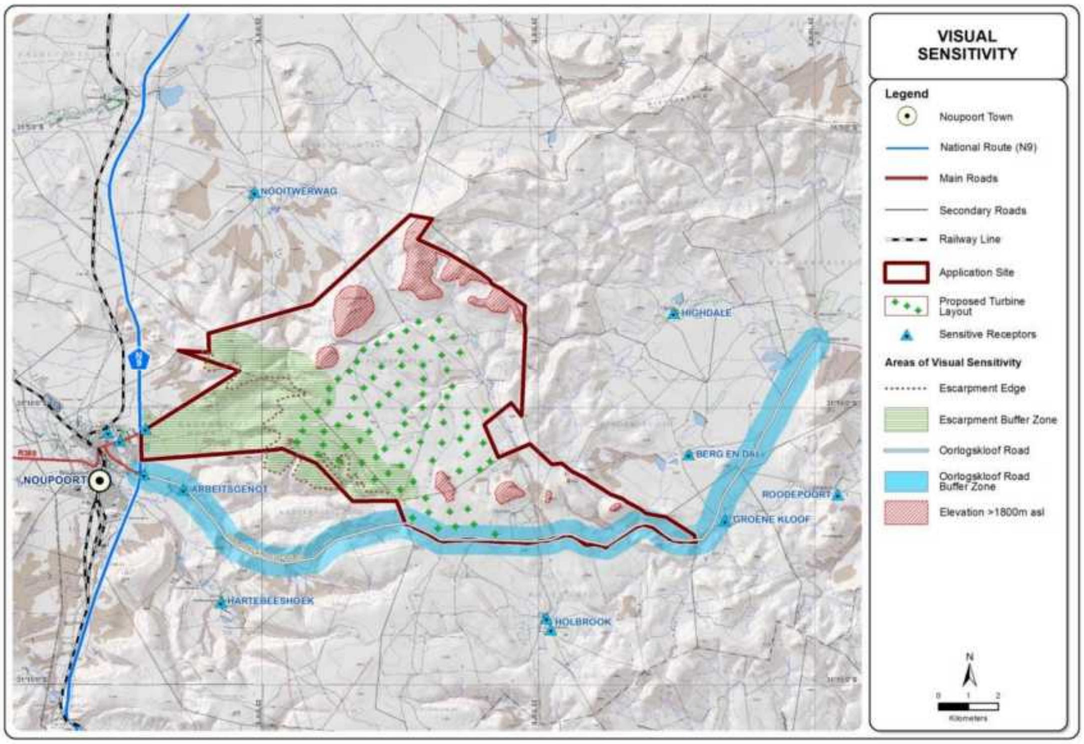

Figure 61. Map showing all visual buffer and sensitive areas on, and around the development site

10.6.4 Visual Implications of the Proposed Turbine Layout

The spatial layout of the turbines of the site would have a very important bearing on the degree of visibility of the turbines, and on the potential visual intrusion factor of the turbines, that would affect the intensity of visual impacts associated with the wind farm. The visually sensitive areas on the site were therefore delineated based on their visibility from areas surrounding the site, and thus three sensitive zones have been suggested in which it was recommended that no turbines be placed were identified. The current wind farm layout has mostly taken these sensitive areas into account. The location of the turbines as proposed in the latest layout is indicated in the figure below.

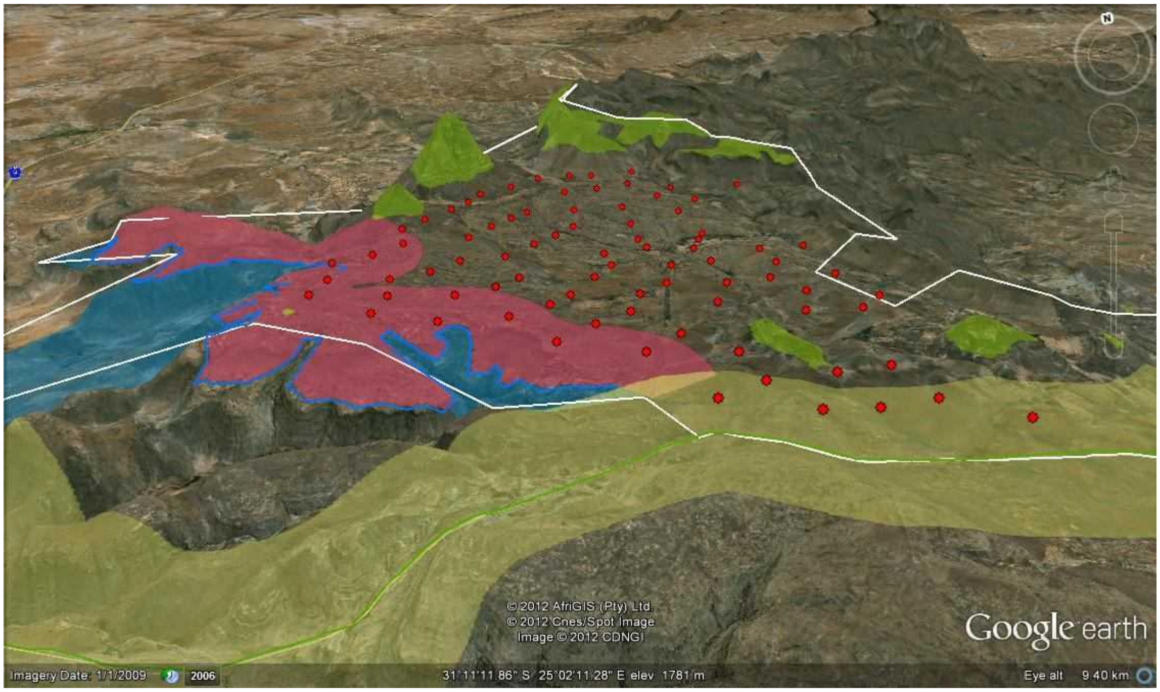

Figure 62. Google Earth aerial view of the latest Turbine Layout in relation to the visual buffer and sensitive areas (coloured areas)

It is important to note that no turbines have been placed within the exclusion area to the west of the ‘escarpment edge’ or above the 1800m contour on the site. The turbines have been mostly excluded from the sensitive buffer to the east of (behind) the ‘escarpment edge’ however a number (19) have been placed within this sensitive buffer zone. A number have also been placed within the sensitive buffer of the Oorlogspoort Road. These turbines could be potentially be visible from surrounding areas on the site as these buffer areas are those most likely to be visible.

It should also be noted that the placement and layout of turbines is not just a result of the potential visual impact, but due to other environmental, as well as technical and social upliftment factors as explored below; there are other factors that a development should consider which includes other environmental impacts including :

10.6.5 Generic Visual Impacts Typically Associated with Wind Farms

It is important to note that as yet, no large scale wind farms have yet been developed in South Africa, although within a few years wind farms approved recently in the late part of 2011 should be constructed in this country. The development and associated environmental assessment of wind farms in South Africa is relatively new, and thus it is valuable to draw on international experience. Thus this section of the report draws on international literature and web material (of which there is significant material available) to describe the generic impacts associated with wind farms.

A single wind turbine is a massive object and as such is highly visible. The height of the turbine thus means that the turbine would be typically visible from a large radius. A wind farm consists of a series of turbines spaced apart in groups around the site. The wind farm would thus typically be highly visible.

Much literature has explored public perceptions of wind farms. For a full description of these impacts please refer the specialist Visual study in Appendix 6.

- Shadow flicker

Shadow flicker is an effect which is caused when shadows repeatedly pass over the same point. It can be caused by wind turbines when the sun passes behind the hub of a wind turbine and casts a shadow that continually passes over the same point as the blade of the wind turbine rotates (http://www.ecotricity.co.uk).

The effect of shadow flicker is only likely to be experienced by people situated directly within the shadow cast by the blade of the wind turbine. As such, shadow flicker is only expected to have an impact on and cause health risks to people residing within houses that are located at a specific orientation and within close proximity to a wind turbine (less than 500m), particularly in areas where there is little screening present. Shadow flicker may also be experienced by and impact on motorist if a wind turbine is located in close proximity to an existing road. The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby houses and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting surrounding residents (http://www.ecotricity.co.uk). With the exception of possibly a couple of farm workers, there is currently no-one living on the site of the wind farm, or in the immediate vicinity, thus shadow flicker is unlikely to be a significant phenomenon associated with this wind farm.

- Associated Infrastructure

The new substation (approximately 90m x 120m), with the height of its components typically being no greater than 10m) and overhead power lines by their nature are large objects and will typically be visible for great distances. Power lines consist of a series of tall towers thus making them highly visible. Like wind turbines, power lines and substations are not features of the natural environment, but are representative of human (anthropogenic) alteration. Thus when placed in largely natural landscapes, they can be perceived to be highly incongruous in this setting. The existing power line infrastructure (to which the wind farm would link) are located to west of the site. As the turbines are proposed to be located in the hilly ground to the east of Noupoort, it is highly likely that the power lines would have to traverse the ridge to the east of town to link the site with the grid network. In this context power line towers may be highly visible, especially as they traverse the edge of the ridge, and may be associated with a significant intrusion factor as they may break the horizon.

Other associated infrastructure may also be associated with visual impacts. The turbines are inter-connected with a series of cables, which are likely to be buried, but which also may take the form of above-ground power lines. These cables may become a visual intrusion if placed in areas of the site that are visible to the surrounding areas, especially those areas that are located on ridge tops and side slopes of these ridges. A trench dug for the cable (both during construction and post-construction once the trench has become back-filled) may become prominent if it creates a linear feature that contrasts with the surrounding vegetation.

In a similar way access roads across the steep side slopes on the site may have an even greater effect. If turbines are placed on ridge tops, it is likely that access roads will be needed to be constructed to transport the turbine components up to the ridge top, and then to access the ridge-top turbine locations, once operational. On steep side slopes, a road may have to be 'cut' into the side slope, creating a prominent linear feature that contrasts sharply with the hillside.

Lastly buildings placed in prominent positions such as on ridge tops may also break the natural skyline, drawing the attention of the casual viewer.

10.6.6 Summary of Visual Impacts at Key Observation Locations

In order to better understand the visual impacts associated with the proposed wind farm, a visual contrast assessment has been undertaken. This is done in order to quantify the degree of visual contrast or change that would be caused by the proposed wind farm and associated infrastructure at a number of key observation locations (including static receptor locations and along sensitive receptor roads). Table 33 below provides a summary of the results of the visual impact assessment at the key observation locations near to the study area.

Table 34: Summary of results from impact assessment at key observation locations

Key Observation Location	**Receptor-based Visual Impact (as per matrix)**	**Degree of visual contrast in key view (landscape) and consistency with visual change tolerance level**
Noupoort – residences on Wilmot Street	Low	Moderate (Consistent with tolerance level)
Noupoort – residences on Main Street	Low	Moderate (Consistent with tolerance level)

Noupoort Golf Course Noupoort – land parcel 25 of 182 – Communal ground sports activities and small landing strip	Moderate	Strong (Inconsistent with tolerance level)
Holbrook Farmstead – Upper	Moderate	Strong (Inconsistent with tolerance level)
Entrance Road to Hughdale and Berg-en-dal Farmsteads	No Impact	None (Consistent with tolerance level)
N9 north of Noupoort	[redacted]	Weak (Consistent with tolerance level)
R389 west of Noupoort	[redacted]	Strong (Inconsistent with tolerance level)

10.7 Noise

Increased noise levels are directly linked with the various activities associated with the construction of the facility and related infrastructure, as well as the operational phase of the activity. The description of potential noise sources and the resultant findings based on the modelling analysis of potential noise sources on nearby sensitive receptors are elaborated on below.

10.7.1 Description of Construction Activities Modelled

The following construction activities are assumed to take place simultaneously:

- General work at the workshop area.
- Surface preparation prior to civil work.
- Preparation of foundation area (sub-surface removal until secure base is reached – excavator, compaction, and general noise). Activities will be taking place for 10 hours during the 16 hour day time period.
- Pouring and compaction of foundation concrete (general noise, electric generator/compressor, concrete vibration, mobile concrete plant, TLB).
- Erecting of the wind turbine generator (general noise, electric generator/compressor and a crane).
- Traffic on the site (trucks transporting material, aggregate/concrete, work crews) moving from the workshop/store area to the various activity sites.

There will be a number of smaller equipment, but the addition of the general noise source (at each point) covers most of these noise sources. It has been modeled that all equipment would be operating under full load (generate the most noise) and that atmospheric conditions would be ideal for sound propagation.

Even though construction activities are projected to take place only during day time, it might 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.
- Working late due to time constraints.

10.7.2 Results: Construction Phase

The scenario as defined in the previous section was modeled with the output presented in Figure 63 and Figure 64. Modeled noise levels are defined for the layout in Table 35.

Only the calculated day time 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 the activities taking place simultaneously during wind-still conditions, in good sound propagation conditions (20° C and 80% humidity).

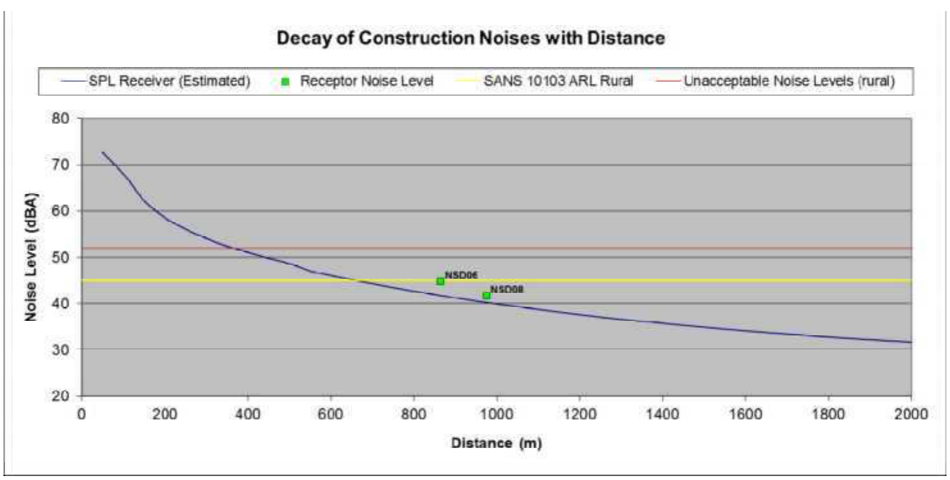

Figure 63: Construction noise: Projected Construction Noise Levels as distances increase between NSDs and locations where construction can take place

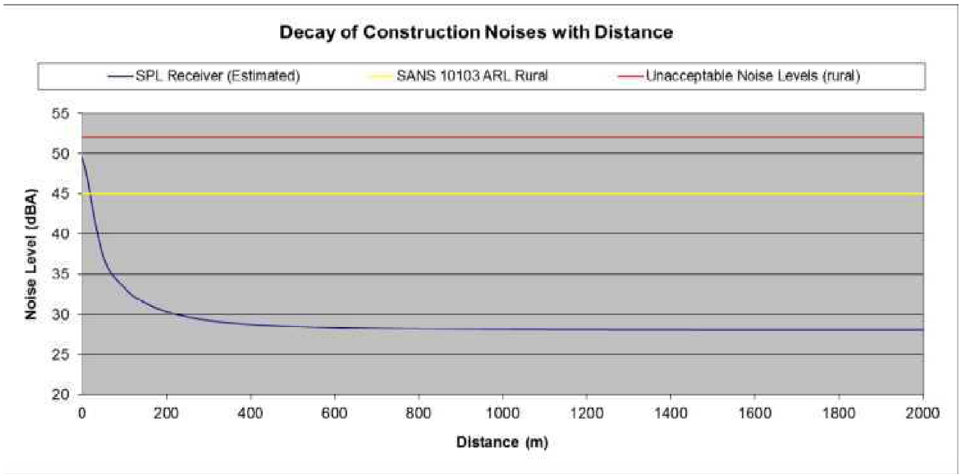

Figure 64: Construction noise: Projected Road Traffic Noise Levels as distances increase between a conceptual NSD and access roads (5 LDV and 5x Trucks per hour travelling at 50 km/hr on a gravel road)

Table 35: Construction: Defining noise impact on Receptors (dBA)

Receptor	Estimated Daytime Ambient Sound Level	Day Ambient Noise Level[6]	Above daytime rating level	Change From ambient sound level	Defining Significance of Noise Impact				
					Magnitude	Duration	Extent	Probability	Sig-nificance
NSD01	28	31.6	0.0	3.6	4	1	2	1	7
NSD02	28	31.5	0.0	3.5	4	1	2	1	7
NSD03	28	32.3	0.0	4.3	4	1	2	1	7
NSD04	28	31.1	0.0	3.1	4	1	2	1	7
NSD05	28	31.0	0.0	3.0	4	1	2	1	7
NSD06	28	44.8	0.0	16.8	10	1	2	1	13
NSD07	28	31.4	0.0	3.4	4	1	2	1	7
NSD08	28	41.6	0.0	13.6	10	1	2	1	13
NSD09	28	31.8	0.0	3.8	4	1	2	1	7

From the preceding figures it can be observed that the noise levels due to construction activities as well as increased traffic due to construction activities would be insignificant (access roads further than 20 meters from dwellings).

[6] Ambient sound level was calculated using the SANS methods discussed in the Noise Specialist Report.

10.7.3 Description of Operational Activities Modelled

Typical day time and night time activities would include:

- The operation of the various Wind Turbines,
- Maintenance activities (relative insignificant noise source).

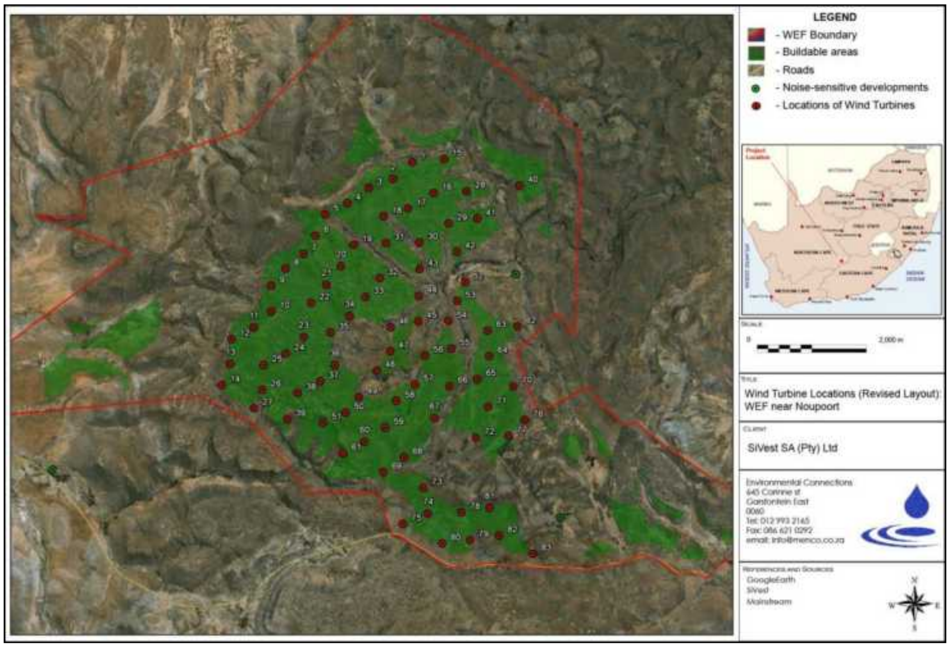

Figure 65: Current proposed layout of the WEF

10.7.4 Results: Operational Phase

Considering the revised current layout, also using the Nordex H90 2500HS wind turbine and model parameters as previously outlined, the following can be concluded:

- Excluding NSD06 and NSD08, the operation of the WEF will not have any noise impact on any other identified potential noise-sensitive development.
- Output from the ISO model indicates that noise levels from the WEF could exceed the estimated ambient sound levels as well as noise limits as used in Canada (MoE) at NSD06 and NSD08.
- Output from the Concawe model indicates that noise levels from the WEF is likely to be less than the estimated ambient sound levels and the noise limits as used in Canada (MoE) at all identified NSDs (for a northern wind).

From the above, the nearby noise sensitive developments of concern include NSD 06 and NSD08. All other noise sensitive developments identified are located sufficiently from the proposed development to not be adversely affected.

Due to the lack of a specific wind turbine make and model, the use of a large wind turbine such as the Nordex H90 2500HS might project noise levels higher than it may be. However, as the make and model is unknown a worst case scenario is assumed.

The highest risk of a noise impact would be predicted using the ISO model at a wind speed of 5 and 6 m/s. The model was therefore rerun using the current proposed layout at the two wind speeds, with the results presented in Table 36.

Table 36: Sound Pressure Levels and change in ambient sound levels at relevant NSDs for a 5 and 6 m/s wind with the Nordex H90 2500HS WTG

NSD	Estimated ambient sound levels, LAeq (dBA)	Modelled Noise Levels due to Wind Turbines, Concave Model (dBA)	Modelled Noise Levels due to Wind Turbines, ISO Model (dBA)	Change in Ambient Sound Levels due Wind Turbines, ISO Model (dBA)	Magnitude	Duration	Extent	Probability	Significance of noise Impact
5 m/s wind									
NSD01	37.3	18.8	27.8	0.5	2	4	2	1	8
NSD02	37.3	18.7	27.7	0.5	2	4	2	1	8
NSD03	37.3	22.4	29.9	0.7	2	4	2	1	8
NSD04	37.3	18.2	27.2	0.4	2	4	2	1	8
NSD05	37.3	14.1	24.6	0.2	2	4	2	1	8
NSD06	37.3	35.4	41.1	5.4	6	4	2	3	36
NSD07	37.3	16.2	26.9	0.4	2	4	2	1	8
NSD08	37.3	32.8	38.4	3.6	6	4	2	2	24
NSD09	37.3	18.1	27.7	0.5	2	4	2	1	8
6 m/s wind									
NSD01	40.85	21.8	30.8	0.4	2	4	2	1	8
NSD02	40.85	21.7	30.7	0.4	2	4	2	1	8
NSD03	40.85	25.4	32.9	0.6	2	4	2	1	8
NSD04	40.85	21.2	30.2	0.4	2	4	2	1	8
NSD05	40.85	17.1	27.6	0.2	2	4	2	1	8

NSD06	40.85	38.4	44.1	5.0	6	4	2	2	24
NSD07	40.85	19.2	29.9	0.3	2	4	2	1	8
NSD08	40.85	35.8	41.4	3.3	6	4	2	2	24
NSD09	40.85	21.1	30.7	0.4	2	4	2	1	8

10.8 Geotechnical Assessment

Access roads can best be built on the site by fully clearing the vegetated topsoil and overlaying the cleared surface with a coarse graded granular stone of thickness at least 0.3m.

The site gradients are generally sufficiently flat to allow the access roads to be built at gradients to match the natural topography and avoid any significant cutting and filling.

10.8.1 Wind Turbine Foundations

Bedrock is present on the site and blasting will be required for the turbine foundations. A detailed engineering geotechnical investigation will be required prior to construction.

10.8.2 Substation

No constraints have been identified for the substation foundations however a detailed engineering geotechnical investigation will be required prior to construction.

10.9 Heritage

10.9.1 Methodology

- Preliminary investigation
    - Survey of the literature

A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. The following sources were consulted – Beaumont & Vogel 1984; Bousman 2005; Playne 1910-1911; Raper 2004; Richardson 2001; Sampson 1970,1985; Wilson & Anhaeusser 1998. Information on events, sites and features in the larger region were obtained from these sources.

- Data bases

The Heritage Atlas Database, the Environmental Potential Atlas, the Chief Surveyor General (CS-G) and the National Archives of South Africa (NASA) were consulted. Database surveys produced a number of sites located in the larger region of the proposed development. The original Title Deed for the farm was accessed.

- Other sources

Aerial photographs and topocadastral and other maps were also studied - see the list of references below. Information of a very general nature was obtained from these sources.

- Field survey

The area that had to be investigated was identified by SiVEST Environmental Division by means of maps. The site was surveyed by walking transects over the areas indicated by Mr Lessing, the current owner of the farm, where it is proposed to establish the wind farm. In addition Mr Lessing was interviewed as to the possibility of sites occurring on the property and he kindly took some time off to point out the existence of a number of sites.

10.9.2 Identified sites

Based on the available literature, other sources and the field visit, the following heritage sites, features and objects displayed in Figure 66 were identified in the proposed development area. These areas are identified as sensitive features from a heritage resources perspective and are to be regarded as no-go areas. An adequate buffer zone for these areas can only be determined once the finds have been evaluated and assessed.

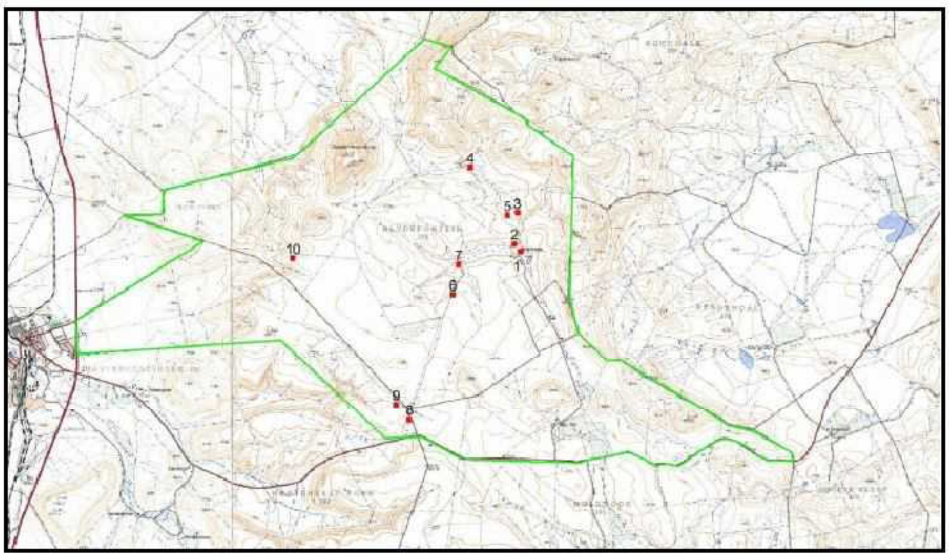

Figure 66: Map showing the location of the identified sites (Map 3125AA, 3124BB: Chief Surveyor-General).

- Archaeological sites

Archaeological sites can vary from open sites with surface scatters of material, to shelters sites where continuous occupation took place over shorter or longer periods of time. Sites can also vary according to use, ranging from living sites to special purpose (quarries, ritual significance).

Location	No. 3	S 31.14913	E 25.06651
Description			
Rock shelter occupied during the Later Stone Age. It was intensively investigated by Sampson (1970) and later again by Bousman (2005). It contained material ascribed to the Wilton industrial complex and some rock paintings. Some graffiti occur on the back of the shelter and some stone walling is located in the in front. In his analysis of material from the Blydefontein shelter Bousman was able to shown that during wetter periods the population increases, territories shrunk and mobility declined (Bousman 2005:219).			
Significance		High on a regional level – Grade II	
Mitigation			

This site is located in a valley which is outside the area of the proposed development. It is therefore highly unlikely that it would be impacted on. Based on current understanding of the project, it is also unlikely that the proposed development would have a physical or visual impact on the site. No mitigation measures are therefore required.

Figure 67: The rock shelter and some of the paintings inside.

- Farmstead

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

The architecture of these farmsteads can be described as an eclectic mix of styles modified to adapt to local circumstances. Farm buildings were generally single storied. Walls were thick and built in stone. The roof was either flat or ridged and thatched or tiled and was terminated at either end by simple linear parapet gables.

In some cases outbuildings would be in the same style as the main house, if they date to the same period. However, they tend to vary considerably in style and materials used as they were erected later as and when they were required.

Location	No. 1	S 31.15812	E 25.06733
Description			
Old farmstead dating to beginning of the 20th century. It includes a house, barn and stables, all dating to slightly different periods in time. The structures were built with stone and bricks and have reed ceilings. Most of it is very run down, but the owner plans to restore it for future tourism use.			
Significance		High on a regional level – Grade III	

Mitigation
This structure is located outside of the area of proposed development and therefore there would be no impact on it.


Figure 68: Views of the farmstead.

- Farmstead

Location	No. 3	S 31.13805	E 25.05443
Description			
Old farmstead possibly dating the late 19th century. Only the outer walls and foundations remain. An old threshing floor and stone walling demarcating agricultural fields occur in close proximity.			
Significance		High on a regional level – Grade III	
Mitigation			
This structure is located outside of the area of proposed development and therefore there would be no impact on it.			

Figure 69: View of the threshing floor, now mostly overgrown.

- Cemeteries

Apart from the formal cemeteries that occur in municipal areas (towns or villages), a number of these, some quite informal, i.e. without fencing, is expected to occur sporadically all over, but probably in the vicinity of the various farmsteads. Many might also have been forgotten, making it very difficult to trace the descendants in a case where the graves are to be relocated.

Most of these cemeteries, irrespective of the fact that they are for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore serve as important 'documents' linking people directly by name to the land.

Location	No. 2	S 31.15642	E 25.06580
Description			
Informal cemetery, probably for farm labourers. Approximately 20 graves, all only marked with stones. No names or other inscriptions could be found.			
Significance		High on a local level – Grade III	
Mitigation			
These graves are probably linked to the homestead discussed above. Therefore there would be no impact on it as a result of the proposed development.			

Figure 70: The identified cemetery.

- Farming related features

Location	No. 5	S 31.14978	E 25.06417
	No. 6	S 31.16822	E 25.05141
	No. 7	S 31.16127	E 25.05273
	No. 8	S 31.19755	E 25.04126

	No. 9 No.10	S 31.19414 S 31.15982	E 25.03819 E 25.01402
Description			
According to Mr Lessing, the owner of the farm, these structures were erected by sheep herders who brought the sheep up onto to high areas during the summer, and were vacated during winter when it became too cold. Typically these structures seem to consist of a small area used for sleeping and a larger enclosed space used to keep the sheep in overnight.			
Significance		High on a regional level – Grade III	
Mitigation			
Fortunately all of these structures are located in the valleys or on ridges, areas which are unlikely to be impacted on by the proposed development. However, if there is to be an impact on any of these structures, the relevant structures should be recorded in full (mapped, photographed and excavated) prior to the development taking place.			

10.10 Palaeontological Heritage

The fossil heritage within each of the major rock units that are represented within the Noupoort wind farm study area is outlined here, together with a brief account of Upper Beaufort Group fossil records from the Noupoort region itself. Note that a separate account of fossils from the uppermost Adelaide Subgroup (Pa) is not given because the upper part of the Palingkloof Member belongs to the same assemblage zone (i.e. the Lystrosaurus AZ) as the overlying Katberg Formation, and no exposures of Palingkloof Member rocks were identified in the field.

GPS data for fossil localities mentioned in the text are provided separately in an appendix to the palaeonotlogical report in Appendix 6.

10.10.1 Fossil heritage in the Katberg Formation and uppermost Adelaide Subgroup

The Katberg Formation is known to host a low-diversity but palaeontologically important terrestrial fossil biota of Early Triassic (Scythian / Induan - Early Olenekian) age, i.e. around 250 million years old (Groenewald & Kitching 1995, Rubidge 2005). The biota is dominated by a small range of therapsids ("mammal-like reptiles"), amphibians and other tetrapods, with rare vascular plants and trace fossils, and has been assigned to the Lystrosaurus Assemblage Zone (LAZ). This impoverished fossil assemblage characterizes Early Triassic successions of the upper part of the Palingkloof Member (Adelaide Subgroup) as well as the Katberg Formation and - according to some earlier authors – the lowermost Burgersdorp Formations of the Tarkstad Subgroup. Recent research has emphasized the rapidity of faunal turnover during the transition between the sand-dominated Katberg Formation (Lystrosaurus Assemblage Zone) and the overlying mudrock-dominated Burgersdorp Formation (Cynognathus Assemblage Zone) (Neveling et al. 2005). In the proximal (southern) part of the basin the abrupt faunal turnover occurs within the uppermost sandstones of the Katberg Formation and the lowermost sandstones of the Burgersdorp Formation (ibid., p.83 and Neveling 2004). This work shows that the Cynognathus Assemblage Zone correlates with the entire Burgersdorp Formation; previous authors had proposed that the lowermost Burgersdorp beds belonged to the Lystrosaurus Assemblage Zone (e.g. Keyser & Smith 1977-78, Johnson & Hiller 1990, Kitching 1995). It should also be noted that the dicynodont Lystrosaurus has now been recorded from the uppermost beds of the Latest Permian Dicynodon Assemblage Zone but only becomes super-abundant in Early Triassic times (e.g. Smith & Botha 2005, Botha & Smith 2007 and refs. therein).

Useful illustrated accounts of LAZ fossils are given by Kitching (1977), Keyser and Smith (1977-1978), Groenewald and Kitching (1995), MacRae (1999), Hancox (2000), Smith et al. (2002), Cole et al. (2004), Rubidge (2005 plus refs therein) and Damiani et al. (2003a), among others. These fossil biotas are of special palaeontological significance in that they document the recovery phase of terrestrial ecosystems following the catastrophic end-Permian Mass Extinction of 251.4 million years ago (e.g. Smith & Botha 2005, Botha & Smith 2007 and refs. therein). They also provide interesting insights into the adaptations and taphonomy of terrestrial animals and plants during a particularly stressful, arid phase of Earth history in the Early Triassic.

Key tetrapods in the Lystrosaurus Assemblage Zone biota are various species of the medium-sized, shovel-snouted dicynodont Lystrosaurus (by far the commonest fossil form in this biozone. contributing up to 95% of fossils found), the small captorhinid parareptile Procolophon, the crocodile-like early archosaur Proterosuchus, and a wide range of small to large armour-plated "labyrinthodont" amphibians such as Lydekkerina. Botha and Smith (2007) have charted the ranges of several discrete Lystrosaurus species either side of the Permo-Triassic boundary. Also present in the LAZ are several genera of small-bodied true reptiles (e.g. owenettids), therocephalians, and early cynodonts (e.g. Galesaurus, Thrinaxodon). Animal burrows are attributable to various aquatic and land-living invertebrates, including arthropods (e.g. Scoyenia scratch burrows), as well as several subgroups of fossorial tetrapods such as cynodonts, procolophonids and even Lystrosaurus itself (e.g. Groenewald 1991, Damiani et al. 2003b, Abdala et al. 2006, Modesto & Brink 2010, Bordy et al. 2009, 2011). Vascular plant fossils are generally rare and include petrified wood ("Dadoxylon") as well as leaves of glossopterid progymnosperms and arthrophyte ferns (Schizoneura, Phyllotheca). An important, albeit poorly-preserved, basal Katberg palaeoflora has recently been documented from the Noupoort area (Carlton Heights) by Gastaldo et al. (2005). Plant taxa here include sphenopsid axes, dispersed fern pinnules and possible peltasperm (seed fern) reproductive structures. Pebbles of reworked silicified wood of possible post-Devonian age occur within the Katberg sandstones in the proximal outcrop area near East London (Hiller & Stavrakis 1980, Almond unpublished obs.). Between typical fossil assemblages of the Lystrosaurus and Cynognathus Assemblage Zones lies a possible Procolophon Acme Zone characterized by abundant material of procolophonids and of the amphibian Kestrosaurus but lacking both Lystrosaurus and Cynognathus (Hancox 2000 and refs. therein).

Most vertebrate fossils are found in the mudrock facies rather than channel sandstones. Articulated skeletons enclosed by calcareous pedogenic nodules are locally common, while intact procolophonids, dicynodonts and cynodonts have been recorded from burrow infills (Groenewald and Kitching, 1995). Fragmentary rolled bone and teeth (e.g. dicynodont tusks) are found in the intraformational conglomerates at the base of some the channel sandstones.

Several Karoo vertebrate fossil sites are reported from the Katberg Formation and underlying rocks in the Middelburg – Noupoort region by Kitching (1977; see Karoo biozonation map in Figure 71). For example, he recorded as many as five different species of Lystrosaurus from good mountain slope exposures as well as road and railway cuttings in the Carlton Heights area near Noupoort. Abundant lystrosaurids, including three species of the genus, were found at Edenvale and on Noupoort Commonage (ibid., pp. 89-100). It is interesting that the spectrum of Lystrosaurus species recorded by Kitching (1977) in the Noupoort region – if correctly identified - suggests that Latest Permian beds referable to the Dicynodon Assemblage Zone may in fact be present here (cf. Botha & Smith 2007). This is supported by a recent search for fossil records from the Noupoort area in the Karoo fossil database at the BPI (Wits University) kindly undertaken by Mr Mike Day. Sites on the farms Naauwport 1, Bergendal 179, New Jakkalsfontein 172 and Carolus Poort 167 have yielded abundant material of Lystrosaurus together with Procolophon, Tetracynodon and a few specimens of Dicynodon.

An unusually diverse LAZ assemblage has recently been recorded from Barendskraal near Middelburg by Damiani et al. (2003a). The spectrum of nine or more tetrapod species found here includes Lystrosaurus (albeit with low abundance), therocephalians, archosaurs and several procolophonid reptiles. The poorly-preserved fossil flora recorded by Gastaldo et al. (2005) from the basal Katberg at Carlton Heights near Noupoort is of special interest because plant fossils are so rare in this stratigraphic interval.

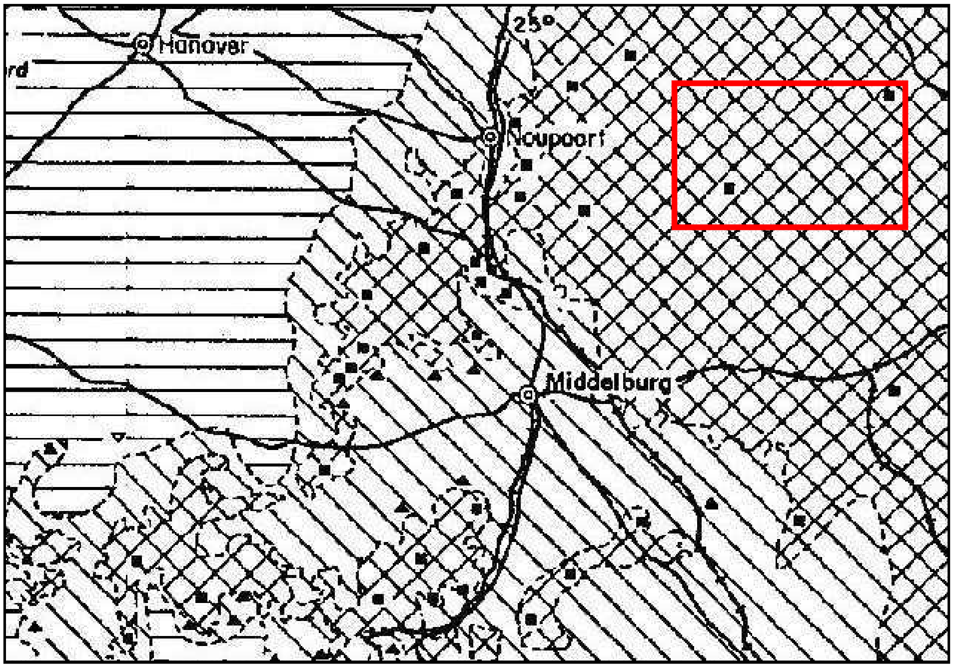

Figure 71. Fossil zonation map of the Middelburg – Noupoort region showing the occurrence of several fossil localities in the area to the east of Noupoort (red rectangle). Black squares here refer to fossils of the Early Triassic Lystrosaurus Assemblage Zone (mainly within the Katberg Formation). Triangles to the south are Dicynodon AZ fossils within Late Permian rocks of the Adelaide Subgroup. Figure modified from Karoo biozonation map of Kitching (1977).

Of the several potentially fossiliferous exposures of Katberg Formation sediments identified within the Noupoort wind farm study area during fieldwork, only three areas yielded significant palaeontological material (See specilalist palaeontological study for illustrations of the finds and GPS data).

The densest fossil remains were recorded within and below low cliffs of Katberg sandstone in the western escarpment zone on Blydefontein 168. The base of the thin Lower Katberg succession exposed here comprises maroon mudrocks containing small, irregular-shaped calcrete nodules that are overlain by grey-green siltstones with irregular sandstone blobs (possibly load balls). The base of the overlying channel sandstone sheet is formed by coarse, sandstone-hosted breccio-conglomerates of platy mudclasts as well as distinctive pale greyish-weathering calcrete glaebule conglomerates, locally cross-bedded, up to a meter or more in thickness and lenticular in geometry. Fragmentary reworked skeletal remains, including disarticulated skulls, postcrania and teeth (especially dicynodont tusks) are fairly common within the greyish calcrete conglomerates. Some of the fossils were clearly encased in ferruginous pedogenic calcrete before they were exhumed and reworked. Lenticular bodies of thin bedded, low angle cross-bedded sandstone also occur within the conglomerate zone. This is overlain by massive grey-green siltstones with rare "bone-bed" concentrations (e.g. Lystrosaurus skull and postcrania) and horizons of large ferruginous calcrete nodules representing palaeosols. The following prominent-weathering channel unit largely consists of well-sorted, thick-bedded buff sandstone showing well-developed horizontal lamination, primary current lineation and occasional tabular cross-bedding. The basal breccio-conglomerates contain large mudrock intraclasts associated with small flute clasts. This composite channel infill comprises several beds of buff sandstone separated by intraclast and calcrete-rich conglomerates. Thinner sandstone beds often show a distinctive deep erosional gullying into underlying overbank mudrocks implying high rates of denudation of the Katberg floodplain.

On the southwestern flanks of Langberg (Blydefontein 168) did not yield any vertebrate fossil remains, despite locally good exposures of maroon mudrocks and occasional thin sandstone interbeds. Low diversity trace fossil assemblages, primarily cylindrical vertical burrows attributed provisionally to the ichnogenus Skolithos, are common here and may form dense populations within thin calcretised siltstone horizons. Float blocks of coarse, greenish sandstone contain concentrations of rusty-hued impressions of fragmentary plant remains, none of which are identifiable. Plant fossils are notoriously rare in the Katberg Formation but have been previously recorded from Carlton Heights south of Noupoort (Gastaldo et al. 2005).

Closely-spaced localities 438-440 on Hartebeest Hoek 182 are situated in small stream gullies in the western escarpment zone. They lie within the lowermost part of the Katberg succession, which in this region has a gradational rather than abrupt contact with the underlying Adelaide Subgroup (Section 2.1). The spectrum of sedimentary facies seen here mirrors that which lies only 2.4 km to the northeast. Likewise, semi-articulated skeletal remains (e.g. of a small-bodied tetrapod, possibly a procolophonid reptile) occur within grey-green overbank mudrocks while scattered reworked bones and teeth are found in grey-weathering calcrete-dominated channel conglomerates. Vertical burrows ("Skolithos") up to several centimetres deep are locally abundant within calcretised siltstones. Centimetre-wide meniscate back-filled invertebrate burrows ("Taenidium") occur within similar settings here.

It is notable that excellent Katberg mudrock exposures examined in Oorlogspoort, just south of the study area, did not yield body fossils after a search of several hours, although trace fossils such as "Skolithos" are common here (N.B. only a very small portion of the available mudrock exposures in Oorlogspoort were examined; Locs. 431-434). Calcrete intraclasts within channel conglomerates are often irregularly elongate to vermiform in shale, and occasionally cylindrical. These delicate objects must have been of fairly local origin, though probably protected by debris-flow (slurry) processes during emplacement by flood events. They may well represent reworked calcretised plant rootlets and / or invertebrate burrows.

The new and very extensive road cuttings at Carlton Heights, 11.6 km south of Noupoort along the N9, provide outstanding vertical and horizontal sections through the Katberg Formation that are of considerable sedimentological interest (e.g. fossil mudcracks, channel geometries). Of palaeontological relevance here is the apparent rarity of vertebrate skeletal remains within the Katberg mudrock intervals here (cf Kitching 1977); only a few postcranial remains and a calcrete-encrusted tusk were identified during a search of two hours. Numerous examples of the cm-wide subcylindrical invertebrate burrow Katbergia occur here, penetrating down through grey-green mudrocks at an oblique angle. These burrows show surface scratch markings and have been tentatively attributed to decapod crustaceans (Gastaldo & Rolerson 2008, Bordy et al. 2010). Poorly preserved plant fossil assemblages were recorded from this area by Gastaldo et al. (2005).

10.10.2 Fossil heritage within the Karoo Dolerite Suite

The dolerite outcrops within the Noupoort study area are in themselves of no palaeontological significance since these are high temperature igneous rocks emplaced at depth within the Earth's crust. However, as a consequence of their proximity to large dolerite intrusions in the Great Escarpment zone, the Beaufort Group sediments nearby have probably been thermally metamorphosed or "baked" (i.e. recrystallised, impregnated with secondary minerals). Embedded fossil material of phosphatic composition, such as bones and teeth, is frequently altered by baking – bones may become blackened, for example - and can be very difficult to extract from the hard matrix by mechanical preparation (Smith & Keyser, p. 23 in Rubidge (Ed.) 1995). Thermal metamorphism by dolerite intrusions therefore tends to reduce the palaeontological heritage potential of adjacent Beaufort Group sediments. This is possibly apparent in the present study area on the northern margins of Blydefontein 168 where reworked calcrete nodules and any associated vertebrate fossil material (bones, teeth) within Katberg basal channel conglomerates has been dissolved away in the neighbourhood of dolerite intrusions.

10.10.3 Fossil heritage within the Late Caenozoic superficial deposits ('drift')

The relatively young - largely Quaternary to Recent - superficial deposits (colluvium, gravels, silty alluvium etc) in the Karoo region as a whole have been comparatively neglected in palaeontological terms for the most part. However, they may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals (e.g. Skead 1980, Klein 1984, MacRae 1999, Partridge & Scott 2000, Partridge et al., 2006). Other late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods, rhizoliths), ostrich egg shells, trace fossils (e.g. calcretised termitaria, coprolites, trackways), and plant remains such as peats or palynomorphs (pollens) in organic-rich alluvial horizons. Stone artefacts of Pleistocene and younger age may prove useful in constraining the age of superficial deposits such as gravelly alluvium within which they are occasionally embedded.

Thick successions of incised stream alluvium and colluvial deposits within the Noupoort study area were examined for fossil remains, generally without success. Surface gravels downslope from fossiliferous Katberg Formation exposures contain sparse reworked fossil bone fragments.

Some of the darker grey, fine-grained alluvium appears to be carbonaceous and may contain palaeontologically useful plant material (including palynomorphs).

10.11 Socio-economic

10.11.1 Potential Impacts: Pre-Construction

The following social change processes are expected during the **pre-construction phase**:

- Geographical change processes (land use changes), which will mainly relate to establishing site access and the clearing of the site;
- Demographical change processes, which would involve the arrival of the construction team component involved with site clearing (expected to be mostly unskilled workers); and
- Institutional and legal change processes, which would involve finalising the lease agreements with the affected landowners.

    - Geographical Change Processes

Based on the results of all the specialist studies, a buildable area within the site was identified. The buildable area avoids all social sensitive areas within the site (refer to Figure 72).

Figure 72: Buildable area within the Noupoort site in relation to social sensitive areas

The closest turbines are located approximately 4.4km east of Noupoort, approximately 650m southwest and 1km west of point 1, and approximately 740m west of point 2.

Figure 73: Turbine lay-out in relation to Social sensitive points

In terms of other structures on site, both substation and O&M alternatives 1 and 2 are located away from any of the social sensitive points as is construction laydown area 1. Construction laydown area 2 is located some 470m south of sensitive point 1 and would therefore not be preferred from a social perspective.

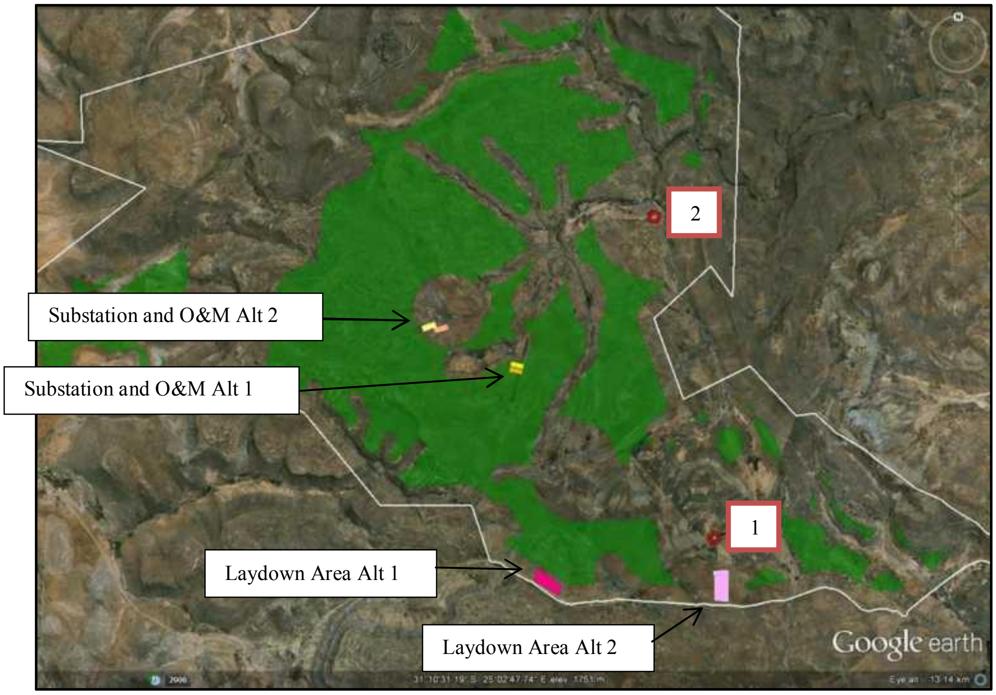

Figure 74: Building structures lay-out in relation to Social sensitive points

No relocation will be required during the pre-construction phase and therefore no impacts are foreseen in this regard apart from a nuisance factor to neighbouring landowners during the construction phase.

- Demographical Change Processes

At this stage it is foreseen that a very small team will be involved with the site testing and monitoring and that the site clearing will mostly entail unskilled labour that can be sourced locally. As such it is not foreseen that there will be any significant changes brought about to the size and composition of the local population during the pre-construction phase and hence no impact are foreseen during this phase of the project.

- Institutional and Legal Change Processes

During the preconstruction phase the lease agreements with the affected landowners will be finalised and effected. However, these negotiations are between the landowner and Mainstream and fall outside the scope of the study and as such have not been assessed in detail.

10.11.2 Potential Impacts: Construction

The categories of expected change processes during the **construction phase** are as follows:

- Geographical processes refer to the processes that affect the land uses of the local area, of which most is expected to be more long term and therefore has been assessed in more detail under the operational phase of the project.
- Demographical processes refer to the structure of the local community, of which most impacts would be due to the influx of people to the area in the form of the construction team and the in-migration of unemployed job seekers, if any.
- Economic processes refer to the livelihood of people in the area, and could entail a number of impacts, but during the construction period this would mostly be limited to employment opportunities.
- Institution and Legal processes refer to the processes that affect service delivery to the local area and could entail a change in housing needs, which in turn could cause an additional demand on municipal services.
- Socio-cultural processes refer to the processes that affect the local culture of an affected area, i.e. the way in which the local community live (however, sometimes different cultural groups occupy the same geographical area and these groups are seldom homogenous). During the construction phase changes would mostly be limited to possible conflict situations between local residents and newcomers to the area, most notably where there is a marked dissimilarity in social practices.

  - Demographical Change Processes

It is expected that the construction of the various components of the project (i.e. the wind farm, the substation and the transmission lines to link into the Eskom grid) would lead to a temporary change in the number and composition of the population within the affected local area during the construction period, which in turn could lead to economic, land use, and socio-cultural change processes. The following demographical change processes are expected:

Influx of construction workers; and
Increase of an in-migration of job seekers.

i. Influx of construction workers

Table 37 below provides an overview of the estimated size of the construction team. The size of the team should not be confused with employment opportunities, as it is expected that the bulk of these positions will be filled by skilled employees appointed by the contractor. However, Mainstream have indicated that they intend to source the bulk of the unskilled labour from the local area wherever possible.

Table 37: Wind Turbine Construction Team per Skills Level and Source for the 214 MW windfarm (Source: Project Proponent).

Skills Level	Number	District	National
Unskilled	214	214 (100%)	0 (0%)
Semi-skilled	107	75 (70%)	32 (30%)
Skilled	189	10 (5%)	179 (95%)
Professional	34	1 (1%)	33 (99%)
TOTAL	544	300 (55%)	244 (45%)

As reflected above, a construction team consists of a certain number of people (the size of the team depends largely on the type of construction required) and they enter the area with a very specific purpose. The time they spend in the area is clearly defined and often controlled as such (e.g. construction workers arrive on site in the morning and depart from the area in the evening), and due the nature of their work, their contact with local communities is expected to be limited. Once the project has been completed, construction workers who form part of a contractor's permanent workforce will move on to a next project and will seldom stay in the area.

As indicated in the baseline profile, the total population size in the ULM is estimated at 21,995 people, of which approximately 4,000 are resident in Noupoort. The sudden influx of approximately 244 people on the wind warm construction team will result in a rapid population increase of approximately 6.1% in Noupoort over the duration of the construction period (18-24 months). However it must be noted that not all these people will be on the site at the same time as the construction process is phased. Accommodation sources have been identified in the town by the developer and these will be utilised during construction.

Although the population might be able to absorb the additional amount of people, their presence can lead to a number of changes within the community, such as an increase in housing needs, a rise in conflict situations, and health issues such as an increase in the HIV/AIDS infection rate. These have been discussed and assessed under the appropriate change processes.

ii. Increase of in-migration of job-seekers

Unlike the regulated circumstances surrounding a construction team, the influx of job seekers is unregulated and often very difficult to control. It is also very difficult to predict how many job seekers could be expected and the extent to which they can change the size and composition of the local population, as the intensity of the effect will be influenced by the actual number of job seekers.

Unfortunately, projects in the public domain often unintentionally create unrealistic expectations, especially amongst communities where unemployment is high and poverty is rife. Job seekers then become a burden to the host community, as they do not have the means to sustain themselves, thereby becoming dependent on others (usually people who themselves only have limited resources). It is then likely that the presence of job seekers could lead to the formation or expansion of informal settlements (cumulative impact).

As is the case with the influx of construction workers, the actual in-migration of unemployed jobseekers might not yield a significant change to the community (although that is dependent on the uncertain number of jobseekers), but their presence can lead to a number of change processes and impacts, such as the expansion of informal settlements giving rise to an additional demand on municipal services, conflict situations over job opportunities and other limited resources, etc. These have been discussed and assessed alongside the presence of construction workers under the various relevant change processes as cumulative impacts.

- Economic Change Processes

It has been assumed that the construction of the Noupoort wind farm will be completed within 24 months. The construction costs will be spread equally between the 2 years. Construction involves:

- Wind turbines generating up to 188.6MW;
- Access roads;
- Power lines;
- Wind farm control room; and
- Temporary construction lay down area.

- Direct employment and output

During the construction phase it is estimated that 313 new jobs will be created for the 2 year construction period of which 190 jobs will be locally sourced, 122 from the rest of South Africa and 21 from outside the borders of South Africa.

Local jobs created would therefore be 313 per annum (for a two year period), i.e. almost 10.4% of the 3 022 jobs created in 2010 (IHS Global Insight, 2012) by the formal economy of Umsobomvu Local Municipality (ULM) – a significant percentage for a single project. The majority of jobs will be unskilled (65%) followed by semi-skilled jobs (31%) and skilled (4%) jobs. While this could be good news in terms of job opportunities for the large portion (72%) of the adult population (20+years) without complete secondary education in ULM (StatsSA Community survey 2007), the opportunity has a limited time span (24 months) and could also mean limited opportunities for skills upgrading depending on the policies of the contracting companies in terms of associated training.

In terms of the direct impact on local output or gross value added (GVA) of the area the estimated additional R129m of value added created per annum for a two year period could make a rather significant contribution towards the annual domestic production of the ULM, representing almost 22% of the entire ULM gross value added (economic production) of 2010 – a significant percentage for a single project within any area.

- Economic multiplier effe cts

Construction activities also have an indirect impact on the economy through backward linkages with suppliers of construction materials and other inputs such as consulting services. Based on information supplied by the developers as well as the Northern Cape Social Accounting Matrix (DBSA, 2011), it is estimated that additional temporary jobs in the local economy could be as high as 53 jobs for a two year period due to increased activity of local traders and producers of construction materials and equipment, transport services, accommodation services etc. Local production could potentially increase by an additional R10m per annum for a two year period due to supply linkages with the construction of the Noupoort wind farm.

Apart from the indirect contribution of suppliers to the construction of the wind farm, the induced effect relates to the multiplier effect of the income received by construction workers and workers in the supply industries being spent on goods and services in the local economy. It is estimated that the induced effect could create an additional 50 jobs during the two-year construction period and contribute an additional R14m towards local production.

A large portion of construction inputs will be supplied outside the local economy creating an estimated R 112m value added in the rest of South African economy and an additional 510 jobs in the construction supply industries outside the local area. The induced spending is furthermore expected to create an additional 72 jobs during the construction phase and add some R22.4m towards the rest of the South African economy's output.

The total impact on the local and national economy during the construction phase

The total annual impact of the construction of the Noupoort wind farm on local and national employment and output levels is expected to last for two years and can be summarised as follows:

Type of impact	Local employment (nr of jobs)	Local output: Gross value added (Rm)	% of local employment (3 022 jobs in	% of local output (R580 m in 2010)	Employment SA (incl local) (nr of	Output SA (incl local) Gross value	% of SA employment (total=8.2 m formal jobs in	% of SA output (total = R2412 bn in

			2010)		jobs)	added (Rm)	2010)	2010)
Direct impact	313 (190 locally sourced)	129	10.4	22.2	313	129	0.004	0.005
Indirect impact	53	10	1.8	1.7	563	122	0.007	0.005
Induced impact	50	14	1.6	2.4	122	36	0.001	0.001
Total impact	416	153	13.8	26.3	998	287	0.012	0.011

Sources: Based on information supplied by developer, IHS Global Insight, 2012, Stats SA, 2007 and 2011, DBSA, 2011

The total impact on the Umsobomvu labour force:
Number of jobs created for local people by the wind farm = 293 jobs
Total number of formal jobs in local economy = 3 022 in 2010
Total number of informal jobs = 480 in 2010
Total number of unemployed people in the local area = 3 668 in 2010
% unemployment = 51% of labour force
Locally created jobs as % of informal employment and unemployment = 7%

- Institutional & Legal Change Processes

Institutional and Legal Change Processes assesses the way in which a development of this nature could change the face of service delivery in the affected area, the power relationships between groups and how people are able to negotiate through situations that might affect their lives. During the construction phase the most significant expected change to occur is the need to accommodate the construction team.

The professional team is normally housed in formal accommodation (guest houses, lodges, etc.) in town. As far as could be determined there are 3 guesthouses/B&Bs, 2 hotels and 2 guest farms in Noupoort and surrounds. At this stage it is assumed that the hospitality industry in the area would be able to absorb the additional demand in housing for the length of the construction period and that, in line with Mainstream's intention, there will not be a need for a residential construction camp (also given the fact that unskilled labour will be sourced from the local area and therefore already resident in the area, i.e. they will not require housing). Where existing housing is used, it is not foreseen that additional demand on municipal services will be exerted within town.

Mainstream have stated that water will not be sourced from the local municipality but rather from local farms (presumably those with sufficient boreholes and reservoirs), electricity will be sourced from Eskom as part of a connection agreement; and that the construction area will not be connected to the municipal sanitation grid. Overall this means that municipal water and sanitation should not be affected by the proposed project.

The municipal services directly affected by the proposed project during the construction phase include electricity (as per a connection agreement between Eskom and Mainstream removal of liquids from a conservation tank and refuse removal. Mainstream have projected that during construction the refuse created will likely be the equivalent of that created by 20 households. Moreover, although sanitation facilities will be organised by Mainstream and will not be connected to the municipal grid, it has been indicated that the municipality may be required to provide services in the form of removal of a conservation tank – approximately 5Kl to be removed per month.

It is not predicted that the provision of electricity (through Eskom and subsequent to formal agreements), slightly more refuse removal services, and conservation tank removal services will place unmanageable strain on municipal services. Rather, a minor and achievable service-related outlay is likely to ensue.

- Socio-Cultural Change Processes

As socio-cultural processes recount the way in which humans behave, interact, and relate to each other and their environment, socio-cultural change processes in turn looks at the way in which the proposed developments can alter the interactions and relationships within the local community. In line with the results of the scoping study, conflict situations are the most important socio-cultural change process expected during the construction phase. In addition to the Scoping study results, health and safety has been identified as an additional socio-cultural change process during the construction phase.

  - Risk for Social Mobilisation (Conflict)

Attitudes are formed by means of people’s take on a specific issue, coupled with their past experiences associated with either the issue itself or, more likely, the way it has been dealt with by those responsible for creating the situation in the first place. A person’s attitude towards a certain issue or situation can strongly influence the way in which that person views subsequent issues/situations of a similar nature. If local residents are unsupportive of either the proposed project in question or of the project proponent, it could lead to social mobilisation.

The risk for social mobilisation greatly increases if the project proponent is perceived as distrustful, i.e. if they do not deliver on their undertakings with the local residents in terms of employment creation, etc. To ensure support of the project and reduce the risk of social mobilisation, the project proponent should at all times be seen to care about the residents of Umsobomvu LM and its human settlements that will be affected by the construction and operation of the proposed wind farm and associated infrastructure. At this stage Mainstream Renewable Power has a 'clean slate' in the area, but to maintain a trust relationship, residents need to feel that they receive some tangible benefits from the project, e.g. direct and/or indirect employment. The undertakings and mitigation/enhancement measures stipulated in the Environmental Management Plan (EMP) should be implemented effectively and with due diligence to show local residents and affected populations that their needs are important and catered for. In particular the no-go buffer zones mentioned in this report should be maintained.

I&APs have indicated that they expect that any job opportunities would be primarily afforded to them before such positions are advertised on an open market outside the borders of the local area. Although the risk for social mobilisation at this stage of the project is regarded as low, the situation can easily change if local residents are disregarded. If social mobilisation does occur, it could not only severely delay the construction process, but also lead to intense situations of conflict that ultimately affect social well-being.

- Health and Safety

In this context health and safety impacts focus mainly on the spread of certain sexually transmitted infections (STI), including HIV/AIDS. It is not uncommon for construction workers who are separated from their families for a period of time to establish temporary sexual relationships with members of the local community. Disempowered and desperate local women often view construction workers as financially well-off. This can lead to an increase in prostitution. Other women just enter into normal (sexual) relationships with construction workers believing that they will be supported financially. These situations have the potential to lead to an increase in pregnancies within the local community and eventually single parent households without financial support.The spread of STIs and HIV then become matters of great concern, also in light of the fact that construction workers move out of the area into another areas where the spread of STIs and HIV may continue.

The Northern Cape Provincial Government has set HIV/AIDS as a major point of concern and has indicated that one of their core aims is to reverse the HIV prevalence rate by 2014. The Social Development Unit in the Directorate: Community and Social Development Services deal with issues such as TB/STI/HIV/AIDS programmes and poverty alleviation and as such the Unit provides voluntary counselling and testing services and is also involved in the following activities:

- Provision of responsive reaction to TB/STI/HIV/AIDS prevention and treatment through regular education.
- Provision of support through Peer Educators and EAP members and support group.
- Provision of Anti-Retro-Viral drugs (ARVs).
- Provision of condoms at all times.
- Commemoration of special events like TB Day; STI/ Condom Week; ‘Candle-light’ & World Aids Day.
- Monitoring and evaluation of the programme on an annual basis.

In line with the municipality’s efforts in reducing the HIV prevalence rate, the project should ideally develop a comprehensive Health and Safety Plan that includes an HIV prevention plan. The HIV prevention plan should link up with the local municipality’s initiatives and should extend to local communities.

Also included under health and safety is the quantity and quality of the water supply and sanitation services. If these services are inadequate and/or not managed properly, it could lead to waterborne diseases and unhygienic living conditions. These conditions will not only affect the construction workers, but can also spread to the local community, more so in the event of a construction village that is not managed properly.

A further consideration under health and safety is the perception amongst local communities (landowners) that the presence of construction workers leads to an increase in crime levels. However, it should be noted that it is most likely not the actual construction worker who engage in criminal activities but more likely job seekers who loiter in the area or at the construction site.

10.11.3 Potential Impacts during Operations and Maintenance

The categories of expected change processes and resultant impacts during the operations and maintenance phase are as follows:

- Geographical processes in this case would be the long term loss of land, a change in access in resources that sustain livelihoods and the presence of new infrastructure. Most of the land use change would result in economic impacts. It must however be noted that a maximum of 55 ha of 7400 ha i.e. less than 1% will be lost to the project and farming activities will be able to continue on the property.
- No further impacts are foreseen as part of demographical change processes during the operations and maintenance phase as the maintenance teams are too small to warrant a significant change to the size and composition of the local community.

- Economic processes, which would entail a large number of impacts in terms of employment, , diversification of the local economy, social income, opportunity costs of the development and impact on rural/agricultural property prices.
- No further impacts are foreseen as part of the institution and legal change processes during the operations and maintenance phase.
- Socio-cultural processes refer to the way in which the local community live and therefore the visual presence of the wind farm and associated infrastructure can affect their sense of place, especially where the landscape of an area went from ‘pristine’ to ‘spoilt’. In addition certain physical health and safety aspects pertaining to the operation of the wind farm turbines must be considered.

  - Geographical Change Processes

The identification and assessment of social impacts arising from geographical change processes within a social context, focuses on how the proposed development might impinge on the behaviour and/or lives of landowners and/or land users in the affected area. The following geographical change processes and resultant impacts were assessed:

- Permanent loss of land; and
- Change in access to resources that sustain livelihoods.
- Presence of roads, bridges and connection routes to the site (new infrastructure).

i. Long Term Loss of Land

There will be a long term loss of land on the site (less than 1% of the land under development) and within the local area due to this project. Based on a review of maps and IDP documentation it does not appear that any institutional loss of land will occur due to this project (i.e. planned developments and/or currently existing municipal/institutional infrastructure). For this reason any indication thereof within the scoping report has been dismissed for this SEIA. Potential loss of private land is according to the section below.

ii. Change in access to resources that sustain livelihoods

Any effect on agricultural processes could hold negative outcomes for those employed in agriculture, those who hold ownership over the agricultural activities, and for food security locally.

The nature of these impacts would largely be of an economic nature and as such have been assessed in the Economic section of this report.

iii. Construction of roads and connection routes to the site

Mainstream have stated that they plan to construct roads on the site areas in order to connect turbines, administration buildings and other planned infrastructure. These roads will be within the confines of the site area (as existing farm roads will be used as far as possible) which itself will be fenced off and will be home to an array of larger infrastructure. Additionally, there will be new roads constructed in and around the site as well as new infrastructure in the form of one (or perhaps more) bridge. This means that further road infrastructure will be created but largely within an area in which major infrastructure is already planned and in an area that will not be accessed by the general public. Alterations to existing roads would include strengthening them, the creation of turning circles for large trucks, and the construction of culverts over gullies and rivers should this be required.

Overall then, permanent changes to road infrastructure will be largely of a positive and strengthening nature although any damage to roads that comes about due to the transport of heavy machinery or the presence of heavy duty trucks may pose a long term impact.

- Economic Change Processes

i. Direct employment and output

A recent study by Greenpeace has indicated that in South Africa, the operation and maintenance of wind energy facilities accounts for approximately 0.72 job years per MW (in EEU, 2011) equating to 154 jobs created during the design life of a minimum of 25 years. As is the case with other wind farms, the Noupoort wind farm's figures are much lower as the figures noted the direct jobs at the Noupoort facility and not the indirect jobs nationally. According to figures provided by the developer, only 22 permanent jobs will be created in the operation of the wind farm mainly sourced from the local area (17) and the rest mainly from the national economy. The majority of these jobs will be unskilled (70%) or semi-skilled (24%).

The operation of the plant is furthermore expected to contribute some R 636m towards the value of final goods and services produced within the boundaries of the ULM. The SPV must have 40% South African ownership, 2.5% must be owned by the local community through a local Trust, ownership of which will be funded by the likes of DBSA, IDC etc. Therefore a minimum of 40% of dividends will be staying within South Africa. A minimum of 2.5% of dividends will go towards the local Trust which will be spent on projects within a 50km radius of the project for the upliftment of the community.

Land is leased by the wind farm from local farmers. The lease is a cost incurred by the wind farm, paid from its revenue, therefore reducing the wind farms profits and dividends. The lease costs paid by the wind farm will therefore be 'retained' in the community (by the farmer).

ii. Economic multiplier effects

Linkages to suppliers during the operational phase are mainly restricted to repairs and maintenance of the plant that could add almost R3m to local production annually and some 6 additional jobs. However it is expected that the larger part of maintenance and repair expertise would come from the rest of South Africa with an additional R27m added to national output and 54 additional jobs created outside the local area.

The induced effect relates to the multiplier effect of the income received by workers in operations and maintenance being spent on goods and services in the local economy. , the salaries and wages of local workers, the lease income from local farmers and a large % of retained profits in the form of corporate social investment could be expected to be spend within the local economy. It is estimated that the induced effect could create an additional 26 jobs and contribute an additional R7.3m towards local production.

In the broader economy the spending of earnings from workers employed by industries that benefit from maintenance and repairs spending of the Noupoort wind farm could potentially contribute to an additional R 5.5m in output and 17 jobs.

The total impact on the local and national economy during the operational phase

The total impact of the operation and maintenance of the Noupoort wind farm on local and national employment and output levels is summarised below:

Type of impact	Local employment (nr of jobs)	Local output: Gross value added (Rm)	% of local employment (3 022 jobs in 2010)	% of local output (R580 m in 2010)	Employment SA (incl local) (nr of jobs)	Output SA (incl local) Gross value added (Rm)	% of SA employment (total=8.2 m formal jobs in 2010)	% of SA output (total = R2412 bn in 2010)
Direct impact	22 (17 locally sourced)	636 (17 excluding profit)	0.6	109.6 (2.9% excl profit))	22	636	-	0.03
Indirect impact	6	3	0.2	0.5	60	30	-	-
Induced impact	26	7.3	0.9	1.3	43	12.8	-	-
Total	54	646.3	1.5	111.4	125	688.3	0.002	0.03

impact				(4.7% excl profit)				

Sources: Based on information supplied by developer, IHS Global Insight, 2012, Stats SA, 2007 and 2011, DBSA, 2011

The total impact on the Umsobomvu labour force:
Number of jobs created for local people by the wind farm = 49 jobs
Total number of formal jobs in local economy = 3 022 in 2010
Total number of informal jobs = 480 in 2010
Total number of unemployed people in the local area = 3 668 in 2010
% unemployment = 51% of labour force
Locally created jobs as % of informal employment and unemployment = 1.2%

iii. Diversification of the local economy

The tress index shows the level of diversification of an economy with an index value of 100 showing an economy relying on only one sector while an index value of 0 shows a perfectly diversifies sector where all sectors contribute equally to the total economy. In 2009 the Northern Cape economy had a tress index of 47.8, significantly higher than the 39.6 of the national economy (IHS Global Insight, 2012). Underlying the relatively high tress index value of the Northern Cape is the high contributions made by the mining, finance and services sectors.

The ULM economy is more concentrated than the Northern Cape economy in general with economic activity concentrated in agriculture (13%) and services (37%) – a typical situation in many undeveloped rural economies. The development of the renewable energy industry could therefore play a significant role to diversify the economy away from the climate-dependent agricultural sector and the public service sector. The wind farm is furthermore expected to pay relatively higher wages to unskilled labour than is the case in the agriculture and tourism sectors.

iv. Social income

- Additional central government tax revenue

With total tax revenue calculated as 26% of national value added in 2010, it follows that 26% of the total value added generated by the project could probably be added to central tax revenue, i.e. R179m (26% of R688.3m value added. This includes revenue generated for central government through direct taxes (company and personal taxes) as well as indirect taxes (e.g. VAT). This presents about 0.03% of the R 656 bn government tax revenue collected between 2010/11 (SARB, 2012).

- Net income to local government

Municipal income from property tax will increase since the new structure would most probably be classified as public service infrastructure (not exempt) and not as plant and equipment (exempt) (Interview with DDP Valuers, 20120).

The municipal services that the wind farm needs from the local authorities is expected to be minimal, i.e. limited to 5kl fluids/ per month to be removed from a preservation tank and refuse removal equal to that produced by one household. If the local authority will provide the service we could furthermore assume that municipal costs will mainly be offset by charges to the wind farm.

- Corporate social investment

Of the expected profit of R619m, a substantial portion (R46.4m per annum or 7.6% of profits) will be retained for development in the form of an enterprise development fund (0.4% of profits) socio economic development fund (1.1%) and a community development funds (building up towards 6% of profits after debts has been paid by trust). The total fund of R46m per annum is expected to be reached within a ten to fifteen year period after inception. This is a substantial percentage by any standard and especially high if compared to the ULM economy, namely 8% of the total output of the local economy in 2010. The amount is also almost thrice the value of the wages paid to workers in the operation of the wind farm (R17.1m per annum). Coming from a single project, the R46.4m social funds is more than 10% of the entire social development budget of the entire Northern Cape and almost 1% of the joint provincial budget for health and education budgeted for 2010/11 (Northern Cape Treasury, 2008).
Given the size and the potentially large influence of corporate social investments planned for the project we have also focussed on approaches in terms of institutional arrangements towards social investment funds as well as potential corporate social investment (CSI) priority areas for the Northern Cape.

- Corporate social investment structures and approaches

The first question to answer is who are the communities that should participate, ultimately the beneficiaries? The communities need to be defined, communal structures established and representatives identified and/or elected. The leading approaches are based on:

Firstly, gaining an understanding of the existing community structures, dynamics and identifying the key socio-economic initiatives, programmes being delivered through e.g. government, Civic organisations, LED forums, NGO's and private initiatives.
Secondly, identify community groupings for participation, such as key civic organisations, forums, societies and other role players.
Thirdly, identify community groupings for participation and develop clear criteria for the selection of individual representatives.

In applying this process experience has shown that there are significant benefits to be derived from building on a variety of existing community structures and groupings. Initiatives that strive to develop entirely new community body(s) often find they are undermined by existing structures, frustrated by gate keeping and/or become politicised. The community/beneficiaries would be typically represented by Board members or Trustees depending on the institutional models applied.

It is critical that at the time of establishing the community representative bodies that clear purpose and criteria for the allocation of funds are developed and captured in the founding documentation (statues). These criteria should indicate the criteria on which the basis of funding amounts and allocations are to be made and detail the decision making process to be applied. The criteria and process to be applied need to be openly and effectively communicated to all stakeholders. The majority of problems experienced with community participation models revolve around conflicts pertaining to the allocation of funds, often resulting in the total collapse of the community representative body. Most of these challenges can be address trough developing clearly defined purposes for fund allocation, criteria for funding decisions and defined and transparent decision making process.

The challenge is to ensure that the revenues generated are effectively and efficiently applied in accordance with the community priorities. The community and/or individuals in the community could potentially participate in the benefits of the social trust fund in a variety of ways, namely through:

- Local government structures;
- Local Economic development Forums;
- Direct community involvement;
- Entrepreneurial participation directly in the venture or provision of supporting services e.g. maintenance and transport;
- Community participation (Trusts and section 21 companies), intern investing in or supporting community development initiatives;
- Community bodies (societies and associations) addressing a variety of community needs and interests;
- Non-governmental organisations; and
- Development programmes e.g. school feeding schemes, market gardening schemes, HIV Aids programmes etc.

- Community development priorities

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) states that poverty reduction is the most significant challenge faced by the provincial government and its growth and development partners. Furthermore, it emphasises the following priority areas have to be addressed:

- Reducing the backlog in basic needs such as water, sanitation and housing
- Improving basic services such as health, education and social services
- Reducing the HIV/AIDS prevalence rate
- Creating employment opportunities
- Reducing the crime rate
- Empowering vulnerable groups

Taking a lead from the NCPGDS, drawing from the earlier socio-economic scoping work undertaken, coupled with a cursory review of the local municipal IDP's, the following development priorities emerge.

Priority areas	Key priorities identified
Provision of basic services	Services: Sanitation Water (potable & agricultural) Housing Electricity Roads (gravel upgrades & tarring main roads) Facilities: Community centre Recreational /sports facilities
Poverty alleviation	Poverty relief schemes School feeding schemes
Unemployment	SME and farmer development promotion: Enterprise funding Training and mentorship Training and re-skilling: Adult education Skills training Expanded public works programmes
Health programmes and Social Services (awareness and direct support)	Supporting individual programmes and initiatives to address priority health challenges HIV/AIDS prevalence Alcohol abuse TB
Education (enable access to opportunities – mobility)	Investment in school infrastructure (physical facilities and staff) Bursaries to performing students

Increasingly emphasis in CSI programmes is being placed on supporting social investment to address basic needs through the following priority interventions:

- Provision of basic services: There is increasing focus in development initiatives on focusing scare resources on providing basic services. In this regard the key priorities are in addressing:
- The backlogs in sanitation and housing through for example the continued roll out of access to flush toilets in line with the sated National Government priorities.
- Improving the access to water, particularly potable drinking water and livestock drinking water. This could be through investing in community wells and boreholes following models applied successfully in other parts of Southern Africa.
- The improvement of road infrastructure, particularly upgrading deteriorating gravel roads and tarring more major roads. In this regard to maximise community participation and also support poverty relief and employment consideration could be given to the Zibambele process applied successfully in KZN, where communities take responsibility for maintaining sections of road for a maintenance fee.
- Provision of improved education: There is an increasing acceptance that a key development intervention in depressed rural areas, characterised by limited job opportunities and high unemployment, is to improve education to enable job seekers to migrate and secure jobs in urban centres. In this regard most community based development initiatives are placing significant priority on improving education standards through investing in educational infrastructure.
- Direct poverty and health interventions: The Northern Cape rural communities are characterised by significantly high levels of poverty, coupled with specific challenges pertaining to health, particularly in terms of AIDs, Alcohol abuse and TB. In this regard investment into feeding schemes and improvements in access to healthcare facilities and services are regarded as a priority. Integrated models successfully being applied in the Eastern Cape could be considered, where the feeding schemes are integrated with supporting market gardening initiatives, which in turn provide produce to support school feeding schemes.

v. Potential opportunity costs of the development

- Development opportunities

No alternative development projects are currently under review for the site.

- Agricultural output

Combining the total land area of the Northern Cape of 361,830 square km and 98% used for stock farming (Department of Agriculture, undated) with agricultural output and employment figures of R3 938 m (IHS Global Insight, 2012) and 44 000 jobs respectively in 2010 (Department of Agriculture Forestry and Fisheries, 2010) it is deduced that the average agriculture output and employment for the province is R11 105 and 0.12 jobs per square kilometre respectively.

Of the 74 square kilometres planned for the Noupoort wind farm about 3% of agricultural land is expected to be displaced assuming that cattle will be allowed to graze inside the facility. Assuming provincial averages for the area, we can roughly surmise that around R 25 000 of agricultural output and one low-paid job per annum might be forfeited by changing the land use of the area from agriculture to a wind farm. However it is more likely that excess farming stock will be shifted to adjacent areas with no economic implications but with potentially implications for bio-diversity resulting from over-grazing.

- Tourism

The contribution of hotels and accommodation towards total output is relatively high (1.2%) in ULM especially compared to the Northern Provincial average of 0.4% and the fairly tourism intensive economy of the Western Cape (1.4%).

Determining how wind farms directly affect the tourist industry is problematic and many researchers believe the evidence is inconclusive. A large number of international surveys conducted among tourists show that most tourists (70 – 91%) are not bothered by the presence of wind farms, and an increase of wind farms in the area would not deter them from visiting again (in EEU, 2011).

It is furthermore suggested that the type of tourism to the area consist of stay-over visits, visiting family and business tourism, i.e. tourism categories that will not be affected negatively by the wind farm and could even be influenced positively by the wind farm due to an increase in business tourism and stay-over visits en route to the south or north.

vi. Impact on rural/agricultural property prices

International studies reveal conflicting results related to the effect of wind farms on property values. Arguments can go both ways (EEU, 2011).

In a local survey of estate agents with experience of in the Darling and Yzerfontein property markets in the vicinity of the Darling wind farm that has been in operation since 2008, estate agents are unanimous in their opinion that the wind farm had no impact on property prices in the area. The single opinion was also that the wind farm would not deter future investors nor cause people to move out of the area. In an area like Noupoort with vast spaces of open agricultural land and where land uses are predominantly agricultural, it is not likely that the proposed wind farm would impact property values since it will not in any way affect the agricultural activities or productivity on these properties (EEU, 2011).

In the case of Noupoort, the labour sources outside the local area (i.e. 140 mainly skilled jobs) during construction could potentially temporarily increase property rental prices at the higher income end of the property market as 140 new families could have an impact within a local municipal area with only an estimated 5 500 households. However it is more likely that the temporary skilled labour component would only visit the area as contract workers for periods during the two year period and would therefore be more likely to use local guesthouses and B&Bs. The five additional families that could result in the operational period are not expected to have any significant impact on property prices.

- Socio-Cultural Change Processes

The most important socio-cultural change during the operation and maintenance phase relates to a change in sense of place.

Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms. It is because of a sense of place and belonging that some people loath to be moved from their dwelling place, despite the fact that they will be compensated for the inconvenience and impact on their lives.

Place attachment is a construct that is used to determine and/or explain sense of place. Kyle et al. (2003b page 250) stated that place attachment "is the extent to which the individual values or identifies with a particular environmental setting." It has to with meaning and value, an intimate connection with an environment.

Place attachment is generally recognised as having two components: Place Identity and Place Dependence. According to Proshansky et al. (1983) place identity refers to the way in which a person views the self in relation to the environment. It refers to the way in which a person uses a place to construct or maintain self-identity (e.g. a conservationist). In contrast, place dependence refers to the way in which the environment is able to fulfil the intentions of the user (e.g. hunt, farm, relax).

Stedman (2003b) presented research that has found that repeated experience led to strengthening of attachment, including developing emotional ties and self-identity. The familiarity with an area may therefore differ between visitors and local people, leading to differences in attachment. However, research findings indicate that direct contact with a place is not necessary for place attachment to develop. Proponents of the socio-cultural perspective on sense of place support this research. Blake (2002) argued that places could have symbolic and cultural meaning for groups of people, which leads to place attachment even though they have never been there.

Stedman (2003a) uses the term place meanings to describe the dimension of sense of place which is more cognitive than emotional (place attachment is more emotional). It has to do with evaluative and symbolic beliefs. For example: "The bushveld is a place favoured by hunters" refers to place meaning, whereas place attachment is communicated by: "My favourite place is the bushveld." According to Stedman, place meaning can change over time, independently of place attachment. Levels of attachment may not change despite the presence of a wind farm, but the meanings that people attach to it may change. Levels of attachment might not change because place attachment may be based on social relationships, rather than the physical appearance of a landscape.

Research on the psychological experience of sense of place suggests that people rapidly discount a landscape as soon as the first scar occurs, rather like a stain ruining a favourite garment (Petrich 1993). Thereafter, any additional impacts on the landscape have a correspondingly smaller effect. Hence, the aesthetic impact of placing any form of development in a landscape that already bears the marks of development would be less than that of placing it in a relatively unspoilt environment. In discussing the diverse research showing that people overwhelmingly prefer “nature scenes” to urban and built environments, Zadik (1985) explains "people seem to respond to environments as natural if the areas are predominantly vegetation and do not contain human artefacts such as roads or buildings."

Finally for this section it must be pointed out that the potential impact on socio-cultural behaviour and the related perception of environmental changes can have either a positive or a negative impact on sense of place (e.g. peace of mind vs. frustration/anger). The introduction of a new project to the area can be viewed as a positive impact if people perceive the project as infrastructural and/or economic development that is not intrusive on their lives and does not cause them immediate danger. Potential negative impacts include the visual impact (to be assessed in the visual specialist’s report) and the resultant intrusion on sense of place. Furthermore, much of the possible negative impact rests upon the sentiments of the individual perceiver. Some may find the wind farm to be an unwelcome intrusion which degrade the natural beauty of the landscape and reduce the natural qualities to which they are accustomed. Others may find such it to be a welcome sign of progress and infrastructure development, as well as a conservation effort towards ‘green energy’.

In addition to considering the psychosocial and emotional aspects, an assessment of sense of place also has to consider the physical placement of the infrastructure associated with the wind farm within a demarcated site area that would affect as few people as possible. Problem areas in this regard were highlighted as part of geographical change processes during pre-construction impacts.

11 ENVIRONMENTAL IMPACT ASSESSMENT

11.1 Methodology for Impact Assessment

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

11.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 39.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

11.1.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

- Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating (Table 37). In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 38: Description

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse		

activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY/ MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the		

following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 39: Rating of impacts

IMPACT TABLE FORMAT	
Environmental Parameter	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water
Issue/Impact/Environmental Effect/Nature	A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the

IMPACT TABLE FORMAT		
	proposed activity e.g. oil spill in surface water	
Extent	A brief description indicating the chances of the impact occurring	
Probability	A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity	
Reversibility	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water	
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	A brief description of the amount of time the proposed activity is likely to take to its completion	
Cumulative effect	A brief description of whether the impact will be exacerbated as a result of the proposed activity	
Intensity/magnitude	A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily	
Significance Rating	A brief description of the importance of an impact which in turn dictates the level of mitigation required	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMPr.	

The 2010 EIA regulations also specify that alternatives must be compared in terms of impact assessment.

11.1.3 Determining the Significance of the Noise Impact

Assessing the significance of a noise impact differs in some respects to that of evaluating impacts from biological and socio-economic parameters. An individual impact assessment and significance rating system has therefore been utilised which is elaborated on below.

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. An explanation of the impact assessment criteria is defined in Table 40.

Table 40: Impact Assessment Criteria

Duration	
The lifetime of the impact that is measured in relation to the lifetime of the proposed development (construction, operational and closure phases). Will the receptors be subjected to increased noise levels for the lifetime duration of the project, or only infrequently.	
Temporary	Impacts are predicted to be of short duration and intermittent/occasional.
Short term	Impacts that are predicted to last only for the duration of the construction period.
Long term	Impacts that will continue for the life of the Project, but ceases when the Project stops operating.
Permanent	Impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.
Spatial scale	
Classification of the physical and spatial scale of the impact, how far does the noise level exceed the rating level	
Site	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Local	The impact could affect the local area (within 1,000 m from site).
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
National	The impact could have an effect that expands throughout the country (South Africa).

International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
Probability	
This describes the likelihood of the impacts actually occurring, and whether it will impact on an identified receptor. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:	
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined to be up to 25 %.
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined to be between 25% and 50 %.
Highly Likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined to be between 50 % to 75 %.
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined to be between 75% and 100 %.

Magnitude	
This defines the impact as experienced by any receptor. In this report the receptor is defined as any resident in the area, but excludes faunal species.	
Low	Increase in average sound pressure levels between 0 and 1 dB from the expected wind induced ambient sound level (proposed night rating level - Table 42). No change in ambient sound levels discernable. Total projected noise level is less than the Zone Sound Level in wind-still conditions.
Low Medium	Increase in average sound pressure levels between 1 and 3 dB from the expected wind induced ambient sound level (proposed night rating level - Table 42). Increase in sound pressure levels between 3 and 5 above the ambient sound levels (wind less conditions). Total projected noise level is less than the Zone Sound Level in wind-still conditions.
Medium	Increase in average sound pressure levels between 3 and 5 dB from the expected wind induced ambient sound level (proposed night rating level - Table 42). Increase in sound pressure levels between 5 and 7 above the ambient sound levels (wind less conditions). Sporadic complaints. Any point where the zone sound levels are exceeded during wind still conditions.
High	Increase in average sound pressure levels between 5 and 7 (proposed night rating level - Table 42) from the expected wind induced ambient sound level. Increase in sound pressure levels higher than 7 dB above the ambient sound levels (wind less conditions). Medium to widespread complaints. Any point where noise levels exceed zone sound level during wind still conditions.
Very High	Increase in average sound pressure levels higher than 7 dBA (proposed night rating level - Table 42) from the expected wind induced ambient sound level. Increases in sound pressure levels higher than 10 dB above the ambient sound levels (wind less conditions). Change of 10 dBA is perceived as ‘twice as loud’, possibly leading to widespread complaints and even threats of community or group action. Any point where noise levels exceed 65 dBA at any receptor.

In order to assess each of these factors for each impact, the following ranking scales as contained in Table 41 will be used.

Table 41: Assessment Criteria: Ranking Scales

PROBABILITY		MAGNITUDE	
Description / Meaning	Score	Description / Meaning	Score
Definite/don't know	5	Very high/don't know	10
Highly likely	4	High	8
Likely	3	Medium	6
Possible	2	Low Medium	4
Improbable	1	Low	2
DURATION		SPATIAL SCALE	
Description / Meaning	Score	Description / Meaning	Score
Permanent	5	International	5
Long Term	4	National	4
Medium Term	3	Regional	3
Short term	2	Local	2
Temporary	1	Footprint	1

- Identifying the Potential Impacts without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a Significance Rating (SR) value for each impact (prior to the implementation of mitigation measures).

Significance without mitigation is rated on the following scale:

SR < 30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30 < SR < 60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR > 60	High (H)	Impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.

- Identifying the Potential Impacts with Mitigation Measures

In order to gain a comprehensive understanding of the overall significance of the impact after implementation of the mitigation measures, it will be necessary to re-evaluate the impact.

Significance with mitigation is rated on the following scale:

SR < 30	Low (L)	The impact is mitigated to the point where it is of limited importance.
30 < SR < 60	Medium (M)	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR > 60	High (H)	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded of high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

- Expression of the noise Impacts

The noise impacts can be expressed in terms of total ambient noise levels as well as the increase in present background ambient sound levels caused by noise emissions from the proposed project.

Predicted ambient sound levels as well as change in ambient sound levels will be presented in appropriate contours of constant sound pressure levels.

For assessing the potential noise impact the values as proposed in Table 42 as well as the MoE Noise Guidelines will be considered.

Table 42: Proposed ambient sound levels and acceptable rating levels

10 meter Wind Speed (m/s)	Likely LAeq,ambient dBA	Night-time Zone Sound Level (SANS 10103:2008) dBA	Proposed Night Rating Level (considering impact of wind) dBA
3	30.1	35	35.0
4	33.7	35	35.0
5	37.3	35	37.3

6	40.9	35	40.9
7	44.4	35	44.4
8	48.0	35	48.0

11.2 Environmental Impact Assessment

11.2.1 Construction Phase Impacts

11.2.1.1 Construction Phase - Biodiversity

- Loss of habitat for red data / general species

Table 43: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact would result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general

IMPACT TABLE		
	integrity (some impact on integrity).	
Significance Rating	Prior to mitigation measures: There will be a negative Low impact i.e. the anticipated impact will have negligible negative effects however mitigation measures must be implemented. After mitigation measures: After mitigation measures, the negative low impact persists.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-6(low negative)
Mitigation measures	▪ Maintain footprint strictly during construction ▪ Appoint Environmental Control Officer (ECO) for the duration of construction. ▪ Conduct construction walk down prior to construction to conduct a search and rescue exercise. ▪ Existing indigenous vegetation must be retained where possible. ▪ Remove and relocate any plants of botanical or ecological significance (these must be indicated by the ECO) ▪ Vegetation to be removed as it becomes necessary ▪ No vegetation to be used for firewood. ▪ Demarcation of sensitive areas prior to construction activities starting.	

- Edge effect

Table 44: Rating of impacts related to edge effect

IMPACT TABLE		
Environmental Parameter	Biodiversity	
Issue/Impact/Environmental Effect/Nature	Edge effect	
Extent	The impact is only expected to affect the site.	
Probability	Impact will certainly occur (Greater than a 75% chance of occurrence).	
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources	
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)	
Cumulative effect	The impact would result in minor cumulative effects	
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	
Significance Rating	Prior to mitigation measures: There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures After mitigation measures: After mitigation measures, a negative low impact will be achieved.	
	Pre-mitigation impact rating	Post mitigation impact rating

IMPACT TABLE		
Extent	1	1
Probability	4	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	- 30 (medium negative)	- 7 (low negative)
Mitigation measures	▪ The contractor should be responsible for implementing a programme of weed control (particularly in areas where soil has been disturbed); and grassing of any remaining stockpiles to prevent weed invasion. ▪ The spread of exotic species occurring throughout the site should be controlled. Emergence of alien invasive species must be avoided. ▪ All exotic vegetation must be removed from the site (if present).	

11.2.1.2 Construction Phase - Avi-fauna

- Displacement of priority species due to disturbance

Table 45: Potential impacts associated with the displacement of priority species due to disturbance.

IMPACT TABLE	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance during construction phase
Extent	The impact will only affect the site, but may be local if a breeding pair of cranes is displaced.
Probability	Impact will certainly occur (greater than a 75% chance of occurrence) for some species, particularly the larger ones.
Reversibility	Completely reversible. The construction activities will inevitably cause temporary displacement of some priority species. Once the source of the disturbance has been removed, i.e. the noise and movement associated with

IMPACT TABLE		
	the construction activities, most species should re-colonise the areas which have not been transformed by the footprint.	
Irreplaceable loss of resources	Marginal loss of resources. The displacement of most species is likely to be temporary. Blue Cranes may be permanent, which is more significant.	
Duration	Short term. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should re-colonise the areas which have not been transformed by the footprint.	
Cumulative effect	Medium cumulative impact. The priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (except Blue Korhaan which is more range restricted), the cumulative impact of displacement would therefore be locally significant, rather than regional or national.	
Intensity/magnitude	High. Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease.	
Significance Rating	Medium significance. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should re-colonise the areas which have not been transformed by the footprint.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-34 (medium negative)	-22 (low negative)
Mitigation measures	Restrict the construction activities to the construction footprint area. Do not allow any access to the remainder of the property during the construction period. A 500m	

IMPACT TABLE	
	exclusion zone should be implemented around the existing Blue Crane breeding pair where no construction activity should take place. Ideally, construction of turbines within a 1km line of sight around the nest should not take place during the sensitive part of the breeding cycle i.e. October to December.

- Displacement of priority species due to habitat destruction

Table 46: Potential impacts associated with the displacement of priority species due to habitat destruction.

IMPACT TABLE		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to habitat destruction during construction phase	
Extent	The impact will only affect the site.	
Probability	Impact will certainly occur (greater than a 75% chance of occurrence)	
Reversibility	Irreversible. The footprint of the wind farm is an inevitable result of the development.	
Irreplaceable loss of resources	Marginal loss of resources. The overall physical footprint is likely to amount to less than 5% of the development area.	
Duration	Long term. The habitat transformation will be permanent	
Cumulative effect	Low cumulative impact. The overall physical footprint is likely to amount to less than 5% of the development area.	
Intensity/magnitude	Low. The overall physical footprint is likely to amount to less than 5% of the development area.	
Significance Rating	Low significance. The overall physical footprint is likely to amount to less than 5% of the development area.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	4	4
Irreplaceable loss	2	2

IMPACT TABLE		
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-16 (low negative)	-16 (low negative)
Mitigation measures	No mitigation is possible to prevent the permanent habitat transformation caused by the construction of the wind farm infrastructure. to prevent unnecessary habitat destruction (i.e. more than is inevitable), the recommendations of the specialist ecological study must be strictly adhered to.	

11.2.1.3 Construction Phase - Bats

- Destruction of foraging habitat

Table 47: Rating of impacts related to the construction of the wind turbines on destruction of foraging habitat

Environmental Parameter	Destruction of foraging habitat (construction phase).	
Issue/Impact/Environmental Effect/Nature	Some foraging habitat will be destroyed by the construction of the turbines and associated infrastructure. This impact will be effective throughout the lifespan of the wind farm.	
Geographical extent	Site.	
Probability	Probable that some bat foraging habitat will be destroyed when turbines are placed in sensitive areas.	
Reversibility	The impact is barely reversible should the turbines be placed in an area of high bat sensitivity.	
Irreplaceable loss of resources	Marginal without mitigation.	
Duration	For the duration of the operating wind farm with or without mitigation.	
Cumulative effect	Negligible	
Intensity/magnitude	Considered low without mitigation.	
Significance Rating	Medium without mitigation	
	Pre-mitigation impact rating	Post mitigation impact rating

Extent	1	1
Reversibility	3	1
Irreplaceable loss of resources	2	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Probability	3	1
Significance Rating	- 33 (Negative medium)	- 8 (Negative low)
Mitigation	Construction of any turbines in the areas designated as having a High bat sensitivity should be avoided.	

- Destruction of Roosts

Table 48: Rating of impacts related to the construction of the wind turbines on destruction of roosts

Environmental Parameter	Destruction of roosts (construction phase).	
Issue/Impact/Environmental Effect/Nature	During the construction phase of the project, bat roosts can be negatively impacted by earthworks and large machinery. Diggings related to the placement of underground cables can also damage bat roosts.	
Geographical extent	Site.	
Probability	Possible that some bat roosts will be destroyed when turbines are placed in sensitive areas.	
Reversibility	The impact is barely reversible should the turbines be placed in an area of high bat sensitivity.	
Irreplaceable loss of resources	Marginal without mitigation.	
Duration	For the duration of the operating wind farm with or without mitigation.	
Cumulative effect	Negligible	
Intensity/magnitude	Considered high without mitigation	
Significance Rating	Low without mitigation	

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Reversibility	3	1
Irreplaceable loss of resources	2	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	3	1
Probability	2	1
Significance Rating	-26 (Negative low)	-8 (Negative low)
Mitigation	The sensitive areas indicated are to be treated as such. No wind turbines are to be placed within these sensitive areas to avoid excessive bat fatalities.	

11.2.1.4 Construction Phase - Surface Water

- Surface water resources degradation

Table 49: Rating of impacts related to the construction of the wind turbines, and the linear associated infrastructure

IMPACT TABLE	
Environmental Parameter	Surface Water Impacts
Issue/Impact/Environmental Effect/Nature	The construction of the turbines, and the linear associated infrastructure in particular could result in both direct and indirect impacts on surface water features. These activities could result in the physical transformation of surface water features, as well as indirect impacts such as alteration of hydrology regimes, erosion and associated downstream siltation and pollution.
Extent	Local / District (2)
Probability	Probable (3)
Reversibility	Partly reversible (2)
Irreplaceable loss of resources	Significant loss of resources (3)
Duration	Medium term (2)
Cumulative effect	Medium cumulative impact (3)
Intensity/magnitude	Medium (2)

Significance Rating	Medium Negative Impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	2	2
Irreplaceable loss	3	2
Duration	2	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-30 (medium negative)	-9 (low negative)
Mitigation measures	▪ No turbines to be placed in buffer zones and as little associated infrastructure to be placed in buffer zones as possible ▪ All construction mitigation measures to be adhered to.	

11.2.1.5 Construction Phase - Soils and Agricultural Potential

- Loss of agricultural land and / or production

Table 50**:** Impact rating table for the loss of agricultural land and / or production

IMPACT TABLE	
Environmental Parameter	Soil and Land Use Resources
Issue/Impact/Environmental Effect/Nature	Loss of agricultural land and / or production as a result of the proposed activities
Extent	Site: Impacts will be restricted to the site.
Probability	Definite: Loss of grazing land is definitely occur.
Reversibility	Completely Reversible: The land can be returned to grazing after the project has been decommissioned.
Irreplaceable loss of resources	Marginal Loss: If the active agricultural fields are avoided then the construction of the turbines and associated infrastructure will result in a very marginal loss of agricultural land and production.
Duration	Long Term: The impact and its effects will continue or last for the entire operational life of the development. The life span of the development is greater than 20 years.
Cumulative effect	Negligible Cumulative Impact

Intensity/magnitude	Low	
Significance Rating	The anticipated impact will have negligible negative effects and will require little to no mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	1	1
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-12 (low negative)
Mitigation measures	▪ Avoid the active Lucerne and subsistence fields identified in the No-Go Map ▪ Due to the overarching site characteristics and the nature of the proposed development viable mitigation measures are limited and will most likely revolve around erosion control: ➢ Clearing activities should be kept to a minimum (turbine. Road and PV site footprint). ➢ In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion. ➢ If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures. If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site	

11.2.1.6 Construction Phase - Noise

- Numerous construction activities on noise sensitive developments

The impact assessment for the various construction activities that may impact on the surrounding environment is presented in the Table 51.

Table 51: Impact rating table for numerous construction activities on noise sensitive developments.

Nature:	Numerous simultaneous construction activities that could impact on Noise Sensitive Developments (NSDs).
Acceptable Rating Level	Rural district with little road traffic: 45 dBA outside during day (refer to noise specialist study) Use of LReq,d of 45 dBA for rural areas.
Extent (LAeq > LReq,d)	Local – Noise impact does not extend further than 1,000 meters from activity (2).
Duration	Temporary – Noisy activities in the vicinity of the receptors would last only a fraction of the construction period (few months) (1).
Magnitude	See Table 35 Ambient noise levels > Zone Sound Level Change in ambient sound levels > 7dBA High (10)
Probability	The construction noises will significantly change the existing ambient sound levels in the area, especially NSD06 and NSD08, yet the projected noise levels should still be less than the rating level. It is highly likely that the noise levels will be less than typical ambient sound levels associated with a farm dwelling. This is because the noises created by normal daily activities would mask all construction related noises. Improbable (1).
Significance	Low (7 - 13).
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	Not relevant.
Comments	-
Can impacts be mitigated?	Yes, though mitigation not required.
Mitigation:	Refer section 8.1 in noise specialist report.
Cumulative impacts:	This impact is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area.
Residual Impacts:	This impact will only disappear once construction activities cease.

11.2.1.7 Construction Phase - Heritage

- Destruction of pre-colonial stone age sites

Table 52: Rating of impacts related to the destruction of pre-colonial stone age sites.

IMPACT TABLE		
Environmental Parameter	**Pre-colonial: Stone Age sites**	
Issue/Impact/Environmental Effect/Nature	Low possibility of unknown sites. Their potential and significance therefore unknown. The impact will be the physical disturbance of the material and its context. Impact will be focused on a particular node, i.e. turbine positions or access/ inspection roads.	
Extent	Local	
Probability	Can occur	
Reversibility	Irreversible	
Duration	Permanent	
Cumulative effect	High	
Intensity/Magnitude	Moderate	
Significance Rating	Sites have a high significance on a region level – viewed as NHRA Grade II sites. Distinguish from find spots, which have low significance	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	75 – Negative, very high impact	12 – Negative, low impact
Mitigation measures	The identified rock shelter is located in a valley which is outside the area of the proposed development. It is therefore highly unlikely that it would be impacted on. Based on current understanding of the project, it is also unlikely that the proposed development would have a visual impact on the site. No mitigation measures are therefore required. Once sites are identified, if the location is to be used for development purposes, then mitigation of the site will be necessary. This could require excavation, or at least mapping and collection of surface material.	

- Destruction of colonial period farm related features

Table 53: Rating of impacts related to the farmsteads.

IMPACT TABLE		
Environmental Parameter	Colonial Period: Farmsteads	
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.	
Extent	Local	
Probability	Can occur	
Reversibility	Reversible with human intervention	
Duration	Permanent	
Cumulative effect	High	
Intensity/Magnitude	Moderate	
Significance Rating	Sites have a high significance on a region level – viewed as NHRA Grade III sites.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	75 – Negative, very high impact	12 – Negative, low impact
Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.	

Table 54: Rating of impacts related to the Cemeteries

IMPACT TABLE	
Environmental Parameter	Colonial Period: Cemeteries
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.
Extent	Local

Probability	Can occur	
Reversibility	Irreversible	
Duration	Permanent	
Cumulative effect	High	
Intensity/Magnitude	Moderate	
Significance Rating	Sites have a high significance on a local level – viewed as NHRA Grade III sites. Distinguish from find spots, which have low significance.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	75 – Negative, very high impact	12 – Negative, low impact
Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.	

Table 55: Rating of impacts related to the Farming related features

IMPACT TABLE		
Environmental Parameter	Colonial Period: Farming related features	
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.	
Extent	Local	
Probability	Can occur	
Reversibility	Reversible with human intervention	
Duration	Permanent	
Cumulative effect	High	
Intensity/Magnitude	Moderate	
Significance Rating	Sites have a low significance on a region level – viewed as NHRA Grade III sites.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4

Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	75 – Negative, very high impact	12 – Negative, low impact
Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. Mitigation can be implemented after required procedures have been followed.	

11.2.1.8 Construction Phase - Palaeontology

- Destruction of fossiliferous material preserved at or beneath the ground of the development footprint

Table 56: Rating of impacts related to the destruction of fossiliferous material

IMPACT TABLE	
Environmental Parameter	Fossil material (notable remains of vertebrates, plants, trace fossils within the Katberg Formation) preserved at or beneath the ground surface within the development footprint.
Issue/Impact/Environmental Effect/Nature	Disturbance, damage, destruction or sealing-in of fossil remains during the construction phase of the wind farm (mainly as result of excavations for wind turbines, cables, access roads and associated infrastructure such as laydown areas, transmission line pylons) (Negative impact).
Extent	Limited to development footprint (site).
Probability	Possible.
Reversibility	Destruction of fossil remains and their sedimentary context is generally irreversible. Mitigation during construction may reduce negative impact.
Irreplaceable loss of resources	Marginal, since comparable fossil remains are present within the extensive outcrop area of same rock unit (Katberg Formation) elsewhere in the region.
Duration	Permanent.
Cumulative effect	Cumulative impacts cannot be realistically assessed in the absence of data on other development projects in the broader study region, but are likely to be negligible to low given the large outcrop area of the Katberg Formation.

Intensity/magnitude	Low, given the apparent scarcity of vertebrate and plant fossil remains in the Katberg Formation in the Noupoort region.	
Significance Rating	Negative Low impact, so no project-specific mitigation measures recommended for palaeontological heritage	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-14 (Negative Low impact)	-14 (Negative Low impact)
Mitigation measures	Should substantial fossil remains (e.g. vertebrate bones, teeth, petrified wood) be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.	

11.2.1.9 Construction Phase - Socio-economic

- Creation of local jobs and income

Table 57: Rating of impacts related to the creation of local jobs and income

IMPACT TABLE	
Environmental Parameter	Employment and output creation in the construction phase
Issue/Impact/Environmental Effect/Nature	The creation of local jobs and income during the construction of the wind farm
Extent	190 jobs for local people (6% of formal employment) and R 129m (22% of local production) per annum for 2 years.
Probability	High
Reversibility	N/A

Irreplaceable loss of resources	N/A
Duration	2 years
Cumulative effect	An additional 103 extra jobs and R 24m in local production due to economic multiplier effects during the construction phase. Total impact is 10% of local employment and 26% of local production) for two years.
Intensity/magnitude	High
Significance Rating	High

	PRE-MITIGATION		POST-MITIGATION	
Extent	Province/region	3	National	4
Probability	Definite	4	Definite	4
Reversibility	Not required	0	Not required	0
Irreplaceable loss	None	0	None	0
Duration	Short term	1	Short term	1
Cumulative effect	Negligible	1	Negligible	1
Intensity / magnitude	Medium	2	High	3
Significance rating	Positive Low	18	Positive Medium	30
Mitigation measures	▪ Facilitating skills development programmes for unskilled local jobs created during the construction phase			

- Conflict situations

Table 58: Rating of impacts related to conflict situations

IMPACT TABLE	
Environmental Parameter	Note: As it would be difficult for the contractor to control conflict situations where they occur when construction workers spend their free time in the local community, this assessment focusses on conflict situations that the contractor can control. Conflict between Mainstream (or its contractors) and landowners should be avoided by abiding to terms and conditions set out during negotiation process, especially in terms of potential problem areas such as access to properties, fencing and security.
Issue/Impact/Environmental Effect/Nature	Conflict situations that can delay the project and prolong the duration of impacts, which in turn would affect local residents' quality of life and result in economic impacts.

Extent	Where conflict occurs with regard to the issues mentioned above, Mainstream (or its contractors) should aim to restrict it to the landowner in question to prevent problems from extending to other areas.
Probability	The chance of occurrence is dependent on how the construction process is managed, which is difficult to predict – it might therefore be possible that the impact will occur, just as it might be possible that it will not occur.
Reversibility	Conflict situations are for the most part completely reversible if problems are rectified.
Irreplaceable loss of resources	A loss of resources might be the cause for conflict (e.g. a gate left open lead to missing cattle) – again this will be difficult to gauge at this stage and therefore the safest option would be to say that there might be a marginal loss of resources.
Duration	Conflict situations for the most part will be limited to the construction phase.
Cumulative effect	One conflict situation with a particular landowner can spread to other landowners so that they are antagonistic against the contractor even before they arrive on site. Other conflict situations can also arise in other areas as outlined in the body of the report, i.e. between jobseekers and construction workers, between construction workers and the local community and between the local community and Mainstream. Although all of these conflict situations might have small centralised points, collectively the local community as a whole can start resenting the presence of the construction team.
Intensity/magnitude	Conflict can range from barely perceptible (e.g. a contained conflict situation with one landowner that gets resolved quickly) to dispersed conflict situations that lead to high costs of remediation (e.g. community members protesting against the project).
Significance Rating	Negative Low

	PRE-MITIGATION		POST-MITIGATION	
Extent	Site	1	Site	1
Probability	Possible	2	Unlikely	1
Reversibility	Partly reversible	2	Completely reversible	1
Irreplaceable loss	Marginal	2	None	1
Duration	Short term	1	Short term	1
Cumulative effect	Low	2	Low	2

Intensity / magnitude	Medium	2	Low	1
Significance rating	Negative Low	-20	Negative Low	-7
Mitigation measures	▪ Problem areas that are brought under the attention of the contractor should be rectified immediately. If the contractor is unable to so, this should be communicated to the landowner along with a plan on how and when the problem will be addressed. The landowner should be given regular feedback on the matter. ▪ All mitigation measures contained in the EMP should be implemented and monitored by an ECO. Remedial action should be taken where the contractor fails to comply with the EMP.			

- Impacts associated with risk of HIV/AIDS

Table 59: Rating of impacts related to impacts associated with the risk of HIV/AIDS

IMPACT TABLE	
Environmental Parameter	Reduce the risk spreading Sexually Transmitted Infections including HIV.
Issue/Impact/Environmental Effect/Nature	HIV/AIDS has numerous impacts ranging from the obvious health impacts to the less obvious economic impacts as result of a reduced workforce, loss of breadwinners resulting an alteration in family structures.
Extent	For the duration of the project the impact of HIV infections might be restricted to the local area, but as people move to other areas, so too does the virus.
Probability	The probability that construction workers will engage in sexual relationships with locals is quite high. This is beyond the control of the contractor, but the contractor can supply condoms and information material to reduce the probability of HIV and other STI infections.
Reversibility	Once infection has occurred, the impact is irreversible. It is therefore important to develop and implement a Health and Safety Plan, including a HIV/AIDS prevention plan during the construction phase.
Irreplaceable loss of resources	HIV/AIDS will eventually lead to the loss of human resources, which would have an economic impact on the contractor who would have to spend time and money on training new employees

Duration	Until such time that a cure is found, HIV infection is permanent
Cumulative effect	Humans are transportable; therefore these infections can be spread when the construction worker migrates to a new area and perpetuates old behaviour (i.e. engage in a new casual sexual relationship). The death of parents and breadwinners alters family structures so that children become heads of households, restricting them from completing their education, holding them in downward poverty cycles.
Intensity/magnitude	HIV infections can severely impair the functionality of the construction process due to illness and absenteeism.
Significance Rating	Negative High impact (pre-mitigation) to Negative Low impact (post-mitigation)

The health and economic impacts as result of STI and HIV infection is a category 1 impact, as these impacts will occur regardless of the alternative chosen. The impact table below therefore reflects the same numerical value for each of the impact variables as no distinction was made between alternatives.

	PRE-MITIGATION		POST-MITIGATION	
Extent	National	4	Local	2
Probability	Probable	3	Possible	2
Reversibility	Irreversible	4	Barely reversible	3
Irreplaceable loss	Significant	3	Marginal	2
Duration	Medium	2	Medium	2
Cumulative effect	High	4	Medium	3
Intensity / magnitude	High	3	Medium	2
Significance rating	Negative High	-60	Negative Low	-28
Mitigation measures	▪ Mainstream or its contractor should appoint a service provider or local NGO to develop, implement and manage an HIV/AIDS prevention programme. The service provider or NGO should specialise in the field of HIV/AIDS. ▪ The HIV/AIDS prevention programme should extend to the local community and should pay special attention to vulnerable groups such as women and youth.			

11.2.2 Operation Phase Impacts

11.2.2.1 Operation Phase - Biodiversity

- Loss of habitat for red data / general species

Table 60: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact would result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	Prior to mitigation measures: There will be a negative Low impact i.e. the anticipated impact will have negligible negative effects however mitigation measures must be implemented. After mitigation measures: After mitigation measures, the negative low impact persists.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1

IMPACT TABLE		
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-6(low negative)
Mitigation measures	▪ Maintain footprint strictly during operation ▪ Constant removal of alien invasive species in and around site.	

- Edge effect

Table 61: Rating of impacts related to edge effect

IMPACT TABLE	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Edge effect
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact would result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	Prior to mitigation measures: There will be a negative low impact i.e. the anticipated impact will have moderate negative effects and will require moderate

IMPACT TABLE		
	mitigation measures After mitigation measures: After mitigation measures, a negative low impact will be achieved.	
	Pre-mitigation impact Rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-7 (low negative)
Mitigation measures	▪ The client should be responsible for implementing a programme of weed control ▪ The spread of exotic species occurring throughout the site should be controlled. ▪ All exotic vegetation must be removed from the site (if present).	

11.2.2.2 Operation Phase - Avi-fauna

- Displacement of priority species due to disturbance

Table 62: Potential impacts associated with the displacement of priority species due to disturbance.

IMPACT TABLE	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance during operational phase
Extent	The impact will only affect the site.
Probability	Possible. The impact may occur (between a 25% to 50% chance of occurrence).

IMPACT TABLE		
Reversibility	Completely reversible. The operational activities could cause displacement of some priority species. Once the operation of the wind farm ceases, the birds would re-colonise the area.	
Irreplaceable loss of resources	Marginal loss of resources. Habituation is likely for some species after the construction phase, especially smaller species. Blue Cranes may tolerate operational activities, if they are not displaced by the construction activities in the first place.	
Duration	Long term. Although habituation may happen in some instances, it must be assumed that in some instances the impact may be long term i.e. for the life-time of the activity.	
Cumulative effect	Medium cumulative impact. The priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges (except Blue Korhaan which is more range restricted), the cumulative impact of displacement would therefore be locally significant, rather than regional or national.	
Intensity/magnitude	Medium. Although habituation may happen in some instances, it must be assumed that in some instances the impact may be long term i.e. for the life-time of the activity.	
Significance Rating	Low significance. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should re-colonise the areas which have not been transformed by the footprint.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-26 (low negative)	-22 (low negative)

IMPACT TABLE	
Mitigation measures	Post-construction monitoring should be implemented to make comparisons with baseline conditions possible. Operational activities should be restricted to the plant area. Maintenance staff should not be allowed to access other parts of the property unless it is necessary for wind farm related work. If actual displacement levels of priority species prove to be high, appropriate off-sets should be considered.

- Collision of priority species with the wind turbines

Table 63: Potential impacts associated with the collisions of priority species with the wind turbines.

IMPACT TABLE	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Collisions of priority species with the turbines in the operational phase
Extent	The impact will only affect the site, but may be local if the breeding pair of cranes or their offspring are killed.
Probability	Probable. The impact will likely occur (between a 50% to 75% chance of occurrence), the fledgling cranes are particularly at risk
Reversibility	Completely reversible. The operational activities could cause collision mortality of some priority species. Once the operation of the wind farm ceases, the mortality would cease as well.
Irreplaceable loss of resources	Marginal loss of resources. The loss of a pair of Blue Cranes and/or their off-spring should not lead to the local extinction of the species, as the site may be re-colonised by other cranes.
Duration	Long term. The risk of collision will be present for the life-time of the development.
Cumulative effect	Medium to high cumulative impact. The cumulative impact will depend largely on which species are killed. Bustards and cranes suffer high mortality on power lines, for these species the cumulative impacts may well be high.

IMPACT TABLE		
Intensity/magnitude	Medium. The operational activities could cause mortality of some priority species, but re-colonisation may happen.	
Significance Rating	Medium significance. The anticipated impact will have moderate negative effects and will require moderate mitigation measures.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3 – 4	2 - 3
Intensity/magnitude	2	2
Significance rating	-28 to -30 (medium negative)	-24 to -26 (low negative)
Mitigation measures	Pre-construction monitoring should be implemented to guide the micro-siting of the turbines and to make post-construction comparisons possible. Once the turbines have been constructed, post-construction monitoring should be implemented to compare actual collision rates with predicted collision rates. If actual collision rates indicate high mortality levels, the following mitigation measures will have to be considered: • Negotiating appropriate off-set compensation for turbine related collision mortality; • As a last resort, halting operation of specific turbines during peak flight periods, or reducing rotor speed, to reduce the risk of collision mortality. • A 500m no-turbine zone should be implemented around the existing Blue Crane nest. This should reduce the risk of the fledglings flying into the turbines when they start to fly.	

- Mortality of priority species with the power line

Table 64: Potential impacts associated with the collisions of priority species with the power lines..

IMPACT TABLE		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Mortality of priority species with the power line in the operational phase	
Extent	The impact will only affect the site, but may be local if the breeding pair of cranes or their offspring are killed. The impact will be local if a Martial Eagle gets electrocuted, especially if it is one of a breeding pair.	
Probability	Possible - probable. The impact will likely occur (between a 50% to 75% chance of occurrence), the fledgling cranes are particularly at risk. Electrocution is possible for large raptors.	
Reversibility	Completely reversible. If the power line is dismantled at the end of the life-time of the wind farm, the mortality will cease.	
Irreplaceable loss of resources	Marginal loss of resources. The loss of a pair of Blue Cranes or Martial Eagles (and/or their off-spring) should not lead to the local extinction of the species, as the site may be re-colonised by other individuals.	
Duration	Long term. The risk of collision will be present for the life-time of the development.	
Cumulative effect	Medium to high cumulative impact. The cumulative impact will depend largely on which species are killed. Bustards, cranes and large eagles suffer high mortality on power lines, for these species the cumulative impacts may well be high.	
Intensity/magnitude	Medium. The power line could cause mortality of some priority species, but re-colonisation may happen.	
Significance Rating	Medium significance. The anticipated impact will have moderate negative effects and will require moderate mitigation measures.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2

IMPACT TABLE		
Duration	3	3
Cumulative effect	3 - 4	2 – 3
Intensity/magnitude	2	2
Significance rating	-28 to -30 (medium negative)	-24 to -26 (low negative)
Mitigation measures	The proposed power line should be routed as far as possible from high risk areas (e.g. Blue Crane nest, agricultural lands, and dams). In addition, the proposed alignment must be assessed for potential collision risks and those sections must be marked with Bird Flight Diverters. The proposed pole design must be assessed to ensure that the power line design poses no potential electrocution risk of large raptors, particularly Martial Eagle, which may use the poles as hunting perches.	

11.2.2.3 Operation Phase - Bats

- Bat mortalities due to blade collisions and barotrauma during foraging (operational phase).

Table 65: Potential impacts associated with the potential Bat mortalities due to blade collisions and barotrauma during foraging (operational phase).

IMPACT TABLE	
Environmental Parameter	Bat mortalities due to blade collisions and barotrauma during foraging (operational phase).
Issue/Impact/Environmental Effect/Nature	In section 1.5 the concern of bats and possible wind turbine blade collisions/barotrauma have been discussed, however international research has been unable to propose sustainable large scale mitigation measures that can downgrade this threat to a category of very low concern.
Geographical extent	Only on the site.
Probability	Should mitigation not be implemented the chances of the impact occurring is probable.
Reversibility	Without mitigation it is partly reversible.

Irreplaceable loss of resources	Marginal.	
Duration	For the duration of the operating wind farm with or without mitigation.	
Cumulative effect	Over time the mortalities on bats will have a high cumulative effect without mitigation, since bat populations will not be able to recover faster than mortalities.	
Intensity/magnitude	Considered high without mitigation	
Significance Rating	Medium without mitigation	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Reversibility	2	1
Irreplaceable loss of resources	2	1
Duration	3	3
Cumulative effect	4	3
Intensity/magnitude	3	2
Probability	3	1
Significance Rating	-45 (Negative medium)	-11 (Negative low)
Mitigation	The sensitive areas indicated are to be treated as such. No wind turbines are to be placed within these sensitive areas to avoid excessive bat fatalities.	

- Bat mortalities due to blade collisions and barotrauma during migration (operational phase).

Table 66: Rating of impacts related to the Bat mortalities due to blade collisions and barotrauma during migration (operational phase)

IMPACT TABLE	
Environmental Parameter	Bat mortalities due to blade collisions and barotrauma during migration (operational phase).
Issue/Impact/Environmental Effect/Nature	The migration paths of South African bats in the Northern Cape Province are not well studied and are virtually unknown. Cave dwelling species such *Miniopterus natalensis* and *Myotis tricolor* undertake annual migrations between caves. However, no caves are known to be in close proximity to the study area, and it is not located within any known direct line of path between major caves such that the threat to migrating bats becomes nominal.

Geographical extent	Regional	
Probability	Although unlikely the impact is still possible to occur without mitigation	
Reversibility	Due to the potential large numbers of bats that can be killed if this impact should occur, the reversibility of populations is partly reversible	
Irreplaceable loss of resources	Marginal.	
Duration	For the duration of the operating wind farm with or without mitigation.	
Cumulative effect	Over time the mortalities on bats will have a high cumulative effect without mitigation, since bat populations will not be able to recover faster than mortalities.	
Intensity/magnitude	Considered high without mitigation	
Significance Rating	Medium without mitigation	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	3	3
Reversibility	2	1
Irreplaceable loss of resources	2	1
Duration	3	3
Cumulative effect	4	3
Intensity/magnitude	3	2
Probability	2	1
Significance Rating	-34 (Negative medium)	-13 (Negative low)
Mitigation	The sensitive areas indicated are to be treated as such. No wind turbines are to be placed within these sensitive areas to avoid excessive bat fatalities.	

11.2.2.4 Operation Phase - Visual

- Visual change and intrusion impact of wind turbines and associated infrastructure

Table 67: Potential impacts associated with the potential visual change and intrusion impacts of the wind turbines and the associated infrastructure on the surrounding area.

IMPACT TABLE

Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	The proposed wind farm could create a visual impact on sensitive receptors in the study area by creating visual change and visual intrusion	
Extent	Local / District (2)	
Probability	Definite (4)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	Significant loss of resources (3)	
Duration	Long term (3)	
Cumulative effect	Low cumulative impact (2)	
Intensity/magnitude	High (3)	
Significance Rating	**High Negative Impact**	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	2
Reversibility	1	1
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	3	1
Significance rating	-49 (high negative)	-11 (low negative)
Mitigation measures	See section 8 below	

11.2.2.5 Operation Phase - Noise

- Numerous wind turbines operating simultaneously during a period when a quiet environment is desirable

Table 68: Potential impacts associated with numerous wind turbines operating simultaneously during a period when a quiet environment is desirable.

Nature:	Numerous turbines operating simultaneously during a period when a quiet environment is desirable.
Acceptable Rating Level	Rural district with little road traffic. Refer to Table 42 for the proposed Night Rating Level that varies with wind speed.
Extent ($\Delta L_{Aeq,n} > 7dBA$) $L_{Aeq,n} > L_{Req,n}$	Local – Noise Impact will not extend further than 1,000 meters from the activity (2).
Duration	Long – Facility will operate for a number of years (4)
Magnitude	Refer to noise specialist report. Low (2) to Medium (6) – Nordex H90 2500HS WTG
Probability	Improbable (1) – Likely (3)
Significance	8 - 24 (Low) for all NSD but NSD06 using the Nordex H90 2500HS WTG.
Significance	36 (Medium) for NSD06 using the Nordex H90 2500HS WTG.
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	Not relevant.
Comments	-
Can impacts be mitigated?	Yes.
Mitigation:	Refer section .
Cumulative impacts:	This impact is cumulative with existing ambient background sounds and other noise in the area.
Residual Impacts:	This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

11.2.2.6 Operation Phase - Socio-economic

- Creation of local jobs and income

Table 69: Rating of impacts related to the creation of local jobs and income.

IMPACT TABLE	
Environmental Parameter	Employment and output creation in the operational phase
Issue/Impact/Environmental Effect/Nature	The creation of local jobs and income during the operation of the wind farm and PV plant

Extent	17 jobs for local people (0.6% of local employment) and R 636m towards local domestic production (R17m salaries and wages or 2.9% of local production).
Probability	High
Reversibility	NA
Irreplaceable loss of resources	NA
Duration	average design life of wind farms of around 25
Cumulative effect	An additional 32 extra jobs and R 10.3m in local production due to economic multiplier effects during the operational phase. Total impact = 1.6% of local employment; 4.7% of local output.
Intensity/magnitude	Medium
Significance Rating	Medium

	PRE-MITIGATION		POST-MITIGATION	
Extent	Site	1	Local	2
Probability	Definite	4	Definite	4
Reversibility	Not required	0	Not required	0
Irreplaceable loss	None	0	None	0
Duration	Long term	3	Long term	3
Cumulative effect	Negligible	1	Negligible	2
Intensity / magnitude	Medium	2	High	3
Significance rating	Low Positive	18	Medium Positive	33
Mitigation measures	▪ Linking new and existing local businesses to the supply chain of the wind farm			

- Increase in central and local tax income

Table 70: Rating of impacts related to the increase in central and local tax income.

IMPACT TABLE	
Environmental Parameter	Tax income during the operational phase
Issue/Impact/Environmental Effect/Nature	Increase in central and local tax income during operations

Extent	Revenue generated for central government through direct taxes (company and personal taxes) as well as indirect taxes (e.g. VAT) an estimated R179m; Net increase in local government income due to increase in property taxes
Probability	High
Reversibility	NA
Irreplaceable loss of resources	NA
Duration	As long as the wind farm is in operation (average design life of wind farms of around 25)
Cumulative effect	None
Intensity/magnitude	Small
Significance Rating	Small in terms of national and local tax revenue

	PRE-MITIGATION		POST-MITIGATION	
Extent	Local	2	Local	2
Probability	Definite	4	Definite	4
Reversibility	Not required	0	Not required	0
Irreplaceable loss	None	0	None	0
Duration	Long term	3	Long term	3
Cumulative effect	High	4	High	4
Intensity / magnitude	Low	1	Low	1
Significance rating	Low Positive	14	Low Positive	14
Mitigation measures	▪ None			

- Corporate social investment

Table 71: Rating of impacts related to corporate social investment.

IMPACT TABLE	
Environmental Parameter	Corporate social investment
Issue/Impact/Environmental Effect/Nature	7.6% of expected profits of R619m will be retained for development in the form of an enterprise development fund (0.4% of profits) socio economic development fund (1.1%) and a community development fund (building up towards 6% of profits after debts has been paid by trust)

Extent	R 46m per annum (8% of local production)
Probability	Medium
Reversibility	NA
Irreplaceable loss of resources	NA
Duration	As long as the wind farm is in operation (average design life of wind farms of around 25 years)
Cumulative effect	Development impacts
Intensity/magnitude	High
Significance Rating	High

	PRE-MITIGATION		POST-MITIGATION	
Extent	Province	3	National	4
Probability	Possible	2	Possible	2
Reversibility	Not required	0	Not required	0
Irreplaceable loss	None	0	None	0
Duration	Long term	3	Long term	3
Cumulative effect	Negligible	1	Medium	3
Intensity / magnitude	High	3	Very high	4
Significance rating	Low Positive	27	Medium Positive	48
Mitigation measures	▪ Using the most effective community structures for the trust fund, inclusion of existing structures, transparent rules in allocating funds, prioritisation according to community needs and building on existing regional synergies			

- Displacing existing agricultural production

Table 72: Rating of impacts related to displacing existing agricultural production.

IMPACT TABLE	
Environmental Parameter	Agricultural output
Issue/Impact/Environmental Effect/Nature	Displacing existing agricultural production
Extent	Maximum loss of R25 000 in output and 1 job per annum
Probability	Low
Reversibility	High

Irreplaceable loss of resources	Low
Duration	As long as the wind farm is in operation (average design life of wind farms of around 25)
Cumulative effect	Low
Intensity/magnitude	Low
Significance Rating	Low

	PRE-MITIGATION		POST-MITIGATION	
Extent	Site	1	Site	1
Probability	Possible	2	Possible	2
Reversibility	Barely reversible	3	Barely reversible	3
Irreplaceable loss	None	1	None	1
Duration	Long term	3	Long term	3
Cumulative effect	Negligible	1	Negligible	1
Intensity / magnitude	Low	1	Low	1
Significance rating	Low negative	-11	Low negative	-11
Mitigation measures	▪ None			

- Diverting/attracting tourism from or to the area

Table 73: Rating of impacts related to diverting/attracting tourism from or to the area.

IMPACT TABLE	
Environmental Parameter	Local tourism to the area
Issue/Impact/Environmental Effect/Nature	Diverting/Attracting tourism from or to area
Extent	None (the effect could be positive instead of negative)
Probability	Low
Reversibility	High
Irreplaceable loss of resources	Low
Duration	As long as the wind farm is in operation (average design life of wind farms of around 25 years)
Cumulative effect	Low
Intensity/magnitude	Low
Significance Rating	Low

	PRE-MITIGATION		POST-MITIGATION	
Extent	Site	1	Site	1
Probability	Unlikely	1	Unlikely	1
Reversibility	Partly reversible	2	Partly reversible	2
Irreplaceable loss	No loss	1	No loss	1
Duration	Long term	3	Long term	3
Cumulative effect	Negligible	1	Negligible	1
Intensity / magnitude	Low	1	Low	1
Significance rating	Negative Low	-10	Negative Low	-10
Mitigation measures	▪ None			

- Change in property prices adjacent to the proposed development

Table 74: Rating of impacts related to the change in property prices adjacent to the proposed development.

IMPACT TABLE	
Environmental Parameter	Property prices
Issue/Impact/Environmental Effect/Nature	Change in property prices adjacent to the proposed development (positive or negative)
Extent	Unknown.
Probability	Low
Reversibility	High
Irreplaceable loss of resources	Low
Duration	As long as the wind farm is in operation (average design life of wind farms of around 25)
Cumulative effect	Low
Intensity/magnitude	Low
Significance Rating	Low

	PRE-MITIGATION		POST-MITIGATION	
Extent	Site	1	Site	1
Probability	Unlikely	1	Unlikely	1
Reversibility	Partly reversible	2	Partly reversible	2
Irreplaceable loss	No loss	1	No loss	1

Duration	Long term	3	Long term	3
Cumulative effect	Negligible	1	Negligible	1
Intensity / magnitude	Low	1	Low	1
Significance rating	Low Negative	-10	Low Negative	-10
Mitigation measures	▪ None			

- Change in sense of place

Table 75: Rating of impacts related to the change in sense of place.

IMPACT TABLE	
Environmental Parameter	Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms.
Issue/Impact/Environmental Effect/Nature	The presence of wind farm and associated infrastructure such as the substation and the transmission power lines would change the landscape of the area from open spaces to 'spoilt' which could affect the way in which people related to the land and the sense of connectedness they have with the area, in short, their sense of place.
Extent	The impact on sense of place should be considered in the context of the study area as a whole, as the impact on sense of place per farm portion will depend on a number of variables, such as the visual impact, the biodiversity impact, the placement of turbines in relation to dwellings, the activities on the land, the attachment of the landowner to the land, etc.
Probability	Most of the study area is currently 'unspoiled' with vast open spaces; the negative impact on sense of place is highly probable.
Reversibility	The impact on sense of place can be reversed after decommissioning, provided that rehabilitation is done to a satisfactory level.
Irreplaceable loss of resources	It is not foreseen that an impact on sense of place would lead to any loss of resources.
Duration	The impact will be experienced during the lifetime of the project, but it can be expected that the wind farm will eventually become part of the landscape and absorbed as part of the cultural landscape.
Cumulative effect	The presence of such infrastructure can also set an unintended precedent for further land use change in future, which could further alter people's sense of place.

Intensity/magnitude	The impact on sense of place will be different for different people and will also depend on the way the land is utilised.
Significance Rating	Negative Low

	PRE-MITIGATION		POST-MITIGATION	
Extent	Local	2	Site	1
Probability	Possible	2	Unlikely	1
Reversibility	Barely reversible	3	Partly reversible	2
Irreplaceable loss	Marginal	2	Marginal	2
Duration	Long term	3	Long term	3
Cumulative effect	Low	2	Negligible	1
Intensity / magnitude	Medium	2	Medium	2
Significance rating	Negative Low	-24	Negative Low	-20
Mitigation measures	▪ The impact on livelihoods should be monitored and evaluated before and after the construction of the wind farm.			

11.2.3 Decommissioning Phase

11.2.3.1 Decommissioning Phase - Biodiversity

- Loss of habitat for red data / general species

Table 76: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than

IMPACT TABLE		
	the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	
Cumulative effect	The impact would result in negligible to no cumulative effects	
Intensity/magnitude	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	
Significance Rating	Prior to mitigation measures: There will be a positive Low impact i.e. the anticipated impact will have negligible negative effects however mitigation measures must be implemented. After mitigation measures: After mitigation measures, the positive low impact persists.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	+8 (low positive)	+6(low positive)
Mitigation measures	▪ Maintain footprint strictly during decommissioning ▪ Existing access roads must be used. ▪ All infrastructure must be removed from the site. ▪ A rehabilitation plan must be compiled by a qualified ecologist. ▪ Re-vegetation of affected areas must be made a priority to avoid erosion. ▪ Suitable stormwater / wind controls must be put in place until rehabilitation is complete ▪ Constant removal of alien invasive species in and around plant. ▪ Update and implementation of the EMPr.	

- Edge effect

Table 77: Rating of impacts related to edge effect

IMPACT TABLE		
Environmental Parameter	Biodiversity	
Issue/Impact/Environmental Effect/Nature	Edge effect	
Extent	The impact is only expected to affect the site.	
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).	
Reversibility	The impact is reversible with implementation of minor mitigation measures	
Irreplaceable loss of resources	The impact will result in marginal loss of resources	
Duration	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	
Cumulative effect	The impact would result in minor cumulative effects	
Intensity/magnitude	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	
Significance Rating	Prior to mitigation measures: There will be a positive low impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures After mitigation measures: After mitigation measures, a positive low impact will be achieved.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	1	1

IMPACT TABLE		
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	1
Intensity/magnitude	1	1
Significance rating	+10 (low positive)	+7(low positive)
Mitigation measures	▪ The contractor should be responsible for implementing a programme of weed control ▪ The spread of exotic species occurring throughout the site should be controlled. ▪ All exotic vegetation must be removed from the site (if present).	

12 CUMULATIVE IMPACTS AND MITIGATION MEASURES

12.1 Cumulative Impacts

Table 78: Cumulative impacts and proposed mitigation measures

Environmental Component	Cumulative Impact
Biodiversity Impact Assessment	▪ Construction Due to the negligible amount of infrastructure present within the study area, cumulative impacts are anticipated to be low during construction. ▪ Operation The infrastructure to be added is very small in comparison to that already present. No existing wind farms are in place and no cumulative impacts are thus anticipated. ▪ Decommissioning Decommissioning of the plant will result in the elimination of the cumulative impacts mentioned above. ▪ Residual Impacts

	If rehabilitation of the site is done efficiently and according to the Environmental Management Programme, no residual impacts on biodiversity are anticipated.
Avi-fauna Impact Assessment	Due to the early stage of wind energy development in South Africa, it is impossible to predict with any confidence at this stage what the cumulative impact of all the proposed wind developments in the Karoo bioregion will be on birds. It is therefore imperative that pre- and post-construction monitoring are implemented at all the new proposed sites, in accordance with the latest *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* (Jenkins *et al.* 2011), and that the results of the various studies are made available for research purposes and explored for potential cumulative impacts.
Bats Impact Assessment	
Surface Water Impact Assessment	None.
Soils and Agricultural Potential Impact Assessment	The onsite soil indicates that these areas are dominated by rocky and shallow soils with an inherently low agricultural potential. However, active fields are present which only constitute 0.1% of the assessment area. On the remaining land there are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development. The cumulative effect is therefore negligible.
Visual Impact Assessment	None.
Noise Impact Assessment	Cumulative impacts are anticipated with the operation of the wind turbines when wind speeds reach between 5-6m/s during times when a quiet environment is desired with existing ambient background sounds and other noise in the area.
Heritage Impact Assessment	None.
Palaeonotological Impact Assessment	None.
Socio-economic Impact Assessment	▪ Construction Phase The perception or expectation (even if it is unrealistic on the part of locals) that the project will offer employment, often results in locals informing family and friends from elsewhere that there are jobs available in the area, which in turn then leads to the in-migration of jobseekers. This can make it difficult to distinguish between a permanent resident and an

	opportunistic jobseeker, which in turn can complicate a fair job allocation system should unskilled labour be required – even more so where there is very little demand, but an oversupply of labour. If a simultaneous in-migration of unemployed jobseekers occurs, this can intensify the temporary increase in need for housing. Some of the jobseekers might find shelter with friends or family while others are left destitute. This can then lead to the creation and/or expansion of informal settlements, which in turn can place additional strain on already limited resources (municipal services, available land, job opportunities, etc.). The expansion of informal settlement puts the local municipality under pressure as it increases the housing backlog with more and more people requiring formal housing and municipal services on par with RDP standards. If a HIV/AIDS prevention plan is implemented effectively within the local communities on a level that they understand, and if the necessary resources are easily available and accessible to the community (e.g. condoms, information posters, VCT centres, support groups) for the duration of the construction phase, this would leave an informed and empowered community behind who would be able to continue to prevent HIV infections by informing and empowering others. ▪ Operations and Maintenance Phase The presence of the wind farm and associated infrastructure (substation and transmission line) can set an unintended precedent for further land use change. For example: If additional transmission lines are required in future it is oftentimes preferred to place such lines next to existing lines as the area is already regarded as disturbed. The cumulative impact of corporate social investments through Mainstream's proposed trust can be high. Economic empowerment (through funds and land), improved healthcare, business growth, skills development, and higher education are massive for the local people. These would increase earning potentials, improve livelihoods, increase life-spans, benefit

	quality of life variables, hasten local people out of poverty (where applicable), and assist future generations and relatives of those who benefit directly. ▪ Reversibility of Impacts Most of the impacts that occur during the construction phase will be completely reversible as these impacts are for the most part only temporary in nature. Some impacts might require minor mitigation measures whereas others would require more intensive mitigation measures. In all instances the project proponent or its appointed contractors should be committed to and held accountable for the implementation of mitigation measures, failing which it can be expected that social impacts would intensify and eventually lead to conflict between landowners and/or local communities and Mainstream over the long run. Although most of the impact during the operations and maintenance phase are also reversible, the impacts would occur over the lifetime of the project and it is therefore likely that such impacts would only be reversed when the wind farm is decommissioned.

12.2 Mitigation Measures

12.2.1 Biodiversity

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- o An on-site ecologist should be present when excavation takes place to ensure that any uncovered species are protected from destruction (It is important to remember that even though these species have not been encountered, they could be in a dormant stage and suddenly arise during construction due to more favourable conditions.
- o Demarcation of sensitive areas prior to construction activities starting

- Use of appropriate construction methods in the sensitive area.
- Intensive environmental audits (frequently in sensitive areas) by an independent party during this construction period.
- A copy of the Environmental Impact Report and associated Environmental Management Programme as well as the specialist study must be present at the construction site for easy reference to specialist recommendations in sensitive areas.
- It is recommended that the construction crew be educated about the sensitivities involved in these areas as well as the potential species they could encounter. A poster of sensitive species (compiled by a qualified specialist) should be kept on the construction site for easy reference.
- Rehabilitation to be undertaken as soon as possible after construction in sensitive area has been completed
- Only vegetation within the study area must be removed.
- Vegetation removal must be phased in order to reduce impact of construction.
- Construction site office and laydown areas must be clearly demarcated and no encroachment must occur beyond demarcated areas.
- All natural areas impacted during construction must be rehabilitated with locally indigenous plant species.
- A buffer zone should be established in areas where construction will not take place to ensure that construction activities do not extend into these areas.
- Construction areas must be well demarcated and these areas strictly adhered to.
- The use of pesticides and herbicides in the study area must be discouraged as these impacts on important pollinator species of indigenous vegetation.
- Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora.
- The grid access power line must span rocky areas in order to avoid transformation in these areas.
- ECO must be present when towers are placed in this area.

- Operation Site Specific Mitigation Measures

The following mitigation measures are recommended for the study area

- Six monthly checks of the area should take place for the emergence of invader species.
- Mitigation measures mentioned for the construction phase above must be implemented for any maintenance of the development that may be undertaken during the operation phase.
- Correct rehabilitation with locally indigenous species.

- Monitoring programme to ensure that rehabilitation efforts are successful to ensure that risks such as erosion and the edge effect are avoided.
- Constant maintenance of the area to ensure re-colonisation of floral species.
- Regular removal of alien species which may jeopardise the proliferation of indigenous species.

- Decommissioning Mitigation and Management measures

All mitigation measures applied during construction will apply to the decommissioning phase of the project.

12.2.2 Avi-fauna

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- Ensuring that key areas of conservation importance and sensitivity are avoided, in this instance slopes and potential funnels of bird flight activity.
- Habitat destruction should be limited to what is absolutely necessary for the construction of the infrastructure, including the construction of new roads. In this respect, the recommendations from the Ecological Specialist Study should be applied strictly. Personnel should be adequately briefed on the need to restrict habitat destruction, and must be restricted to the actual construction area.
- The proposed power line should be routed as far as possible from high risk areas (e.g. Blue Crane nest, agricultural lands, and dams). In addition, the proposed alignment must be assessed for potential collision risks and those sections must be marked with Bird Flight Diverters.
- The proposed pole design must be assessed by the author of the Avi -Fauna report to ensure that the power line design poses no potential electrocution risk of large raptors, particularly Martial Eagle, which may use the poles as hunting perches.
- A 500m exclusion zone should be implemented around the existing Blue Crane breeding pair where no construction activity should take place. Ideally, construction of turbines within a 1km line of sight around the nest should not take place during the sensitive part of the breeding cycle i.e. October to December.

- Operation Site Specific Mitigation Measures

The following mitigation measures are recommended for the study area:

- Once the turbines have been constructed, post-construction monitoring should be implemented as part of the continuation of the current monitoring programme, to assess displacement and actual collision rates. If actual collision and displacement levels are deemed too high, the following mitigation measures would need to be considered:
  a. Negotiating appropriate off-set compensation for turbine related displacement and collision mortality;
  b. As a last resort, halting operation of specific turbines during peak flight periods, or reducing rotor speed, to reduce the risk of collision mortality.
- Operational activities should be restricted to the plant area.
- Maintenance staff should not be allowed to access other parts of the property unless it is necessary for wind farm related work. If actual displacement levels of priority species prove to be high, appropriate off-sets should be considered.
- The proposed power line should be routed as far as possible from high risk areas (e.g. Blue Crane nest, agricultural lands, and dams).
- In addition, the proposed alignment must be assessed for potential collision risks and those sections must be marked with Bird Flight Diverters.
- The proposed pole design must be assessed to ensure that the power line design poses no potential electrocution risk of large raptors, particularly Martial Eagle, which may use the poles as hunting perches.

12.2.3 Bats

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- The sensitive areas indicated are to be treated as such and avoided.
- No wind turbines are to be placed within these sensitive areas to avoid excessive bat fatalities.
- Ongoing bat monitoring

- Operation Site Specific Mitigation Measures

The following mitigation measures are recommended for the study area

  - The sensitive areas indicated are to be treated as such and avoided.
  - No wind turbines are to be placed within these sensitive areas to avoid excessive bat fatalities.
  - Ongoing bat monitoring

12.2.4 Surface Water

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

  - No turbines should be placed within 250m of any wetland as delineated in this study; the buffer zone should be strictly maintained as a no-go area for the construction of turbines.
  - No turbines should be located / constructed within 50m of any other type of surface water resource
  - Where at all possible, access roads should avoid crossing wetland areas. Where this is not possible, an attempt should be made to align roads to cross the systems containing wetland habitat where they are rocky and contain less wetland habitat.
  - It is strongly recommended that roads should be aligned to not run across drainage features at the head of valleys where valley seeps tend to occur, as these are sensitive areas. Analysis of the development site indicates that the most eroded areas typically occur at the head of catchments within these valley heads, and as such these areas are particularly vulnerable to erosion. Should the construction of roads across the head of drainage systems be unavoidable, particular care should be taken to ensure that construction practices do not cause erosion, and that stormwater runoff is carefully managed so as not to induce scouring of the water features.
  - The wetland system located on the southern boundary of the site along the current access track to the Blydefontein Farmstead is particularly sensitive, due to its hydrological characteristics and biodiversity value. The proximity of this wetland to the likely main access onto the site entails that this wetland is even more potentially likely to be impacted upon.
  - In this context the design of the road that crosses the wetland should occur at the existing crossing point, and if the footprint needs to be extended, it should be

upstream of the crossing point and not downstream of it where the most sensitive part of the wetland occurs.

- It is strongly recommended that a formal bridge structure be constructed across the wetland, in order to affect the wetland as little as possible. If this is not possible, a structure with sufficient culverts should be constructed so as not to channelise the downstream flow within the wetland
- Design of the road should include swale areas into which stormwater can collect before being discharged into the stream, rather than directly into it.
- Lastly construction of the road at this point should be carefully managed so as to restrict the construction footprint and to ensure that no pollutants or silt enter the wetland.
- Existing access roads and tracks across wetlands must be used as far as possible, as these are typically associated with an existing impact on a wetland / stream. It is preferable for existing drifts / causeways to be upgraded rather than new road structures built into an un-impacted section of the surface water feature.
- Where surface water features cannot be spanned by bridges, road design must incorporate a sufficient number and volume of culverts to allow flow within it to pass under the road in an as natural a manner as possible; i.e. flow within the feature should be kept as diffuse as possible, especially where diffuse flow occurs.
- Measures to minimise stormwater ingress into surface water features off roads should be included in the design of the road. Stormwater from a road in the catchment of the feature should be directed into a deposition / swale area where it can infiltrate the ground and flow slowly into the feature, and not directly into it.
- Road construction through surface water features should ideally occur in the drier winter months. At this time erosion is less likely to be a factor and vegetation is also dormant and less likely to be damaged. There is likely to be less surface flow that could potentially carry silt and pollutants into the wetland, and which could act as an erosive force
- In wetlands with less channelised flow, and in those surface water features carrying greater flows (especially in the Diepkloof stream system), a form of running track should be constructed through wetlands adjacent to the road alignment, especially if heavy tracked machinery is going to access the wetland to undertake construction. The running track would protect underlying soils and vegetation, especially in wetter parts of the wetland, and would facilitate the access of heavy machinery in these areas
- Road design should take into account the potential for flooding and spate flows in wetlands, especially within valley bottom wetlands and along riverine corridors. Due to the nature of runoff in the Study Area, high flow peaks are likely to occur in the larger valley bottom drainage features due to the intermittent nature of rainfall and the development of soil crusting in many parts of the site as discussed above. It is recommended that design be undertaken to withstand a 1:100 year flood.

- As such temporary rights of way across wetland / riverine areas are strongly discouraged (unless these are associated with construction of a road or pipeline across a wetland) as these could be easily washed away, causing pollution / siltation in the downstream wetland.
- Where required, the alignment of roads should aim to cross wetlands perpendicularly to the direction of flow in the wetland, as this is usually the shortest route across the wetland.
- Alignment of roads should aim to cross wetlands at their narrowest point, where possible, as wetlands are often channelised at these points. A smaller area of wetland would thus potentially be affected.
- A simple mitigation measure would be to avoid the underground cables from being aligned across wetlands. Alignment of the cabling should be routed to avoid crossing streams / wetlands as far as possible. If these surface water features have to be crossed, consideration of routing the cables as above-ground power lines for the length of the crossing should be considered in order to avoid having to physically affecting the surface water resource.
- In the event of a trench having to be excavated through a wetland, the following measures should apply:

a. Construction must occur in the drier winter months
b. Minimal use of machinery within the wetland must occur
c. Extreme care must be taken to avoid siltation in the wetland, and silt protection measures must be put in place downstream of the works
d. If possible, flow should be diverted through the works area, or if sufficiently low in volume, be dammed behind the works area to avoid contact with exposed soils
e. All silt-laden water should not be discharged back into the watercourse unless the silt has first been removed
f. The substrate of the surface water feature should be returned to a state as close as possible to the pre-construction state
g. If necessary re-vegetation should occur
h. After construction the area should be monitored for the presence of any developing erosion

- Every effort should be made to avoid placing towers in surface water features, in particular wetlands.
- All relevant Eskom Distribution environmental procedures to mitigate impacts related to wetlands and other surface water resources, especially those impacts related to construction activities and servitude management should be followed. Should these procedures be followed as stipulated in all Eskom power line construction projects, the majority of these impacts will be avoided or reduced to an acceptable level.

12.2.5 Soils and Agricultural Potential

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- Avoid the active Lucerne and subsistence fields identified.
- Due to the overarching site characteristics and the nature of the proposed development viable mitigation measures are limited and will most likely revolve around erosion control:
  a. Clearing activities should be kept to a minimum (turbine. Road and PV site footprint).
  b. In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion.
  c. If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures.
- If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site

12.2.6 Visual

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- Implications of Visual-environmentally-sensitive areas on the site: The areas on the site associated with the greatest potential visual exposure to the areas surrounding the site are:
  a. the area to the west of the 'escarpment edge' – i.e. the part of the site on the rising ground to the east of Noupoort and the N9 highway
  b. a buffer of 1km east of this 'escarpment edge'
  c. a buffer 1km into the site from the Oorlogspoort Road on the southern boundary of the site
- The sensitive areas as described above are those areas on the site where the placement of turbines would be most likely to result in visual impacts on the surrounding receptors. The assessment has found that turbines placed in these buffer zones (as per the final draft layout), in particular the buffer zone to the east of the escarpment edge and the buffer zone to the north of the Oorlogspoort Road will be responsible for the most significant visual impacts associated with the proposed development. It is thus recommended that consideration be given to

removing the turbines from these buffer zones that would further reduce the visual impacts on certain areas surrounding the site.

- Recommended power line routing recommendations: The assessment has found that the degree of change in visual contrast associated with the Southern Alternative 2 power line running along the Oorlogspoort Road is higher than that associated with the Southern Alternative 1 power lines running down the escarpment edge (the more northerly alignment). It must be remembered that the above comparison is based on 2 specific locations, but the assessments are representative of the visual contrast over a wider area. It should also be noted that the visual impact of the Southern Alternative 1 power line as viewed from the eastern edge of Noupoort would be 'lessened' in a sense due to the cumulative, and much greater impact of the turbines that would be visible from this location, as opposed to if the power lines were the only new feature. Taking the above factors into account, Southern Alternative 1 is thus preferred from a visual perspective for the power lines as it would be associated with a combined visual impact, rather than being a new stand-alone impact in an otherwise non-impacted area. Northern Alternatives 1 and 2 follow existing infrastructure for the most part and there is no preference from a visual perspective.

12.2.7 Noise

- Construction site specific mitigation measures

The significance of noise during the construction phase is low, yet mitigation measures are included to allow the developer to further reduce the noise levels. It should be noted that both the magnitude and probability of construction noise impacts would reduce with the implementation of the recommendations made for the construction phase. Mitigation options included both management measures as well as technical changes. The following management mitigation measures/options are recommended for the study area:

- Route construction traffic as far as practically possible from potentially sensitive receptors;
- Ensure a good working relationship between the developer and all potentially sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them. Information that should be provided to the potential sensitive receptor(s) include:

a. Proposed working times;
b. how long the activity is anticipated to take place;
c. what is being done, or why the activity is taking place;

d. contact details of a responsible person where any complaints can be lodged should there be an issue of concern.

- When working near (within 500 meters – potential construction of access roads and trenches) to a potential sensitive receptor(s), limit the number of simultaneous activities to the minimum as far as possible;
- When working near to potentially sensitive receptors, coordinate the working time with periods when the receptors are not at home where possible. An example would be to work within the 08:00 to 14:00 time-slot to minimize the significance of the impact because:
- Potential receptors are most likely at school or at work, minimizing the probability of an impact happening;
- Normal daily activities will generate other noises that would most likely mask construction noises, minimizing the probability of an impact happening.

Technical solutions to reduce the noise impact during the construction phase include:

- Using the smallest/quietest equipment for the particular purpose. For modelling purposes the noise emission characteristics of large earth-moving equipment (typically of mining operations) were used, that would most likely over-estimate the noise levels. The use of smaller equipment therefore would have a significantly lower noise impact;
- Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures.

▪ Operational Phase

The significance of the noise impact is considered to be medium for NSD06 and further mitigation measures are recommended. Mitigation measures that could be considered around NSD06 before the development of this wind energy facility would include:

- The selection of a different make and model of wind turbine;
- Ensuring a larger setback around the potentially sensitive receptor taking cognisance of prevailing wind directions;
- The developer can consider larger wind turbines which would require less wind turbines for the same power generation potential, but increase the buffer zone with an appropriate level. Should the developer select to use a larger or different wind turbine the noise impact assessment should again review the potential impact;
- The findings of this report should be discussed with NSD06;
- A combination of the above options such as the use of more quiet wind turbine closer to potential noise sensitive developments, larger (and possibly louder) machines further from the NSDs, possibly with an increased setback.

Mitigation measures that would reduce a potential noise impact after the implementation of the facility includes (if a reasonable noise complaint is registered):

- Operating all, or selected wind turbines in a different mode. Most manufacturers allow the turbines to be operated in a different mode. This allows the wind turbine generator to operate more silently, albeit with a slight reduction of electrical power generation capability.
- Problematic wind turbines could also be disabled, or the rotational speeds significantly decreased during periods when a quieter environment is desired (and reasonable complaints registered).
- In addition:

a. Good public relations are essential. At all stages surrounding receptors should be educated with respect to the sound generated by wind turbines. The information presented to stakeholders should be factual and should not set unrealistic expectations.
b. Community involvement needs to continue throughout the project. A positive community attitude throughout the greater area should be fostered, particularly with those residents near the wind farm, to ensure they do not feel that advantage has been taken of them.
c. The developer must implement a line of communication (i.e. a help line where complaints could be lodged. All potential sensitive receptors should be made aware of these contact numbers. The Wind Energy Facility should maintain a commitment to the local community and respond to concerns in an expedient fashion.

12.2.8 Heritage

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from

these specialists, the Environmental Control Officer will advise the necessary actions to be taken;

- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).
- In order to achieve this, the following should be in place:

a. A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
b. Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
c. In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

12.2.9 Palaeontology

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- The ECO responsible for the developments should be alerted to the possibility of fossil remains being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
- The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA

12.2.10 Socio-economic

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- Employment and Output Creation
  a. Facilitating skills development programmes for unskilled local jobs created during the construction phase
- Social Mobilisation
  a. Problem areas that are brought under the attention of the contractor should be rectified immediately. If the contractor is unable to so, this should be communicated to the landowner along with a plan on how and when the problem will be addressed. The landowner should be given regular feedback on the matter.
  b. All mitigation measures contained in the EMP should be implemented and monitored by an ECO. Remedial action should be taken where the contractor fails to comply with the EMP.
- Health and Safety
  a. Mainstream or its contractor should appoint a service provider or local NGO to develop, implement and manage an HIV/AIDS prevention programme. The service provider or NGO should specialise in the field of HIV/AIDS.
  b. The HIV/AIDS prevention programme should extend to the local community and should pay special attention to vulnerable groups such as women and youth.

- Operation Site Specific Mitigation Measures

The following mitigation measures are recommended for the study area

- Employment and Output Creation
  a. Linking new and existing local businesses to the supply chain of the wind farm.
- Corporate Social Investment
  a. Using the most effective community structures for the trust fund, inclusion of existing structures, transparent rules in allocating funds, prioritisation according to community needs and building on existing regional synergies
- Sense of Place
  a. Implement mitigation measures detailed in the Visual Impact Assessment
  b. The impact on livelihoods should be monitored and evaluated before and after the construction of the wind farm

13 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALL ALTERNATIVES IDENTIFIED

There are various location alternatives proposed for each key component for the proposed development. Each of these alternatives for each key component are comparatively evaluated below in terms of the findings from the specialist studies conducted during the EIA phase.

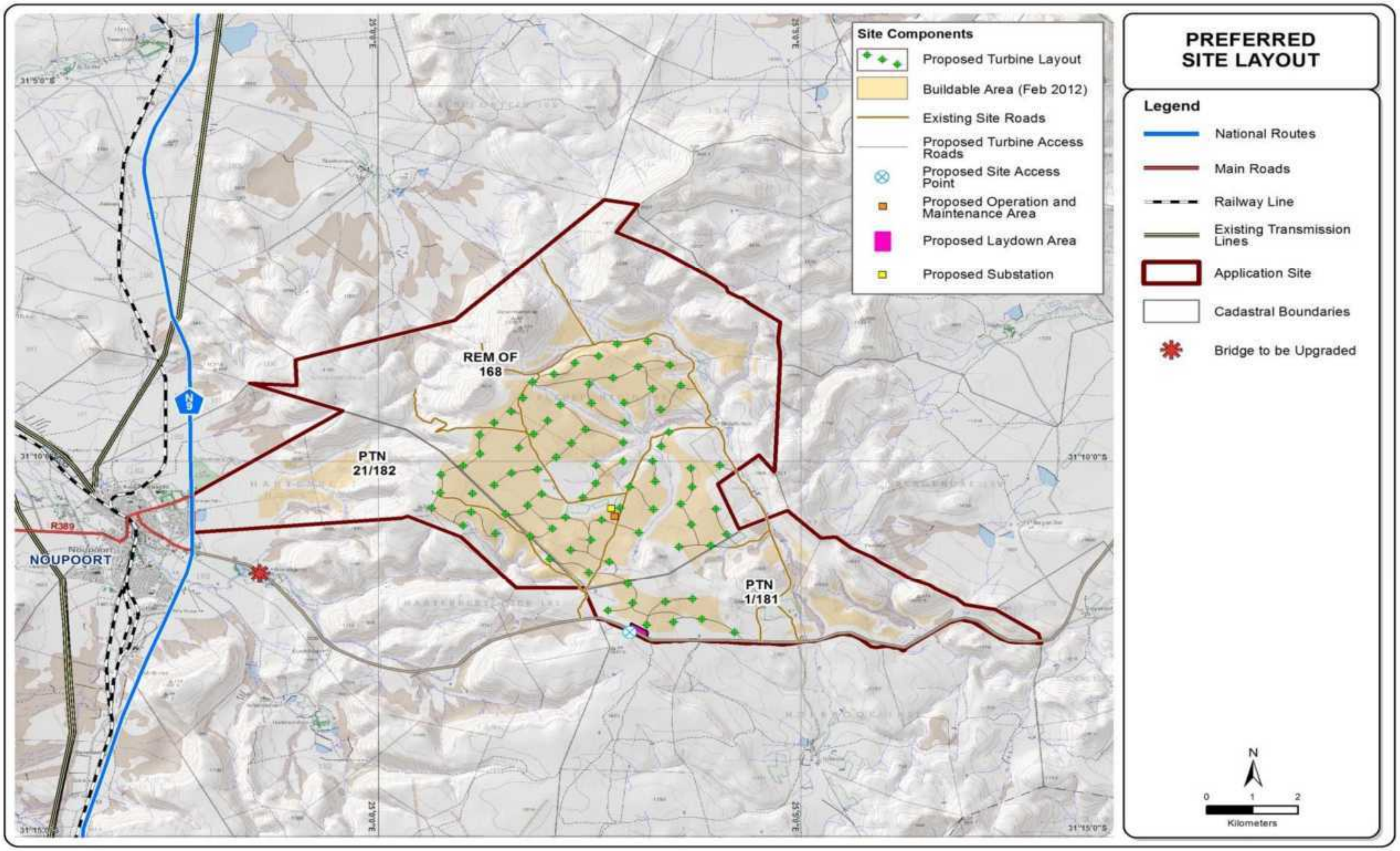

Figure 75: Layout Alternatives proposed

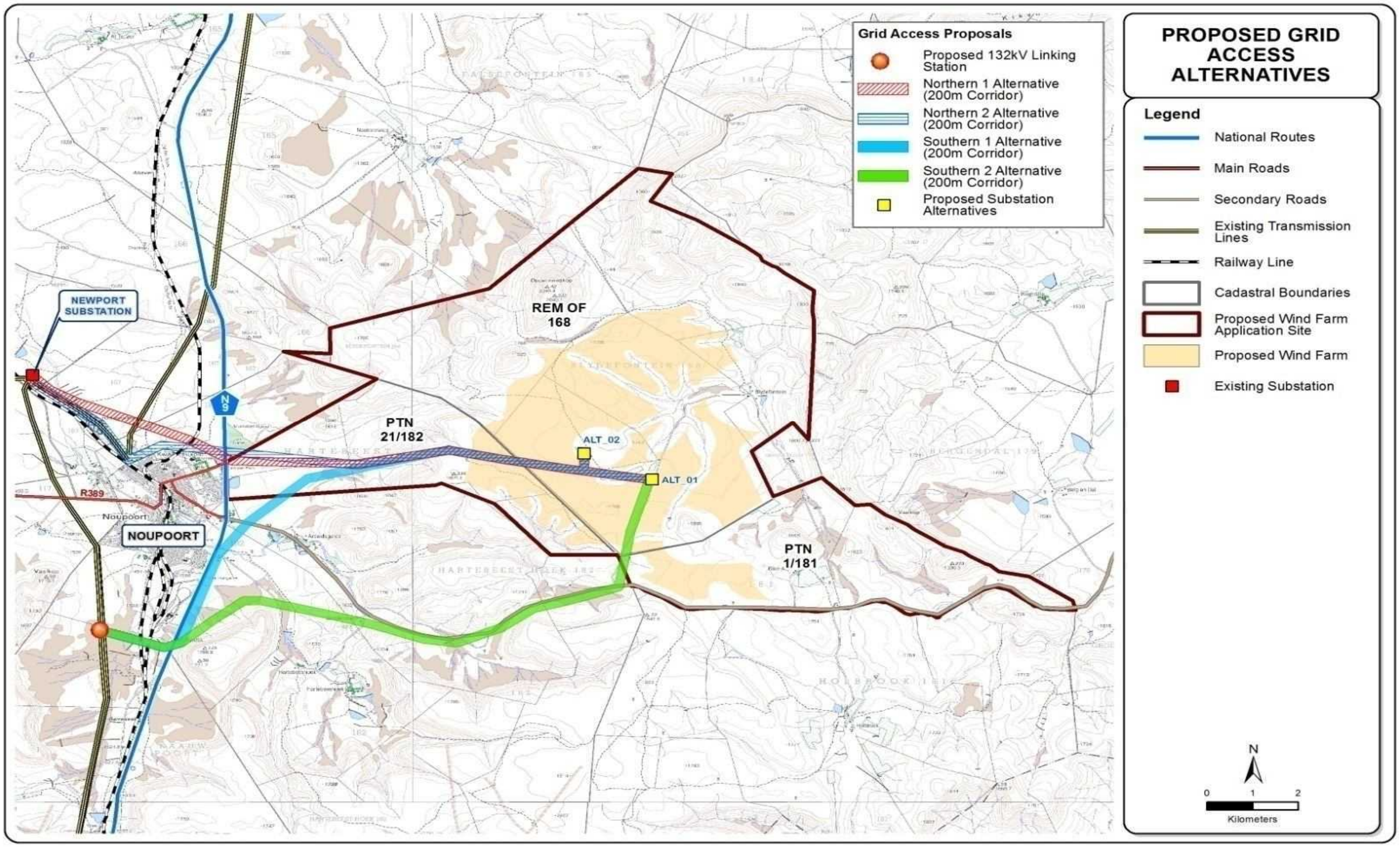

Figure 76: Grid Access Alternatives

Table 79 – 82 below highlights the issues associated with each alternative thereby identifying the preferred alternative.

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Table 79: Grid Access Alternatives Assessment

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
Grid Access Southern Alternative 1	Biodiversity	Passes across karoo vegetation which does not require much clearing.	No Fatal Flaws
	Avi-fauna	Grid access alternative 1 is located farthest from sensitive avi-faunal areas (Blue Crane nesting site) and is therefore the preferred option from an avi-faunal perspective.	No Fatal Flaws
	Bats	No major concerns with regards to bats for grid lines. Route does pass through a bat sensitive area however collisions of bats with power lines is rare.	No Fatal Flaws
	Surface Water	Alternative 1 is the more northern alternative, and emanates from the western edge of the turbine layout, running down the 'escarpment' on the western part of the site and then being aligned to the south-west on the flat terrain near the Aarbeidsgenot Farmstead. Alternative 1 avoids sensitive the highly sensitive wetland to the south of the site where alternative 2 is proposed. Alternative 1 is therefore strongly preferred. Surface water crossings however, will be required.	No Fatal Flaws
	Soils and Agricultural Potential	Grid access alternative 1 does not negatively affect any sensitive soils or highly production land. This option is therefore preferred.	No Fatal Flaws
	Visual	The assessment has found that the degree of change in visual contrast associated with the Alternative 2 power line running along the Oorlogspoort Road is higher than that that associated with the Alternative 1 power lines running down the escarpment edge (the more northerly alignment). It should also be noted that the visual impact of the Alternative 1 power line as viewed from the eastern edge of Noupoort would be	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
		‘lessened’ in a sense due to the cumulative, and much greater impact of the turbines that would be visible from this location, as opposed to if the power lines were the only new feature. Taking the above factors into account, Alternative 1 is thus preferred from a visual perspective for the power lines as it would be associated with a combined visual impact, rather than being a new stand-alone impact in an otherwise non-impacted area	
	Noise	Noise can be anticipated during the construction phase of grid access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered as preferred from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Grid access alternative 1 can be preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	Low potential negative impact. But can be preferred from a palaeontological perspective.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Grid Access Southern Alternative 2	Biodiversity	Passes across karoo vegetation which does not require much clearing.	No Fatal Flaws
	Avi-fauna	Grid access alternative 2 is located some distance from sensitive avi-faunal areas (Blue Crane nesting site) and may therefore be viewed as a viable option but is not preferred from an avi-faunal perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Bats	No major concerns with regards to bats for grid lines. Route does pass through a bat sensitive area however collisions of bats with power lines is rare.	No Fatal Flaws
	Surface Water	Alternative 2, is aligned from the southern part of the turbine location, running parallel to the existing Blydefontein farm access road, and then running parallel with the Oorlogspoort road down onto the flatter ground to the west. Importantly from a surface water perspective, Alternative 2 crosses the highly sensitive wetland system on the southern boundary of the site (at sample point 1). Although the lines would be able to span this system, the presence of power lines and power line construction occurring close to, and across this wetland would not be ideal. Surface water crossings will be required.	No Fatal Flaws
	Soils and Agricultural Potential	Grid access alternative 2 does not negatively affect any sensitive soils or highly production land. This option may therefore be equally selected from a soils and agricultural perspective.	No Fatal Flaws
	Visual	The assessment has found that the degree of change in visual contrast associated with the Alternative 2 power line running along the Oorlogspoort Road is higher than that that associated with the Alternative 1 power lines running down the escarpment edge (the more northerly alignment). It should also be noted that the visual impact of the Alternative 1 power line as viewed from the eastern edge of Noupoort would be 'lessened' in a sense due to the cumulative, and much greater impact of the turbines that would be visible from this location, as opposed to if the power lines were the only new feature. Taking the above factors into account, Alternative 1 is thus preferred from a visual perspective for the power lines as it would be associated with a combined visual impact, rather than being a new stand-alone impact in an otherwise non-impacted area	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of grid access alternative 2. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered suitable from a noise perspective.	No Fatal Flaws
	Geotechnical	No major concerns with regards to bats for grid lines.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Heritage	It is possible that potential heritage and/or palaeontolgoical resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Grid access alternative 2 can equally be viewed as suitable from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	Slightly higher potential negative impacts. Not preferred.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Grid Access Northern Alternative 1	Biodiversity	Crosses the local golf course which has resulted in transformation. Large parts of the route near the town are transformed by anthropogenic activities. ECO must be present when works are done in close proximity to rocky ridges. These areas must be spanned.	No Fatal Flaws
	Avi-fauna	Grid access Northern alternative 1 is located away from sensitive avi-faunal areas (Blue Crane nesting site) and is a viable option from an avi-faunal perspective.	No Fatal Flaws
	Bats	No major concerns with regards to bats for grid lines. Route does pass through a bat sensitive area however collisions of bats with power lines is rare.	No Fatal Flaws
	Surface Water	Northern Alternative 1 avoids sensitive any sensitive surface water features. A walk down is recommended prior to construction to ensure no surface water features are affected. The alternative is preferred.	No Fatal Flaws
	Soils and Agricultural Potential	Northern Alternative 1 does not negatively affect any sensitive soils or highly production land. This option is therefore preferred.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Visual	The proposed routing follows adjacent to existing infrastructure and is viable from a visual perspective.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of grid access Northern alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered as preferred from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Grid access northern alternative 1 is preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	Low potential negative impact. But can be preferred from a palaeontological perspective.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Grid Access Northern Alternative 2	Biodiversity	Follows existing infrastructure and is located in areas that already contain a level of transformation. Preferred from a biodiversity perspective.	No Fatal Flaws
	Avi-fauna	Grid access Northern alternative 2 is located away from sensitive avi-faunal areas (Blue Crane nesting site) and is a viable option from an avi-faunal perspective.	No Fatal Flaws
	Bats	Away from bat sensitive areas and thus preferred from a bat perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Surface Water	Northern Alternative 2 avoids sensitive any sensitive surface water features. A walk down is recommended prior to construction to ensure no surface water features are affected. The alternative is preferred.	No Fatal Flaws
	Soils and Agricultural Potential	Grid access Northern alternative 2 does not negatively affect any sensitive soils or highly production land. This option may therefore be equally selected from a soils and agricultural perspective.	No Fatal Flaws
	Visual	The proposed routing follows existing infrastructure and is viable from a visual perspective.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of grid access Northern alternative 2. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered suitable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Grid access northern alternative 2 is preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	Low potential negative impact. But can be preferred from a palaeontological perspective.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws

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Table 80: Site Access Alternatives Assessment

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
Site Access Alternative 1	Biodiversity	Existing access road in place, well maintained and often used. Limited habitat destruction will therefore take place since existing structures are present.	No Fatal Flaws
	Avi-fauna	Site access alternative 1 does not encroach on any sensitive avi-faunal areas. Additionally, existing access is present which will limit habitat destruction. Site access alternative 1 is therefore preferred from a avi-faunal perspective.	No Fatal Flaws
	Bats	No major constraints with regards to bats.	No Fatal Flaws
	Surface Water	The preferred access point does not lie in close proximity to any wetlands. It lies in an area where there is a relatively low density of surface water features, and the main access road onto the site and to the substation locations and locations for operational maintenance can be routed through an area where only one wetland / drainage system will have to be crossed. This factor is a strong mitigating point, and thus the location of the site access points is welcomed from a surface water perspective.	No Fatal Flaws
	Soils and Agricultural Potential	Site access alternative 1 does not negatively affect any sensitive soils or highly production land. This option is therefore preferred.	No Fatal Flaws
	Visual	Both site access alternatives are situated on the southern buffer zone as proposed by the visual study. Both are therefore, not ideal but can be selected.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered preferable from a noise perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Site access alternative 1 can be preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Site Access Alternative 2	Biodiversity	New access road will be required resulting in likely habitat destruction. Not preferred.	No Fatal Flaws
	Avi-fauna	New access road will be required resulting in likely habitat destruction. From an avi-faunal perspective, this option is not preferred.	No Fatal Flaws
	Bats	No major constraints with regards to bats.	No Fatal Flaws
	Surface Water	Site access alternative point 2 does not lie in close proximity to any wetlands. It lies in an area where there is a relatively low density of surface water features, and the main access road onto the site and to the substation locations and locations for operational maintenance can be routed through an area where only one wetland / drainage system will have to be crossed. This factor is a strong mitigating point, and thus the location of the site access points is welcomed from a surface water perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Soils and Agricultural Potential	Site access alternative 2 does not negatively affect any sensitive soils or highly production land. This option may therefore be equally selected from a soils and agricultural perspective.	No Fatal Flaws
	Visual	Both site access alternatives are situated on the southern buffer zone as proposed by the visual study. Both are therefore, not ideal but can be selected.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 2. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered suitable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Site access alternative 2 can equally be viewed as suitable from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws

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Table 81: Lay-down Area Alternatives Assessment

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
Laydown area Alternative 1	Biodiversity	Adjacent to existing access.	No Fatal Flaws
	Avi-fauna	Laydown alternative 1 does not encroach on any sensitive avi-faunal areas. Additionally, it is located adjacent to the existing access is present which will limit habitat destruction. Site access alternative 1 is therefore preferred from a avi-faunal perspective.	No Fatal Flaws
	Bats	Laydown areas must be located away from potential roosting sites. Site is preferable from a bat perspective.	No Fatal Flaws
	Surface Water	None of the preferred infrastructural components are located in close proximity to any surface water features. The location of these features as proposed, is thus supported.	No Fatal Flaws
	Soils and Agricultural Potential	Laydown area alternative 1 does not negatively affect any sensitive soils or highly production land. This option is therefore preferred.	No Fatal Flaws
	Visual	Both laydown area alternatives are situated on the southern buffer zone as proposed by the visual study. Both are therefore, not ideal from a visual perspective but can be selected.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered preferable from a noise perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Laydown area alternative 1 can be preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Laydown area Alternative 2	Biodiversity	New impacts can be anticipated with new access and lay-down area resulting in likely habitat destruction. Not preferred.	No Fatal Flaws
	Avi-fauna	New impacts can be anticipated with new access and lay-down area resulting in likely habitat destruction. From an avi-faunal perspective, this option is not preferred.	No Fatal Flaws
	Bats	Laydown areas must be located away from potential roosting sites. Site is preferable from a bat perspective.	No Fatal Flaws
	Surface Water	None of the laydown area alternative 2 infrastructural components are located in close proximity to any surface water features. The location of these features as proposed, may equally be supported from a surface water perspective.	No Fatal Flaws
	Soils and Agricultural Potential	Laydown area alternative 2 does not negatively affect any sensitive soils or highly production land. This option may therefore be equally selected from a soils and agricultural perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Visual	Both laydown area alternatives are situated on the southern buffer zone as proposed by the visual study. Both are therefore, not ideal from a visual perspective but can be selected.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered suitable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Laydown area alternative 2 can equally be viewed as suitable from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws

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Table 82: Operation and Maintenance Area Alternatives Assessment

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
Operation and Maintenance Area Alternative 1	Biodiversity	No major preference, but located closest to the central part of the site where the majority of turbines will be located.	No Fatal Flaws
	Avi-fauna	The location of the operation and maintenance area alternative 1 is placed away from the high risk avi-faunal area (Blue Cane nesting site). This option is therefore preferred.	No Fatal Flaws
	Bats	No concerns from a bat perspective with regards to the location of permanent structures which would not influence bat movement. Site is preferred.	No Fatal Flaws
	Surface Water	None of the preferred infrastructural components are located in close proximity to any surface water features. The location of these features as proposed, is thus supported.	No Fatal Flaws
	Soils and Agricultural Potential	Operation and maintenance area alternative 1 does not negatively affect any sensitive soils or highly production land. This option is therefore preferred.	No Fatal Flaws
	Visual	Neither operation and maintenance building location alternatives would be visible from the Holbrook farmstead, or from the receptor locations to the west or east of the site, due to the shielding effect of topography. In spite of its relative proximity to the road, the substation, the preferred substation would not be visible from parts of the Oorlogspoort Road as it runs along the development site boundary. Even if the substation were to be able to be viewed it would be dwarfed by the large number of turbines that would be visible from the road. As such the substation is not expected to be associated with a significant visual impact, or even a measurable cumulative impact.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered preferable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Operation and maintenance area alternative 1 can be preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Operation and Maintenance Area Alternative 2	Biodiversity	No major preference, but located closest to the central part of the site where the majority of turbines will be located. Hence, the location of operation and maintenance area alternative 2 may be equally chosen from a biodiversity perspective.	No Fatal Flaws
	Avi-fauna	The location of the operation and maintenance area alternative 2 is placed within the high risk avi-faunal buffer zone area (Blue Cane nesting site). This option is therefore not suitable.	No Fatal Flaws
	Bats	No concerns from a bat perspective with regards to the location of permanent structures which would not influence bat movement. Site is preferred.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Surface Water	None of the operation and maintenance area alternative 2 infrastructural components are located in close proximity to any surface water features. The location of these features as proposed, may equally be supported from a surface water perspective.	No Fatal Flaws
	Soils and Agricultural Potential	Operation and maintenance area alternative 2 does not negatively affect any sensitive soils or highly production land. This option may therefore be equally selected from a soils and agricultural perspective.	No Fatal Flaws
	Visual	Neither operation and maintenance building location alternatives would be visible from the Holbrook farmstead, or from the receptor locations to the west or east of the site, due to the shielding effect of topography. In spite of its relative proximity to the road, the substation, the preferred substation would not be visible from parts of the Oorlogspoort Road as it runs along the development site boundary. Even if the substation were to be able to be viewed it would be dwarfed by the large number of turbines that would be visible from the road. As such the substation is not expected to be associated with a significant visual impact, or even a measurable cumulative impact.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered suitable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Operation and maintenance area alternative 2 can equally be viewed as suitable from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
		perspective.	

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Table 83: Substation Alternatives Assessment

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
Substation Alternative 1	Biodiversity	No major preference but located closest to the central part of the site where the majority of turbines will be located.	No Fatal Flaws
	Avi-fauna	The location of substation alternative 1 is situated away from the high risk avi-faunal area (Blue Cane nesting site). This option is therefore preferred.	No Fatal Flaws
	Bats	The substation is located away from bat sensitive areas. Both sites are preferred.	No Fatal Flaws
	Surface Water	None of the preferred infrastructural components are located in close proximity to any surface water features. The location of these features as proposed, is thus supported.	No Fatal Flaws
	Soils and Agricultural Potential	Substation alternative 1 does not negatively affect any sensitive soils or highly production land. This option is therefore preferred.	No Fatal Flaws
	Visual	Neither substation location alternatives would be visible from the Holbrook farmstead, or from the receptor locations to the west or east of the site, due to the shielding effect of topography. In spite of its relative proximity to the road, the substation, the preferred substation would not be visible from parts of the Oorlogspoort Road as it runs along the development site boundary. Even if the substation were to be able to be viewed it would be dwarfed by the large number of turbines that would be visible from the road. As such the substation is not expected to be associated with a significant visual impact, or even a measurable cumulative impact.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered preferable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Substation area alternative 1 can be preferred from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws
Substation Alternative 2	Biodiversity	No major preference, but located closest to the central part of the site where the majority of turbines will be located. Hence, the location of substation alternative 2 may be equally chosen from a biodiversity perspective.	No Fatal Flaws
	Avi-fauna	The location of the operation and maintenance area alternative 2 is situated within the high risk avi-faunal buffer zone area (Blue Cane nesting site). This option is therefore not suitable.	No Fatal Flaws
	Bats	The substation is located away from bat sensitive areas. Both sites are preferred.	No Fatal Flaws
	Surface Water	None of the operation and maintenance area alternative 2 infrastructural components are located in close proximity to any surface water features. The location of these features as proposed, may equally be supported from a surface water perspective.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Soils and Agricultural Potential	Substation alternative 2 does not negatively affect any sensitive soils or highly production land. This option may therefore be equally selected from a soils and agricultural perspective.	No Fatal Flaws
	Visual	Neither substation location alternatives would be visible from the Holbrook farmstead, or from the receptor locations to the west or east of the site, due to the shielding effect of topography. In spite of its relative proximity to the road, the substation, the preferred substation would not be visible from parts of the Oorlogspoort Road as it runs along the development site boundary. Even if the substation were to be able to be viewed it would be dwarfed by the large number of turbines that would be visible from the road. As such the substation is not expected to be associated with a significant visual impact, or even a measurable cumulative impact.	No Fatal Flaws
	Noise	Noise can be anticipated during the construction phase of site access alternative 1. However, this is not expected to be of great magnitude and of low significance to nearby sensitive developments. This option can be considered suitable from a noise perspective.	No Fatal Flaws
	Heritage	It is possible that potential heritage and/or paleontological resources may be un-earthed during construction of the wind farm. Mitigation measures addressing this potential affect have been supplied addressing this concern. Visible heritage resources have been provisionally identified and excluded from the development areas. Substation alternative 2 can equally be viewed as suitable from a heritage resources perspective.	No Fatal Flaws
	Palaeontology	No preference.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. Either alternative in this instance may be selected from a socio-economic perspective.	No Fatal Flaws

	ELIMINATED
	PREFERRED

Table 84: No-go and Preferred Alternatives Assessment

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
No Go Alternative	Biodiversity	Should the no-go alternative be selected, the condition and characteristics of the surface water resources as assessed on the study site will remain as is. The positive benefits of alien and weed control measures would not be realised.	No Fatal Flaws
	Avi-fauna	Should the no-Go alternative be selected, the study site would be preserve the status quo as it currently exists.	No Fatal Flaws
	Bats	Should the no-Go alternative be selected, the study site would be preserve the status quo as it currently exists.	No Fatal Flaws
	Surface Water	Should the no-go alternative be selected, the condition and characteristics of the surface water resources as assessed on the study site will remain as is.	No Fatal Flaws
	Soils and Agricultural Potential	Should the no-go alternative be selected, the condition and characteristics of the soils and agricultural potential as assessed on the study site will remain as is.	No Fatal Flaws
	Visual	Should the no-go alternative be selected, the visual characteristics as assessed on the study site will remain as is with no anticipated visual impacts.	No Fatal Flaws
	Noise	Should the no-go alternative be selected, the sound characteristics and ambient sound levels of the current sound environment would remain as is.	No Fatal Flaws
	Heritage	Should the no-go alternative be selected, the condition and characteristics of the heritage resources as assessed on the study site will remain as is. Degradation through natural means can be expected however. The opportunity to document and	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
		report on findings may also not be realised.	
	Palaeontology	The baseline profile of the palaeontological receiving environment would be maintained to a large degree (not taking into account variables outside of the project) in the event that a 'no go' option was implemented. Degradation through natural means can be expected however. The opportunity to document and report on findings may also not be realised.	No Fatal Flaws
	Socio-economic	The baseline profile of the socio-economic receiving environment would be maintained to a large degree (not taking into account variables outside of the project) in the event that a 'no go' option was implemented. None of the positive socio-economic features would be realised.	No Fatal Flaws
Preferred Alternatives	Biodiversity	From a biodiversity perspective, the operation and maintenance buildings, the substation site, the laydown area, the site access and grid access North and South alternative 1 are preferred.	No Fatal Flaws
	Avi-fauna	From an avi-faunal perspective, all of the preferred alternative 1 building and structure locations, laydown area, grid access, access points, wind turbine layout and routing options are supported.	No Fatal Flaws
	Bats	No real preference from a bat perspective.	No Fatal Flaws
	Surface Water	From a surface water perspective, all of the preferred alternative 1 building and structure locations, laydown area, grid access, access points, wind turbine layout and routing options are supported.	No Fatal Flaws
	Soils and Agricultural Potential	From a soils and agricultural perspective, all of the preferred alternative 1 building and structure locations, laydown area, grid access, access points, wind turbine layout and routing options are supported.	No Fatal Flaws
	Visual	From a visual perspective, grid access alternative 1 is preferred. Either alternative for the operation and maintenance buildings, the substation site, the laydown area, the site access can be considered.	No Fatal Flaws

Alternative	Specialist Study	Specialist Concerns	Fatal Flaws
	Noise	From a soils and agricultural perspective, all of the preferred alternative 1 building and structure locations, laydown area, grid access, access points, wind turbine layout and routing options are supported.	No Fatal Flaws
	Heritage	From a heritage perspective, all of the preferred alternative 1 building and structure locations, laydown area, grid access, access points, wind turbine layout and routing options are supported in that all heritage resource areas have been excluded from the developable areas and no identified heritage resources at present are anticipated to be affected by the proposed development.	No Fatal Flaws
	Palaeontology	From a palaeontological perspective, there are no preferences in terms of all the building and structure locations, laydown area, grid access, access points, wind turbine locations. Hence alterantive 1 or 2 can equally be selected. The northern grid access alternatives 1 and 2 as well as the southern grid access alternative 1 are preferred.	No Fatal Flaws
	Socio-economic	The socio-economic environment is assessed in terms of surrounding communities and those which may be affected by the proposed development as a whole. Site specific preferences in the context of this development have therefore not been provided. However, from a socio-economic perspective the preferred alternative could be supported.	No Fatal Flaws

13.1 No-Go Alternative

The No-Go Alternative is the option of not establishing the wind farm on the study site near Noupoort. The No-Go option would therefore result in not contributing to the demand for electricity and more specifically renewable energy targets in South Africa from being met. This would also hinder the economic injection that the project promises to provide for the town of Noupoort in the form of an increase in employment and income generation during the construction phase and long term tax income generation and social corporate investment. From a biological perspective, alien and weed control mechanisms would not be realised.

The No-Go alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated. Additionally, by not building the project, the socio-economic and biophysical benefits would be lost providing further reason for eliminating the no-go alternative.

Based on the alternatives assessment and the negative mapping exercise that was undertaken by all the specialists, the following sensitivity map was compiled.

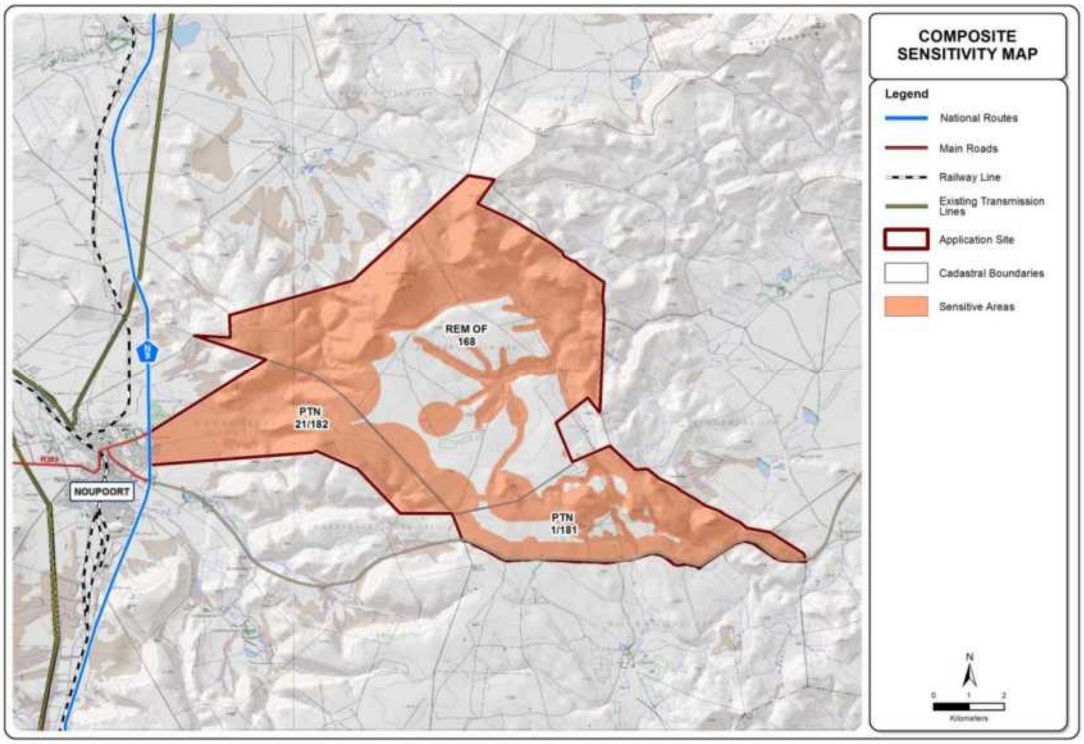

Figure 77: Composite Sensitivity Map

Based on this sensitivity mapping the following preferred layout was decided upon.

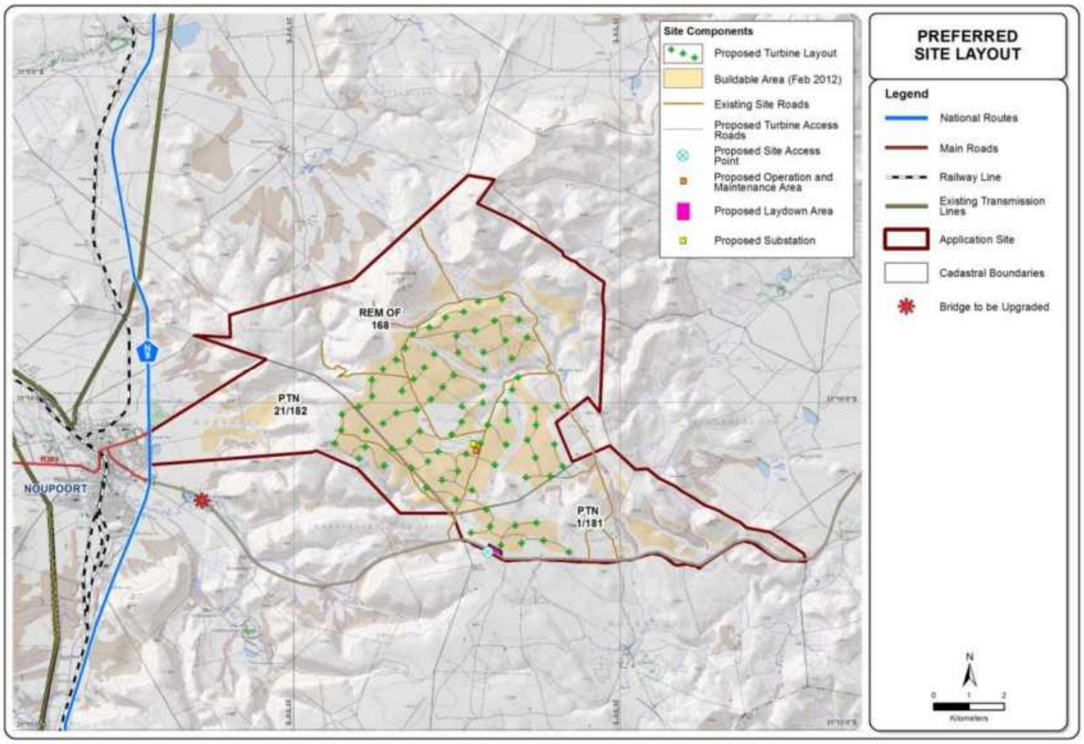

Figure 78: Preferred layout

The specialist supported preferred grid access alternatives include northern griad access alternatives 1 and 2 as well as southern grid access alternative 1. Grid access southern alternative 2 is not preferred from the majority of the specialist recommendations

Below is a map of the sensitivity mapping overlayed with the site layout. This map indicates all specialist sensitive areas overlayed over the site layout. This provides and illustration of how sensitive areas have been taken into account. Note that the only area where wind turbine structures have been placed in the sensitivity areas is to the south west where this area was identified as sensitive from a visual perspective alone. Note that a compromise was reached with regards to the visual buffers in this area as these were not considered to be fatal flaws. Hence some of the turbines are located on the edge of the visual sensitive area.

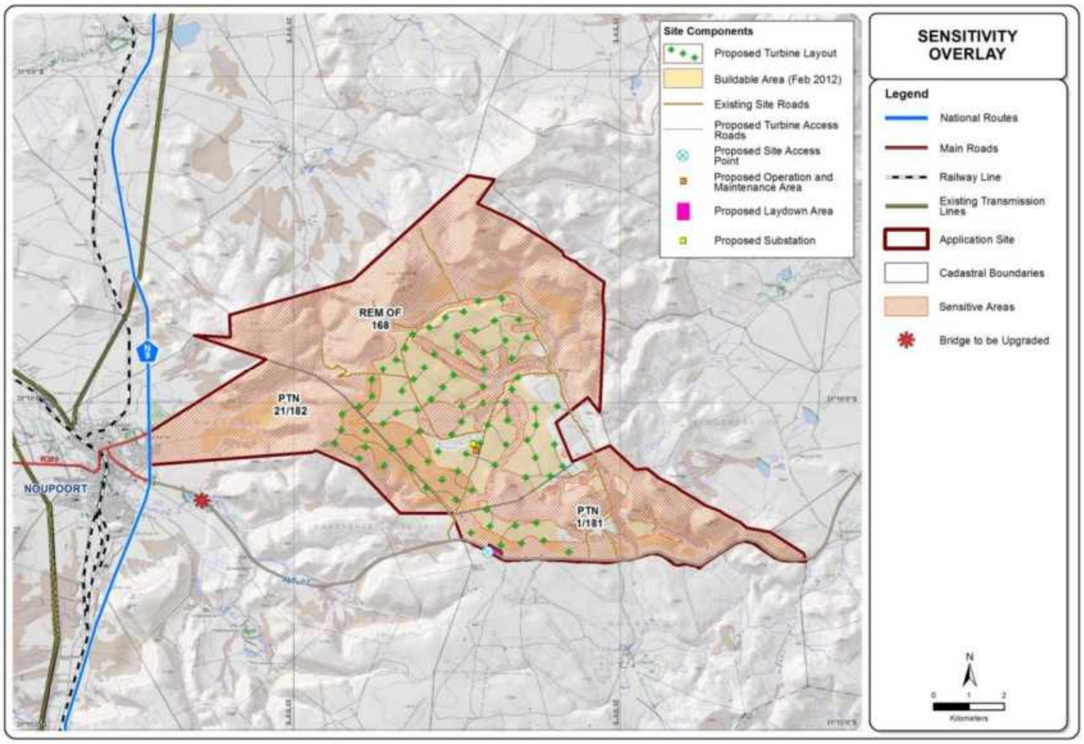

Figure 79: Layout overlayed with the sensitivity mapping

14 ENVIRONMENTAL MONITORING AND AUDITING

The Environmental Management Programme (EMPr) becomes a tool by which compliance on the proposed site can be measured against. In order to utilise this tool, environmental monitoring needs to take place with regular audits against the EMPr to ensure that all aspects are attended to.

Environmental monitoring establishes benchmarks to judge the natural and magnitude of potential environmental and social impacts.

Some of the key parameters for monitoring and auditing of the proposed project include the following *inter alia*:

- Soil erosion and siltation
- Dust and gaseous emissions
- Water quality
- Noise and vibration
- Change in biodiversity
- Possible discovery of heritage and palaeonological finds

- Socio-economic change
- Land use changes

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable responses to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMPr.

Environmental monitoring will be carried out to ensure that all construction activities comply with and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/ environmental requirements. This person will maintain regular contact with the local / district Environmental Officers. The contractor and proponent will have the responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

- Encroachment into sensitive areas
- Maintenance of project footprint
- Vegetation maintenance around project work sites, workshops and camps
- Health & Safety

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the implementing agencies. It is not the Contractor's responsibility to monitor land acquisition and compensation issues. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an international environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

The EMPr is included in Appendix 9.

15 COMPLIANCE WITH WORLD BANK STANDARDS AND EQUATOR PRINCIPLES

This report has been prepared to comply with various environmental legislation as well as World Bank Standards (IFC Guidelines) and the Equator Principles. Thus in order to ensure compliance with these, a checklist has been compiled to ensure that all aspects of these guidelines have been taken into account when compiling this document. Table 85 below indicates that all applicable performance standards have been complied with.

The performance standards which have not been addressed at this stage as indicated in Table 85 below will be addressed at a later stage when the proponent has reached financial closure. Therefore the compliance level is partially compliant at this stage. It is important to note that the project proponent is committed to achieving compliance with the EPs.

The coding key is as follows:

Compliance level			
Clear			
Not assessed/determined	Not compliant	Partially compliant	Compliant

Appendix 10 includes a handbook highlighting how the client plans to comply with the IFC Standards.

Table 85: Compliance with Equator Principles

PRINCIPLES	COMPLIANCE LEVEL	REFERENCE
Performance Standard 1 Environmental & Social Reporting		
1. Baseline Information		Refer to Chapter 6
2. Impacts and Risks		Refer to Chapter 9
3. Global impacts		N/A
4. Transboundary		N/A
5. Disadvantaged / vulnerable groups		Refer to Chapter 10
6. Third party		Refer to Chapter 10
7. Mitigation measures		Refer to Chapter 12 and the EMPr
8. Documentation of Assessment process		Refer to Chapter 9
9. Action Plans		Refer to Appendix 10

10 Organizational capacity		Refer to Appendix 10
11. Training		Refer to Appendix 10
12. Grievance mechanism	The proponent will commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
Performance Standard 2, Labour & Working Conditions		
1. Human Resource Policy	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
2. Working relationship		Refer to Appendix 10
3. Working conditions with and terms of employment		Refer to Appendix 10
4. Workers organization		Refer to Appendix 10
5. Non discrimination and equal opportunities		Refer to Appendix 10
7. Occupational Health and Safety		Refer to Appendix 10
8. Non-employee workers		Refer to Appendix 10
9. Supply Chain		Refer to Appendix 10
10. Labor Assessment Component of a Social and Environmental Assessment		Refer to Appendix 10
Performance Standard 3, Pollution		
1. Pollution Prevention, Resource Conservation & Energy Efficiency		Refer the EMPr
2. Wastes		Refer the EMPr

3. Hazardous material		Refer the EMPr
4. Emergency preparedness & response	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
5. Technical guidance – ambient considerations		Refer to Appendix 10
6. Greenhouse gas emissions	Mainstream's objective is to develop the proposed wind farm near Noupoort under the Clean Development Mechanism (CDM). The project will generate electricity from a renewable energy with an associated carbon dioxide emission of close to zero for every kWh that is generated into the grid. For every kWh generated, approximately 0.97 to 1.1 kg carbon dioxide emissions will be reduced from the national grid managed by Eskom.	No greenhouse gas emissions will result from the proposed development
Performance Standard 4, Health & Safety		
1. Hazardous materials safety		Refer to the EMPr
2.Environmental and natural resource issues		Refer to Chapters 8, 10, 11 and 12 and Appendix 6
Performance Standard 5, Land Acquisition		**Refer to chapter 5**
Performance Standard 6, Biodiversity		**Refer to Chapter 8 and 10**

		and Appendix 6
Performance Standard 7, Indigenous People		**Refer to Chapter 8 and 10**
Performance Standard 8, Cultural Heritage		**Refer to Chapter 8 and 10**

16 OTHER DEA REQUISITE INFORMATION

As per correspondence received from the DEA approving the plan of study for the EIA phase dated 21st February 2012 (Appendix 3) the following information was requested:

- Alien invasive management plan
- Plant rescue and protection plan
- Re-vegetation and habitat rehabilitation plan
- Open space management plan
- Traffic management plan
- Transportation plan
- Storm water management plan
- Erosion management plan
- Avifauna and Bat monitoring programme
- Proof of water use licence
- Mapping Requirements
- Details of the future plans for the site and infrastructure after decommissioning in 20-30years.

The above mentioned aspects can be found within the Appendices of the FEIR which is outlined in Table 86 below.

Table 86: DEA information requirements for wind farms

DEA Requirement	Location in FEIR
Alien invasive management plan	Appendix 9 (pages 107-113 in EMPr)
Plant rescue and protection plan	Appendix 9 (pages 107-113 in EMPr)
Re-vegetation and habitat rehabilitation plan	Appendix 9 (pages 107-113 in EMPr)
Open space management plan	Appendix 9 (pages 107-113 in EMPr)
Traffic management and Transportation plan	Appendix 11 A
Storm water management plan	Appendix 11 C

Erosion management plan	Appendix 9 (pages 107-113 in EMPr)
Proof of water use licence	Appendix 11 B
Mapping Requirements	Appendix 7

- Avi-auna and Bat Monitoring Programme

Avi-fauna and bat monitoring programmes have been initiated for the proposed development for a period of 12 months. The bat monitoring programme initiated in December 2011. The approach is to conduct pre-construction monitoring by means of site visits every season for a year. The intention of the monitoring is to study the habitat types and make predictions based on observations and findings to identify important roosts and geographical features that attract bats which are to be designated as sensitive and buffered to mitigate impacts. In terms of the bird monitoring, the programme was undertaken as of October 2011 similarly with the intention of identifying and monitoring the habitat types thereby making predictions based on observations and findings to identify important roosting sites and geographical features that attract birds which are to be designated as sensitive and buffered to mitigate impacts.

These two monitoring programmes are of great research and development value for South Africa as these studies will contribute to the understanding of wind farm bat and bird mortality potential impacts in a specifically South African context. It is envisaged that should authorisation be granted for the proposed development, further research and development opportunities in the fields of bat and bird research will be available to gain a better understanding of the potential wind farm construction and operation phase impacts on bat and bird mortalities to which there is currently no information available.

- Details of the future plans for the site and infrastructure after decommissioning in 20-30 years.

In terms of the details pertaining to the future plans for the site and infrastructure after decommissioning should the proposed development commence, it is envisaged either the wind farm will be decommissioned after 20-25years or a new lease will be renegotiated with the landowner. In the event that the previous agreement and a new power purchase agreement is renegotiated and the wind farm is to continue operation, it is likely that the wind farm is “re-powered” using new technology. Note that any additional work during re-power outside the scope of original approvals would follow the required environmental approval process as may be required at that stage. However, if the previous agreement is not re-negotiated, decommissioning will be the responsibility of the developer and subsequent rehabilitation of the study site. A fund will be established for the decommissioning of the wind farm for rehabilitation.

- Geotechnical Study

A geotechnical study was conducted for the proposed development to ascertain whether there would be any significant geotechnical constraints. This can be found within Appendix 11D. No fatal flaws were identified although a detailed geotechnical investigation will be required once the final layout is approved. Once the locations of the various wind farm components have been consolidated the findings of the detailed geotechnical investigation will need to be acknowledged and mitigation measures where required will need to form part of the construction EMPr for the proposed development.

17 EVALUATION AND RECOMMENDATIONS

Table 87 summarises the key recommendations for the environmental issues identified in the EIR. In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA must be included within an Environmental Management Programme (EMPr). This EMPr should form part of the contract with the contractors appointed to construct and maintain the proposed. The EMPr would be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

An Environmental Management Programme is included with this Environmental Impact Report.

It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.

17.1 Summary of Findings

Table 87: Summary of specialist major findings and recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity (Flora and Fauna)	▪ The study area consists of a mix of natural veld and unimproved grassland which is used as grazing land for cattle and sheep. Vast grazing land is interspersed incised river channels, which flow intermittently, are present. Large mountains are present within the study site. ▪ Various mammal, amphibian and reptile species are likely to occur within the study area. ▪ The potential impacts of the proposed development during the construction phase mainly related to loss of habitat for red data and general species; potential loss of species richness, edge effect and erosion. The impact of the proposed development will be limited to the turbine construction areas and the associated infrastructure such as roads. Surrounding vegetation will remain intact and will not be impacted upon. As such the impact is localised and if the mitigation measures are implemented, the overall impact can be reduced. ▪ No significant impacts on vegetation and habitat are expected during the operation phase of the proposed development, as long as rehabilitation of the impacted surrounding areas has taken place.	Sensitive areas have been identified within the boundaries of the study area. These relate to rocky cliffs, high mountain sides and tops as well as rivers and wetlands. The preservation of these features, as well as conservation of biodiversity should be maximised through the selection of a site that avoids areas of concern as highlighted in this report. The preferred area steers away from these sensitive areas and strict mitigation measures will further reduce the identified impacts
Avi-fauna	▪ This proposed development site contains some intrinsic avian biodiversity value. It does not contain any unique	Identified sensitive and no-go areas have been identified and must be respected. Additionally,

	habitats or landscape features, nor does it affect any known, major avian fly-ways. However, the site contains two topographical characteristics that are usually linked to increased collision risk, namely slopes which could be used by soaring species for lift, especially during light wind conditions, and valleys which act as natural funnels for birds commuting through the site. If possible, these areas should be kept free of turbines. ▪ There are regionally and/or nationally important impact susceptible species present (or potentially present), and the proposed facility may have a significant detrimental effect on these birds, both during the construction and operational phases of the development.	recommended buffer zones particularly around the Blue Crane nesting site must be enforced. Implementation of the required mitigation measures should reduce potential mortalities due to collision with the wind turbines, displacement due to disturbance, habitat loss due to the footprint of the wind farm mortalities due to collision with associated power line infrastructure impacts to Low. However, this can only be verified in the longer term by implementing an integrated per- and post construction monitoring programme which has been undertaken as of October 2011.
Bats	▪ Two species of bat were confirmed on site Egyptian free-tailed bats (*Tadarida aegyptiaca*) and Cape serotine bats (*Neoromicia capensis*)) but more species are considered to be common here. Although neither confirmed species are of conservation concern, they likely provide important agri- and ecosystem services. ▪ Construction phase impacts relate to destruction of bat roosts and foraging habitat. Operation phase impacts relate to bat mortalities due to collisions and barotrauma during migration and foraging. ▪ Several mitigation measures have been stipulated to address impacts in addition to identifying sensitive areas or exclusion areas for the placement of the wind turbines to minimise the impact. Long term monitoring has been proposed for research purposes and has been	The inland water bodies and stream areas indicated in the data of the buildable areas and their buffers should be treated as sensitive, implicating that no turbines are allowed to be placed in this zone due to the elevated impacts it can have on bat mortalities and have been treated as such. No wind turbines have been placed within these sensitive areas to avoid excessive bat fatalities. Curtailment is recommended as an operational mitigation measure for this site, should operational monitoring highlight the need, as bats were detected flying in open areas as well (not indicated as sensitive). Curtailment will reduce fatalities for bats flying in open areas. To determine the correct cut in

	implemented as of December 2011.	speed should this be required and whether the site falls within a bat migration route, a 12 month long term monitoring is currently being done which was initiated in December 2011.
Surface water	▪ Although the development site exists in an arid area, there are a number of surface water features on the site. These differ in characteristics from drainage lines in rocky terrain to narrow valley bottom wetlands and well-defined streams. In the context of the study area's arid characteristics these surface water features are environmentally and socio-economically important, and are sensitive to disturbance, being especially prone to erosion. ▪ These surface water areas have been designated as sensitive features of the environment, and as such they have been delimited as no-go areas with a buffer to be maintained around them. This report has found that the proposed development could cause direct and indirect impacts on the surface water features on the site. This is especially related to the associated (linear) infrastructure associated with the proposed wind farm, in particular roads and underground cabling. The construction of this infrastructure could be associated with the physical destruction of wetland habitat, as well as possible hydrological and hydromorphological modification of the surface water feature and introduce possible pollutants into	A number of general and site-specific mitigation measures have been recommended to ameliorate the potential impacts and these have been included in the EMPr for the proposed development. The most important of these is the avoidance of surface water features by infrastructure as far as possible. Where this is not possible (e.g. where access roads have to cross surface water features), the design and construction of the infrastructure must be planned to take into account the sensitivity of the feature and to ensure the implementation of the relevant mitigation measures. Should these be adhered to, the development will be able to be constructed and developed without causing significant impacts on the surface water features on the site.

	the surface water drainage feature. Without the implementation of mitigation measures, the impact of the proposed development on surface water features could be significant.	
Soils and Agricultural Potential	▪ The study area is dominated by unimproved veld which is predominantly utilized as grazing land for cattle and sheep. Cultivation, in terms of Lucerne, is possible in valley bottoms were the soils tended to be deeper with higher soil moisture contents due to topographic position. ▪ The study area is almost completely framed by steeper slopes, valley lines and / or ridges while the central areas are characterised by flat and gently sloping topography with an average gradient of less than 10%. The soils identified are predominantly shallow and rocky with a low agricultural potential. Lithic soils (Mispah and Glenrosa Forms) cover 87% of the surveyed area. Virtually all the soils encountered had a layer that was limiting to plant growth and the effective soil depth rarely extended below 50 cm. ▪ The site is not classified as high potential nor is it a unique dry land agricultural resource. The study area has been classified as having an extremely low potential for crop production due to severe climatic limitations, steep topography and restrictive soil characteristics but are considered to have a moderate when utilised as grazing land, its current use.	Normal grazing (the dominant agricultural activity) can be permitted around the turbines. The active Lucerne subsistence fields have been delineated as No-Go Areas in terms of agriculture. These active fields only constitute 0.1% of the assessment area. Even though disrupting these fields would not constitute a fatal flaw it is recommended that these cultivated fields are precluded from the site layout. Other than these fields and the limited subsistence agricultural fields tended by Sipila Nongunzenzela Trust the Noupoort site is dominated by grazing land and this activity is considered non-sensitive when assessed within the context of the proposed development. Consequently, the impact of the proposed development on the study area's agricultural potential will be extremely low, with the loss of agricultural land being attributed to the creation of the service roads and around the turbine foundations

Noise	▪ With the input data as used, the noise impact assessment indicated that the proposed project will have a noise impact of a low significance on all NSD in the area during the construction phase, but of a medium significance on NSD06 during the operational phase. As the wind turbine to be selected is not confirmed, modelling made use of the Nordex H90 2500HS wind turbine. Mitigation measures are proposed that will reduce the potential noise impact to a more acceptable low significance.	Where 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.
Visual	▪ The visual assessment was undertaken based on the final draft layout for the wind farm that was made available for assessment in the final stages of the EIA. It is a critical factor that this layout was designed based on a consideration of a number of visual sensitivity factors, in particular areas on which turbines would be most visible to surrounding areas in which sensitive receptors are present. Although not all 'exclusion areas' were avoided, certain critical areas were not developed, and as such it is very important to note that this new layout represents a scenario under which visual mitigation measures have been applied. ▪ In spite of the changes to the layout to avoid certain parts	The identified potentially impacted areas can be effectively ameliorated by further altering the turbine layout by removing turbines from the parts of the two buffer zones (that to the east of the 'escarpment edge' and that to the north of the Oorlogspoort Road) in which turbines have been placed. It is thus recommended that consideration be given to removing turbines from these locations, as this would result in an acceptable degree of visual change and intrusion associated with the wind farm at all locations (**Note –** this recommendation is subject to technical constraints and other environmental factors that may override visual impact considerations. The

	of the site, the assessment has identified that certain key observation locations will be subject to a visual contrast and thus potential visual intrusion that is inconsistent with the current visual environment. These locations are those receptor locations in natural contexts located to the west of the site (away from the town of Noupoort which has been assessed to be subject to an acceptable level of change) and a farmstead to the south of the site.	current layout already represents the implementation of mitigation measures in terms of restricting turbines from visually sensitive areas. The above recommendations would be favourable to reducing the visual impact however the locations of these turbines are not considered to be a fatal flaw).
Heritage	▪ Several heritage resources have been identified on site which can be classed as having high significance. ▪ The cultural landscape qualities of the region essentially consist of one component. It is a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial (farmer) component. ▪ The following sites, features and objects of cultural heritage significance have been identified: ▪ A rock shelter that was occupied during the Later Stone Age is located in a valley which is outside the area that has been identified as buildable for the turbines. Because of its location in the valley, it is highly unlikely that there would be a physical impact on it arising from the development of the wind farm. However, some of the wind turbines might be visible from the shelter. As the site is in no physical danger and it has already been intensively studied, no mitigation measures are required. ▪ Two old farmsteads were identified. Both these features are located outside of the areas that have been identified	In order to safeguard the identified sites, it is recommended that buffer zones identified are set out around each of the identified sites. These include: ▪ The rock shelter should be demarcated with a buffer of at least 50 metres from the outer edge of the shelter, up to and including the river bank. ▪ The farmsteads should be demarcated with a buffer of at least 10 metres from the outer edge of all structures and features such as gardens, orchards, etc. ▪ Cemeteries should be demarcated by a buffer of at least 10 metres from the outer edge of the fence, or the last visible graves if there is no fence. ▪ The stone walled structures should be demarcated by a buffer of at least 10 metres from the outer edge of the individual structures

	as buildable for the wind turbines and therefore there would be no physical impact on it. ▪ Informal cemetery, probably for farm labourers. Approximately 20 graves, all only marked with stones. No names or other inscriptions could be found. These graves are probably linked to the homestead discussed above. Therefore there would be no impact on it as a result of the proposed development. ▪ A number of stone walled structures were erected by sheep herders who brought the sheep up onto to high areas during the summer and then vacated then during winter when it became too cold. Typically these structures seem to consist of a small area used for sleeping and a larger enclosed space used to keep the sheep in overnight. ▪ Fortunately all of these structures are located in the valleys or on ridges, areas which are unlikely to be impacted on by the proposed development. However, if there is to be an impact on any of these structures, the relevant structures should be recorded in full (mapped, photographed and excavated) prior to the development taking place. ▪ Potential impacts identified for the construction phase include focus on the physical disturbance of the stone age material and its context, damage to farmsteads, damage to cemeteries and damage to farm related features. ▪ Mitigation measures focus on implementing buffer zones to identified sites to prevent potential damage.	These buffer zones have been incorporated into the site layout as exclusion areas. Based on current information regarding sites in the surrounding area, apart from the rock shelter that is viewed to have Grade II significance, all other sites known to occur in the study region are judged to have Grade III significance and therefore would not prevent the proposed development for continuing after the implementation of the proposed mitigation measures and its acceptance by SAHRA. All suggested mitigation measures that are to be implemented have been included in the EMPr for the proposed development.
Palaeontology	▪ The Mainstream wind farm study area east of Noupoort, Northern Cape, is largely underlain by continental	It is considered that no further palaeontological heritage studies or specialist mitigation are warranted

	sediments of the Katberg Formation (Karoo Supergroup) that are known to contain important fossil biotas of Early Triassic age, notably vertebrates, trace fossils and rare plants of the Lystrosaurus Assemblage Zone. ▪ These fossils are of international palaeontological significance in that they document the recovery of terrestrial biotas following the catastrophic end-Permian mass extinction event of 251 million years ago. Several Early Triassic vertebrate fossil localities have already been recorded by previous workers close to the Noupoort study area and are represented in museum collections (e.g. the BPI at Wits University, Johannesburg). ▪ Over the great majority of the study area, including flatter-lying areas that are most likely to be directly affected by the proposed development, the Katberg Formation bedrocks are mantled with superficial deposits such as scree, soil and alluvium that are generally of low palaeontological sensitivity. ▪ The very few good exposures of potentially fossiliferous mudrocks within the region mainly occuring on steeper hill slopes in the escarpment region that lie outside the wind farm development footprint. Even where bedrock exposure is good, fossil vertebrate remains are sparse, disarticulated and usually fragmentary (e.g. reworked bones and teeth in channel conglomerates). Rare plant fossils recorded are very poorly preserved and not identifiable to a specific plant group. Trace fossils (various invertebrate burrows) are locally abundant but assemblages are very low in diversity	for this alternative energy project, pending the exposure of any substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood) during the construction phase. The ECO responsible for the developments should be alerted to the possibility of fossil remains being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA. These recommendations have been incorporated into the EMP for the Mainstream Noupoort Wind Farm.

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<td>and represent common Katberg forms.

It is concluded that the construction phase of the proposed Mainstream Noupoort Wind Farm is likely to have only a LOW NEGATIVE impact on local palaeontological heritage resources. The operational and decommissioning phases of wind farms will not involve significant negative impacts.
Fatal flaws or no-go areas with respect to fossil heritage conservation have not been identified for this project.
There are no preferences on palaeontological heritage grounds for any particular alternative site for the on-site substation, operational and maintenance buildings or lay down area. Likewise, the various alternative transmission line routes from the wind farm to the Eskom grid near Noupoort are assessed as having a similar low negative impact with the exception of the Southern 2 Alternative. In this last case, negative impacts might be slightly higher (but still LOW overall) due to the comparatively good Katberg Formation bedrock exposure along Oorlogspoort.

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<td>Socio-economic</td>
<td>A summary of the construction impacts are shown in the table below:
<table>
<tr><th>Change Process</th><th>Issue</th><th>Pre-Mitigation</th><th>Post-Mitigation</th></tr>
<tr><td>Economic</td><td>Employment and output creation</td><td>+18</td><td>+30</td></tr>
<tr><td rowspan="2">Socio-Cultural</td><td>Social mobilisation</td><td>-20</td><td>-7</td></tr>
<tr><td>Health and safety</td><td>-60</td><td>-28</td></tr>
<tr><td>Average</td><td>Overall construction impacts</td><td>-20</td><td>-1.6</td></tr>
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<td>Though all of the identified social impacts can be mitigated or enhanced successfully, this can only be done if Mainstream, or its appointed contractor(s), commit to the responsibility of ensuring that the level of disturbance brought about to the social environment by the more negative aspects of the project, is minimised as far as possible.

It is therefore recommended that:

Social issues identified during the EIA phase

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	Apart from the possibility of temporary employment, overall (i.e. based on the average significant ratings of impacts as reflected in the table above) the construction phase is characterised by negative low social impacts. In certain instances the implementation of mitigation measures can bring about positive changes. One such case would be the implementation of an effective HIV/AIDS prevention programme that extends to the local communities where construction workers will spend their free time, as this can also serve to inform and empower local people to make better and more informed decisions regarding their future (sexual) behaviour. Where Mainstream has the opportunity to bring about positive change to local communities they should pursue such opportunities where possible. The majority of impacts that would occur during the construction phase would affect people's sense of wellbeing and security within their social environment. A number of changes to the socio-economic environment would lead to economic impacts, but for the most part these impacts would be restricted to individuals or individual households and would not extend to the community at large. A summary of the operations and maintenance impacts are shown in the table below. Change | Issue | Pre- | Post-	are addressed. This could be done by engaging social specialists where necessary or by ensuring that ECOs used during construction have the necessary knowledge and skills to identify social problems and address these when necessary. Guidelines on managing possible social changes and impacts could be developed for this purpose. ▪ Neighbouring landowners are informed beforehand of any construction activity that is going to take place in close proximity to their property. Prepare them on the number of people that will be on site and on the activities they will engage in. ▪ Employees are aware of their responsibility in terms of Mainstream's relationship with landowners and communities surrounding the site. Implement an awareness drive to relevant parts of the construction team to focus on respect, adequate communication and the 'good neighbour principle.' All mitigation measures in the SIA are incorporated in the EMP to ensure that Mainstream and the contractor adhere to these

	Process		Mitigation	Mitigation	
	Economic	Employment and output creation	+18	+33	
		Tax income	+14	+14	
		Corporate Social Investment	+27	+48	
		Agricultural output	-11	-11	
		Tourism	-10	-10	
		Property prices	-10	-10	
	Socio-cultural	Sense of place	-24	-20	
	Average	Overall operations and maintenance impacts	+0.6	+6.3	

The presence of the wind farm during the operation and maintenance phase overall will have a low positive impact, although certain elements will yield medium positive impacts whereas other elements are expected to have a more negative connotation. Most positive impacts are of an economic nature, most significantly Mainstream's corporate social investment in the area, which in turn could lead to an array of other positive social upliftment projects (outside the scope of this study). Negative impacts are expected to be on the low side and would in all probability be over-shadowed by the more positive contributions that Mainstream will make to the area through their CSI.

Table 88: Impact rating summary for the proposed wind farm during the construction phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss of Habitat for Red Data / General Species	-26 (low negative)	-6 (low negative)
	Edge Effect	-30 (medium negative)	-7 (low negative)
	Displacement of priority avifaunal species due to disturbance	-34 (medium negative)	-22 (low negative)
	Displacement of priority avifaunal species due to habitat destruction	-16 (low negative)	-16 (low negative)
	Destruction of foraging habitat for Bats	-33 (medium Negative)	-8 (low negative)
	Destruction of roosts for Bats	-26 (low negative)	-8 (low negative)
Surface Water	Surface Water Resource Degradation	-30 (medium negative)	-9 (low negative)
Agricultural Potential and Soil	Loss of Agricultural land and / or production	-13 (low negative)	-12 (low negative)
Noise	Impact of construction noise on sensitive developments	-13 (low negative)	-7 (low negative)
Heritage	Destruction of pre-colonial stone age sites	-75 (very high negative)	-12 (low negative)
	Destruction of colonial period farm related features	-75 (very high negative)	-12 (low negative)
	Cemeteries	-75 (very high negative)	-12 (low negative)
Palaeonology	Disturbance, destruction, damage or sealing in of fossil remains	- 14 (Low negative)	- 14 (Low negative)
Social-economic	Creation of local jobs and income	+18 (low positive)	+30 (medium positive)
	Conflict situations	-20 (low negative)	-7 (low negative)
	Risk of HIV / AIDS	-60 (high negative)	-28 (low negative)

Table 89: Impact rating summary for the proposed wind farm during the operational phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss of Habitat for Red Data / General Species	-10 (low negative)	-6 (low negative)
	Edge Effect	-26 (medium negative)	-7 (low negative)
	Displacement of priority avifaunal species due to disturbance	-26 (low negative)	-22 (low negative)
	Collision of Priority species with wind turbines	-30 (medium negative)	-24 (low negative)
	Mortality of priority species with power lines	-30 (medium negative)	-26 (low negative)
	Bat mortalities due to blade collisions and barotrauma during foraging	-45 (medium negative)	-11 (low negative)
	Bat mortalities due to blade collisions and barotrauma during migration	-34 (medium negative)	-13 (low negative)
Agricultural Potential and Soil	Displacing existing Agricultural potential	-11 (low negative)	-11 (low negative)
Noise	Numerous turbines operating simultaneously during a period when quiet environment is desired	-24 (low negative)	-8 (low negative)
Visual	Visual change and intrusion impact of wind turbines and associate infrastructure	-49 (high negative)	-11 (low negative)
Social-economic	Creation of local jobs and income	18 (low positive)	33 (medium positive)
	Increase in central and local tax income	14 (low positive)	14 (low positive)
	Corporate Social Investment	27 (medium positive)	48 (medium positive)
	Diverting / attracting tourism from / to the area	-10 (low negative)	-10 (low negative)
	Property Prices	-10 (low negative)	-10 (low negative)
	Sense of Place	-24 (low negative)	-20 (low negative)

17.2 Preferred Alternative Selection

Based on the findings of the specialists and taking into account the uniformity of the site, the selection of a preferred alternative has been determined based on the required key components of the project. The map below indicates the preferred layout highlighting the location of:

- Preferred Site Access
- Preferred Laydown Area
- Preferred Operation and Maintenance Building Area
- Substation Alternative 1

The specialist supported preferred grid access alternatives include northern griad access alternatives 1 and 2 as well as southern grid access alternative 1. Grid access southern alternative 2 is not preferred from the majority of the specialist recommendations.

The layout also highlights the preferred wind turbine locations based on the buildable area.

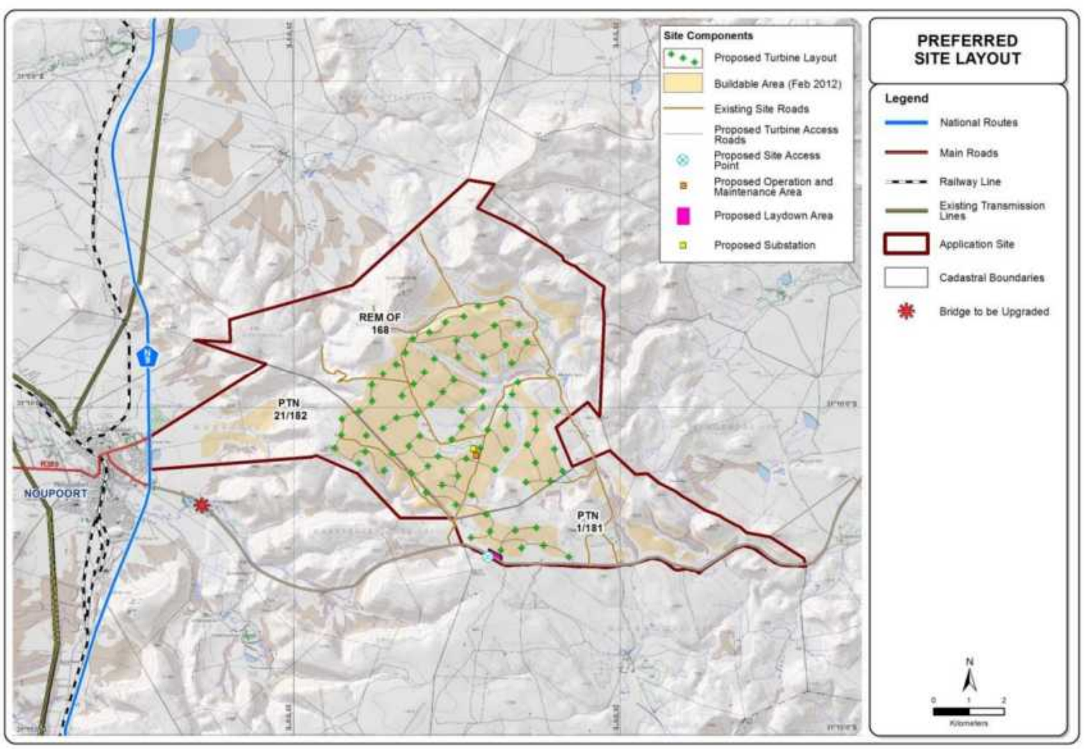

Figure 80: Preferred Site Layout

It should also be noted that the placement and layout of turbines is not just a result of the potential environmental factors, but due to other technical and social upliftment factors as explored in the report; there are other factors that a development should consider which includes other environmental impacts such as:

- Availability of resource (higher wind speeds) – the commercial viability of a windfarm is largely dependent on the availability of higher wind speeds. Average wind speeds vary across a site. Figure 81 shows the modelled average wind speeds on different areas of the site, the simulation was done based on wind resource measurement since September 2010. It is clear that the sensitive 1km area east of the escarpment line and the 1km buffer along the Oorlogspoort road covers the higher average wind speeds for the site.
- The 1 km sensitive area to the east of the escarpment covers **all** the land owned by Siphila Ngokuzenzela Farming CC or the Stofile Family farming operation. Not placing any turbines on the land owned by this black emergent farmer will result in no long term rental income generated by the farmer. The significant 20 year rental income will support the Government initiatives of black economic empowerment and is in line with various other regulations and targets put in place to promote and support black land reform.

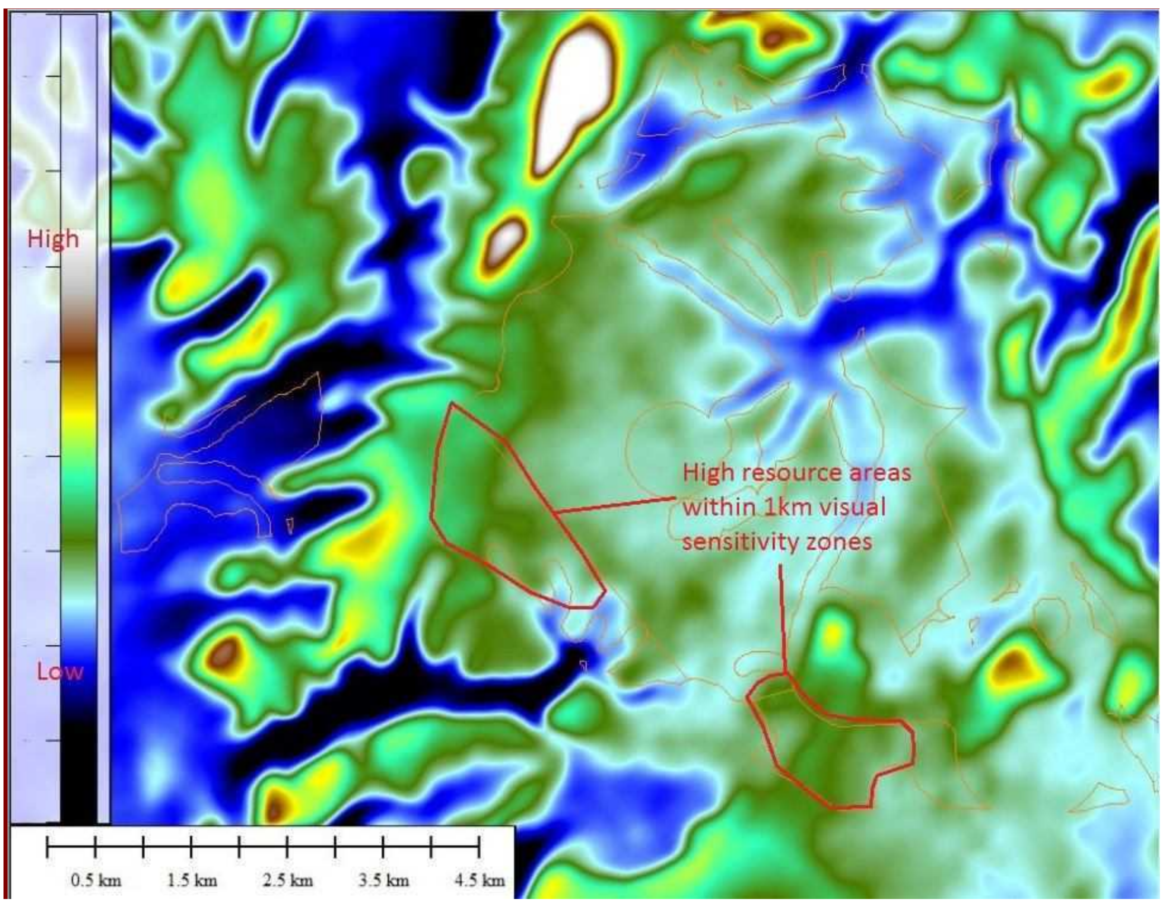

Figure 81: Modelled average wind speeds on different areas of the site

17.3 Final-walk Down Specialist Studies to be Conducted

The following final-walk down studies will be required prior to the construction of the wind farm taking place should authorisation be attained to establish any site specific impacts that could not be determined during the EIA phase. These include the following:

- Biodiversity Study
- Surface Water (power line route)
- Geotechnical Study (detailed)

The findings need to be acknowledged and suggested mitigation measures are to be included in the final construction EMPr for the proposed development.

17.4 Conclusion

The findings of the specialist studies undertaken within this EIA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed Wind farm near Noupoort. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding. Areas of special concern have however been identified which will require site specific mitigation measures. These are included within the EMPr to ensure that these areas receive special attention.

The following recommendations are made with regards to the proposed development:

- Bird mortality monitoring for the duration of the operation of the plant;
- Bat mortality monitoring for 6 months at start of operation;
- Biodiversity walk down assessment;
- Surface water walk down assessment for the selected powerline route;
- Detailed geotechnical investigation;
- Implementation of stormwater management at Substation and Office and Maintenance Buildings; and
- Strict implementation of the EMPr.
- Construction EMPr including final walk-down mitigation measures is to be formulated and implemented for the proposed development upon completion of final walk-down assessments.

Mainstream aims to enhance local community benefits with a focus on Broad-based Black Economic Empowerment through mechanisms such as community beneficiation and a Trust. In line with the Department of Trade and Industry's guidelines, between 2.5 and 4% of after tax profit will be ploughed back into the local community for use on socio-economic and enterprise development initiatives.

It was determined during the EIA that the proposed plant will result in potential negative impacts. A preferred site layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

Further to the above, it was demonstrated in the EIR that a detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations. In addition, all issues raised by I&APs were captured in the EIR and where possible, mitigation measures provided in the EMPr to address these concerns.

As sustainable development requires all relevant factors to be considered, including the principles contained in section 2 of NEMA, the EIR has strived to demonstrate that where impacts were identified, these have been considered in the determination of the preferred site layout.

We are therefore of the view that:

- A preferred site layout has been identified which is less environmentally sensitive compared to the other considered layouts.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the Wind Farm near Noupoort can be mitigated to acceptable levels

It is trusted that the EIR provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

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