SiVEST

BIOTHERM ENERGY

Proposed Construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province

Draft Environmental Impact Assessment Report

DEA Reference: 14/12/16/3/3/2/945
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Date:	25 November 2016
Document Title:	Proposed Construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province: Draft Environmental Impact Assessment Report
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Version Number:	1
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Signature:	
For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Portion 1 of Drielings Pan No.101	C06000000000010100001
Portion 2 of Drielings Pan No.101	C06000000000010100002
Portion 3 of Drielings Pan No.101	C06000000000010100003
Remainder of Drielings Pan No.101	C06000000000010100000

ALETTA WIND: APPLICATION SITE		
CORNER POINT COORDINATES		
POINT	SOUTH	EAST
A_01 (NW)	S29° 52' 51.794"	E22° 32' 27.848"
A_02 (NE)	S29° 59' 52.858"	E22° 35' 30.970"
A_03 (SE)	S30° 2' 11.890"	E22° 33' 19.076"
A_04 (SW)	S29° 56' 56.872"	E22° 27' 9.065"
A_05 (CENTRE)	S29° 57' 40.926"	E22° 31' 50.973"

DEVELOPMENT AREA			
PHASE	AREA (HECTARES)	CENTRE POINT COORDINATES	
		SOUTH	EAST
ALETTA WIND DEVELOPMENT AREA	5638.871	S29° 56' 31.212"	E22° 32' 27.034"

ALETTA WIND: DEVELOPMENT AREA		
CORNER POINT COORDINATES (DD MM SS.sss)		
POINT	SOUTH	EAST
AD_01 (NW)	S29° 55' 57.522"	E22° 28' 39.802"
AD_02 (NE)	S29° 52' 51.794"	E22° 32' 27.848"
AD_03 (SE)	S29° 59' 52.858"	E22° 35' 30.970"
AD_04 (SW)	S30° 0' 36.296"	E22° 34' 49.743"
AD_05 (CENTRE)	S29° 56' 31.212"	E22° 32' 27.034"

ALETTA WIND: COMPONENTS		
CENTRE POINT COORDINATES (DD MM SS.sss)		
COMPONENT	OPTION 1	OPTION 2
SUBSTATION	S29° 57' 17.823"	S29° 58' 13.487"
	E22° 32' 50.861"	E22° 33' 33.860"
O&M SITES	S29° 57' 20.921"	S29° 58' 13.765"

	E22° 32' 54.174"	E22° 33' 38.344"

Refer to **Appendix 9** for the full list of coordinates.

TITLE DEEDS: These are included in **Appendix 1**.

PHOTOGRAPHS OF SITE:

General Characteristics of the study area

TYPE OF TECHNOLOGY: Wind Turbines

STRUCTURE HEIGHT: Max hub height of 120m, and rotor diameter of 150m.

SURFACE AREA TO BE COVERED: The total area of the application site is approximately 11 003 hectares. The area occupied by each wind turbine will be up to 0.5 hectares (85m x 60m). A hard standing area / platform of approximately 2 400m^2 (60m x 40m) per turbine will be required for turbine crane usage. The temporary lay-down / staging area will be approximately 40 00m^2. The operations building will have a total combined footprint that will not exceed 300m^2. The final design details are yet to be confirmed. These details will become available during the detailed design phase of the project, after the project has been selected as a Preferred Bidder project under the Department of Energy's (DoE) Renewable Energy Independent Power Producers Procurement Programme (REIPPPP)

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

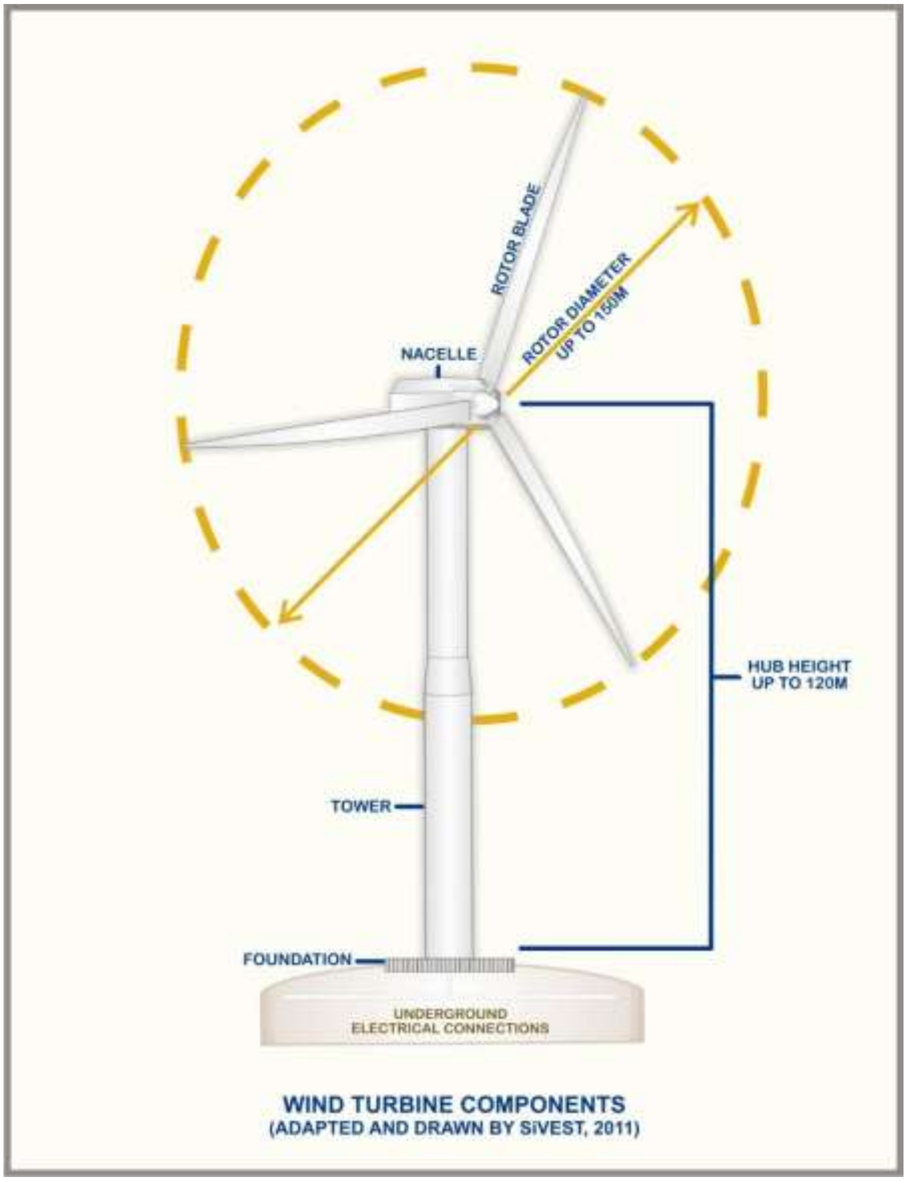

Figure i: Example of a Wind Turbine

STRUCTURE ORIENTATION: Wind Turbines - The turbine blades will not be fixed and will be able to rotate in order to catch the prevailing winds.

FOUNDATION DIMENSIONS: Each wind turbine, depending on geotechnical conditions, will have a foundation diameter of up to 20m, and will be approximately 3m deep. The area occupied by each wind turbine will be up to 0.5 hectares (85m x 60m). The excavation area, depending on geotechnical conditions, will be approximately 1 000m² in sandy soils due to access requirements and safe slope stability requirements.

BLADE ROTATION DIRECTION: The blade rotation direction will depend on wind measurement information received later in the process.

EXPORT CAPACITY: The project will have a total export capacity of 140MW.

TECHNCIAL DETAILS:

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for the proposed project
Aletta Wind Energy Facility (WEF)	14/12/16/3/3/2/945	▪ Portion 1 of Drielings Pan No.101 ▪ Portion 2 of Drielings Pan No.101 ▪ Portion 3 of Drielings Pan No.101 ▪ Remainder of Drielings Pan No.101 Development Area: 5 639 ha	▪ **60 wind turbines** with a total export capacity of up to 140MW. Turbines will have a hub height of up to 120m and a rotor diameter of up to 150m. ▪ **132kV onsite Aletta IPP Substation** ▪ The turbines will be connected via **medium voltage cables** to the proposed 132kV onsite Aletta IPP Substation. ▪ Internal **access roads** are proposed to be between 4m to 6m wide. ▪ A temporary construction **lay down area**. ▪ A **hard standing area / platform** per turbine. ▪ The **operations and maintenance buildings**, including an on-site spares storage building, a workshop and an operations building. ▪ **Fencing** (if required) will be up to 5m where required and will be either mesh or palisade. ▪ Permanent **wind measurement mast**.

A3 Maps of all smaller maps included in the report are included in **Appendix 7**.

WIND MEASUREMENT DATA: BioTherm erected an 80m wind mast on site in May 2015. BioTherm, therefore has 17 months of wind speed data for the Aletta Wind Energy Facility. The average wind speed over a year's period is summarised in **Figure ii** below.

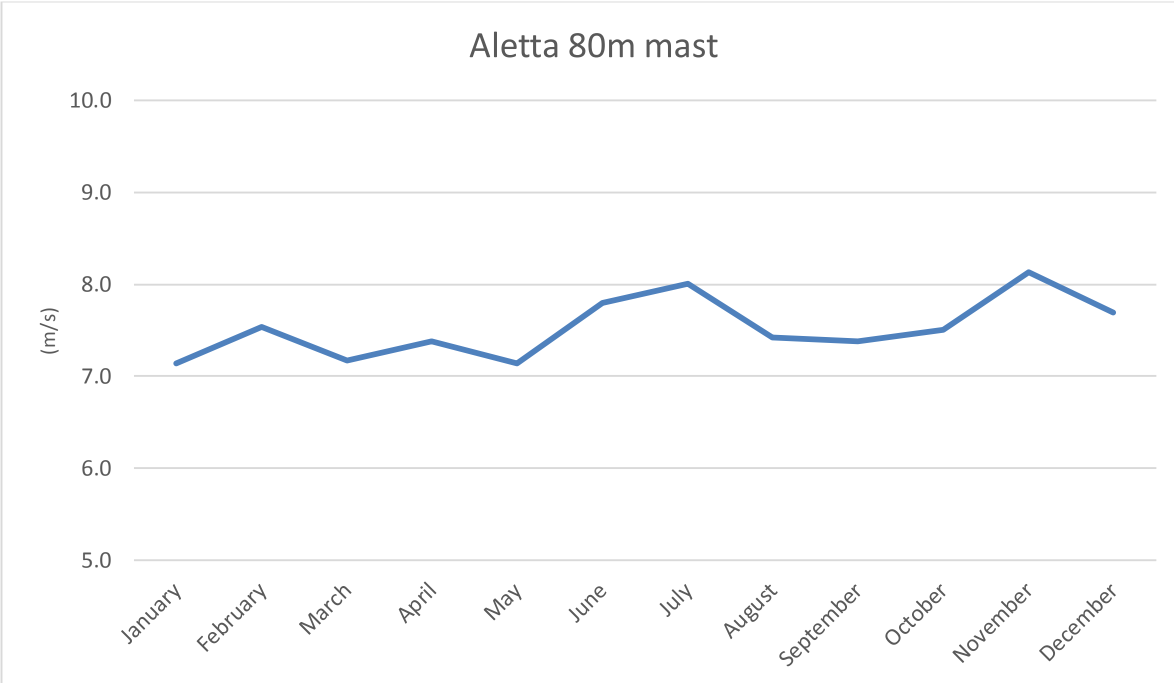

Figure ii: Average monthly wind speeds

The average wind speed over the 17 month Wind Measurement Campaign is 7.5m/s. The wind speed is relatively constant throughout the year and does not go lower then 7m/s. The constant wind speeds result in electricity being generated from the facility at regular periods, unlike some wind farms that have very low wind speed months and very high wind speed months.

In addition to the high average wind speeds the shear factor for Aletta is high. A high shear factor means that it is viable to install turbines with greater hub heights as the wind speed significantly increases with height within the project area.

Overall the Wind Measurement Campaign has confirmed the pre-feasibility desktop analysis and confirmed that the Aletta Wind Energy Facility is a viable and highly competitive wind farm.

POTENTIAL UPGRADE: The renewable energy sector is constantly developing more efficient and higher yielding wind turbines.

After the 20 year PPA has come to an end there is possibility of replacing the ageing wind turbines with more powerful modern units. This practice, 'wind repowering', has taken place in Europe where wind farms have been present for decades and their older turbines are now being replaced with more modern turbines.

Today a 2MW wind turbine coming off the production line with a rotor diameter of 80 metres can generate four to six times as much electricity as the 500kW wind turbine with a 40 metre rotor built in 1995 (James

Lawson, 2013). Currently there is a movement towards fewer, larger and taller turbines that are quieter, more reliable, more efficient and higher yielding.

Depending on South Africa's energy needs after the 20 year period and Eskom willingness to re-enter into a PPA with BioTherm, the replacement of ageing turbines after the PPA is a possibility.

Alternatively the turbines will be decommissioned and the land rehabilitated.

(James Lawson, 2013) http://www.aweablog.org/repowering-gives-new-life-to-old-wind-sites/

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE ALETTA 140MW WIND ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Executive Summary

BioTherm Energy (Pty) Ltd (hereafter referred to as BioTherm) intends to develop the Aletta wind energy facility and associated infrastructure near Copperton, Northern Cape Province of South Africa (hereafter referred to as the 'proposed development'). SiVEST Environmental Division has been appointed as independent consultants to undertake the Environmental Impact Assessment (EIA) for the proposed energy facility and associated infrastructure. The overall objective of the project is to generate electricity to feed into the national grid. The proposed project will consist of a 140MW export capacity wind energy facility.

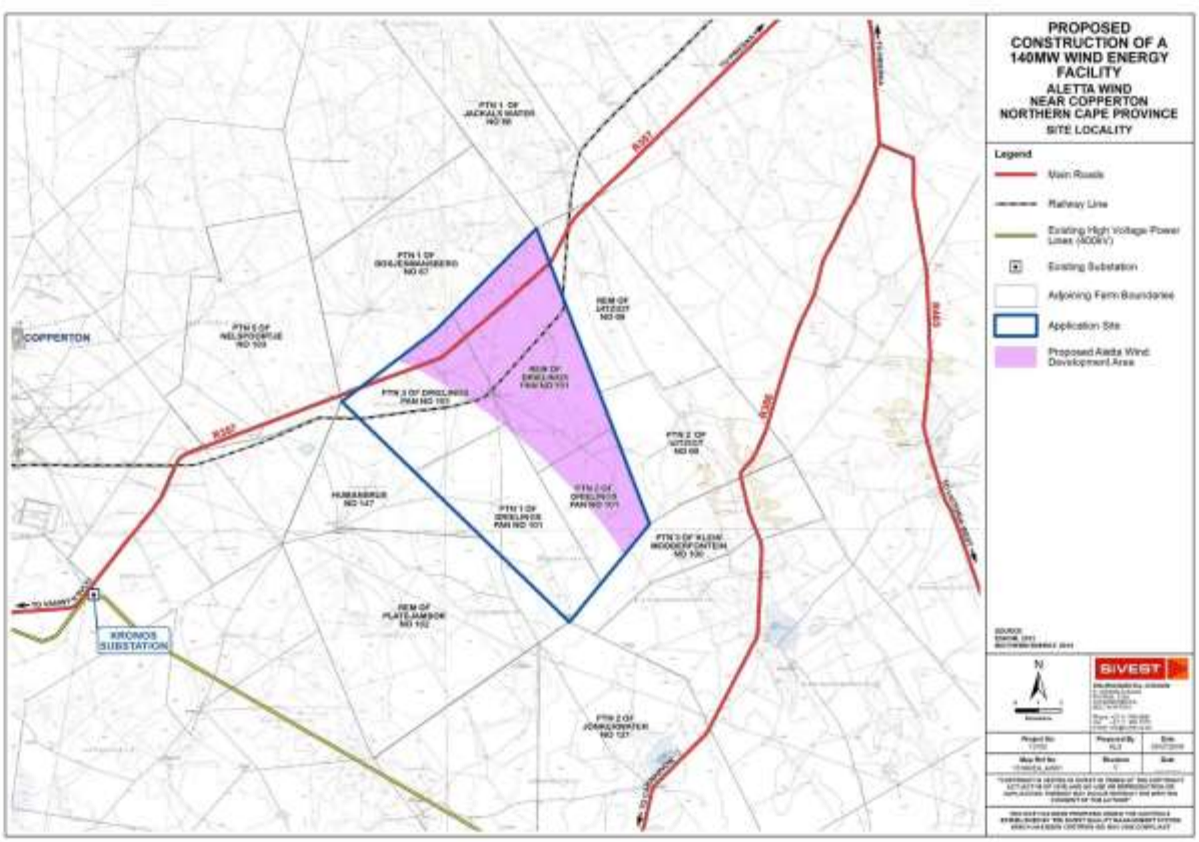

Figure ii: Site locality for the proposed Aletta wind energy facility

Additionally, BioTherm are proposing to develop the associated Aletta substation and power line, both with a capacity of up to 132kV. This associated electrical infrastructure will require a separate Environmental Authorisation and is being conducted as a part of a separate Basic Assessment (BA) process. The Aletta power line has been included in the wind energy facility EIA for background information but will be authorised under a separate BA to allow for handover to Eskom. The Aletta onsite substation will include an Eskom portion and an Independent Power Producer (IPP) portion, hence the substation has been included in the wind energy facility EIA and in the substation and power line BA to allow for handover to Eskom. Although the wind energy facility and the electrical infrastructure will be assessed separately, a single public participation process is being undertaken to consider both of the proposed developments. The potential environmental impacts associated with both developments will be assessed as part of the cumulative impact assessment. The DEA reference number allocated for the Aletta substation and power line has not yet been allocated by the DEA. This will be provided in the Final Environmental Impact Assessment Report (FEIAr).

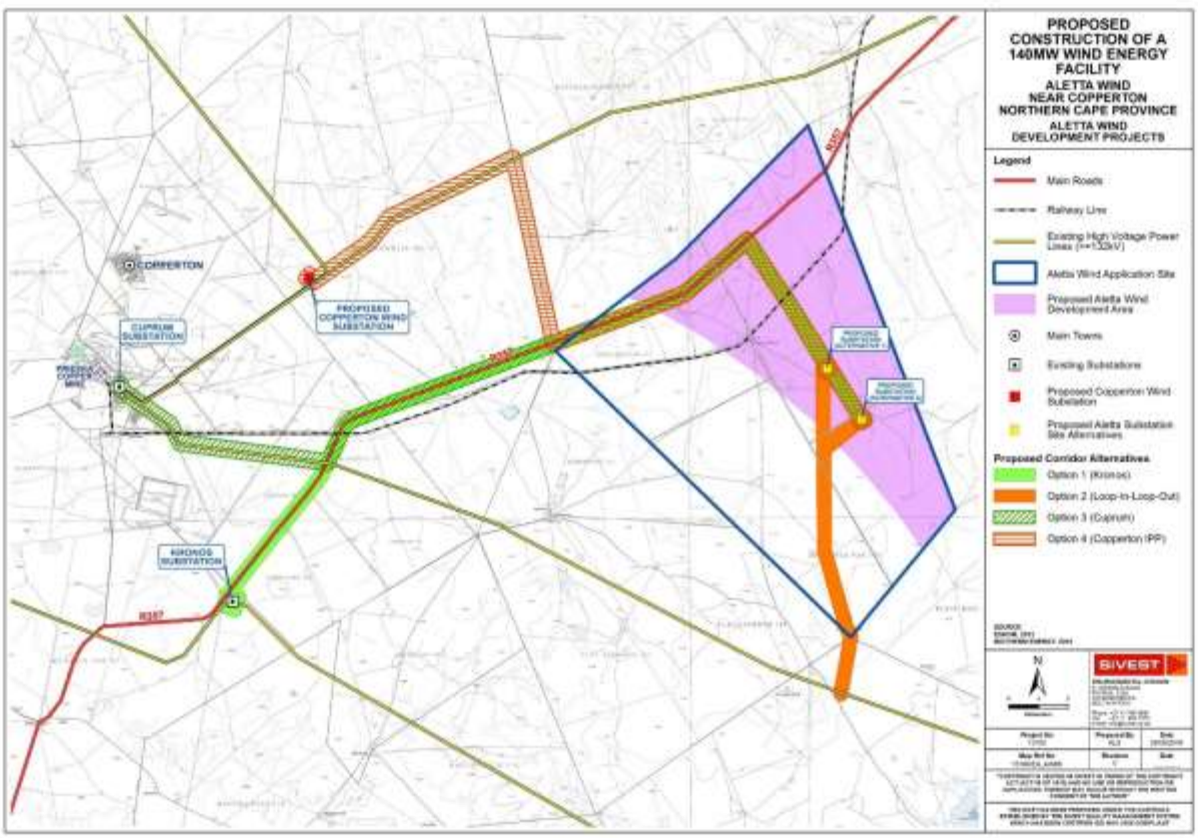

Figure iii: Site locality map showing both of the proposed Aletta projects

DEVELOPMENT AREA		
PHASE		**CENTRE POINT COORDINATES**

	AREA (HECTARES)	SOUTH	EAST
ALETTA WIND DEVELOPMENT AREA	5638.871	S29° 56' 31.212"	E22° 32' 27.034"

ALETTA WIND: COMPONENTS		
CENTRE POINT COORDINATES (DD MM SS.sss)		
COMPONENT	**OPTION 1**	**OPTION 2**
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	E22° 32' 54.174"	E22° 33' 38.344"

Refer to **Appendix 9** for the full project coordinates.

The proposed development requires Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA). However, the provincial authority will also be consulted (i.e. Northern Cape Department of Environment and Nature Conservation (NC DENC)). The EIA for the proposed development will be conducted in terms of the EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on the 8^{th} of December 2014. In terms of these regulations, a full EIA is required for the proposed project. All relevant legislations and guidelines (including Equator Principles and IFC Performance Standards) will be consulted during the EIA process and will be complied with at all times.

The proposed project involves the construction of a 140MW wind energy facility (namely the Aletta Wind Energy Facility) and associated infrastructure. Layout alternatives have been investigated which relate to the location of the infrastructure on the site. These are illustrated below:

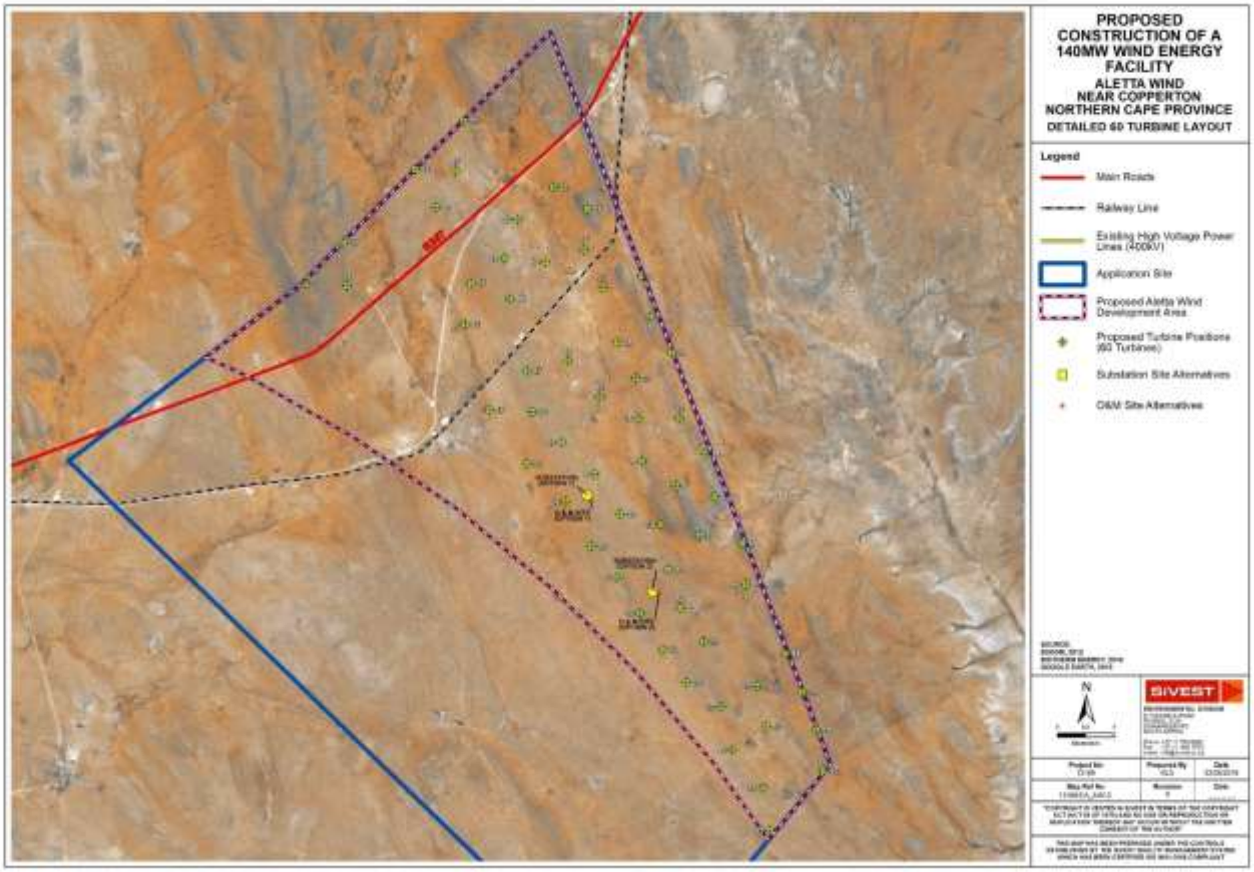

Figure iv: Aletta Wind Energy Facility layout alternatives

The majority of the site falls within the Bushmanland Arid Grassland vegetation unit. However, the Lower Gariep Broken Veld vegetation unit can also be found to the north of the application site and also extends slightly into the northern part of the application site. These above-mentioned vegetation units are typically characterised by a well-developed shrub layer as well as an open tree layer. In certain areas, man has had an impact on the natural vegetation, especially around farmsteads, where over many years tall exotic trees and other typical garden vegetation have been established. Much of the surrounding area however is still characterised by natural low shrubland with transformation limited to areas to the west and south-west of the application site, as well as along the R357 road and railway line which traverse the surrounding area.

Specialist studies were conducted for the following environmental parameters, as part of the EIA phase and as stipulated in the Plan of Study for EIA:

- Biodiversity Assessment
- Avifauna Assessment (including preconstruction monitoring)
- Bat Assessment (including preconstruction monitoring)
- Surface Water Impact Assessment

- Soils and Agricultural Potential Assessment
- Noise Assessment
- Visual Impact Assessment
- Heritage and Palaeontology Assessment
- Socio-economic Impact Assessment
- Traffic Assessment
- Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)

Table i: Summary of findings

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	The vegetation types that occur within the region (Bushmanland Arid Grassland, Lower Gariep Broken Veld and Bushmanland Vloere and possibly floristic elements of Bushmanland Basin Shrubland and Northern Upper Karoo) are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation on the sites is therefore not considered to have high conservation status. The area is not within a Centre of Plant Endemism or in areas identified in Provincial Conservation Plans to be of concern, but it does occur within an area identified as part of the National Parks Area Expansion Strategy. Local factors that may lead to parts of the sites having elevated ecological sensitivity are the potential presence of the following: ▪ Presence of natural vegetation on site, although of low conservation priority. ▪ Presence of a number of provincially protected plant species. ▪ Presence of a number of individuals of one protected tree species, *Boscia albitrunca*. ▪ Presence of drainage areas and pans. ▪ Presence of low, rocky hills with higher biodiversity than surrounding areas. ▪ Potential presence of the following animals of potential conservation concern:	The report concludes that the project is unlikely to have highly significant impacts on the ecological receiving environment and impacts that will occur can be controlled and reduced to low significance. Mitigation measures are provided to avoid or minimise these impacts. Some impacts require permits to be issued, either by National or Provincial authorities. If mitigation measures are applied then the potential impacts can be well-managed, in which case the project is supported and it is recommended that it be authorised.

	- Honey badger (NT) - Littledale's Whistling Rat (NT) - Giant Bullfrog (NT/LC) ▪ Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features. Cumulative impacts of this project in combination with similar projects is likely to be of low significance. The two (2) proposed sites for the combination of on-site substation and operation & maintenance (O&M) building were evaluated and both sites were found to be favourable. No significant features of concern were found at either site.	
Avifauna	The proposed BioTherm Aletta (Copperton) Wind Farm will have a variety of impacts on avifauna which range from low to high. The impacts are (1) displacement of priority species due to disturbance during construction phase (2) displacement of priority species due to habitat destruction during construction phase (3) displacement of priority species due to disturbance during operational phase (4) and collisions of priority species with the turbines in the operational phase. Displacement of priority species due to disturbance during construction phase is likely to be a temporary medium negative impact, but can be reduced to low with the application of mitigation measures. Mitigation measures are the restriction of construction activities to the construction	The impacts of the proposed WEF on priority avifauna could be mitigated to acceptable levels, therefore the development could proceed provided that mitigation measures are strictly implemented.

	footprint area, no access to the remainder of the property during the construction period, measures to control noise and dust, maximum use of existing access roads, the implementation of a 3km no development buffer zone around a Verreaux's Eagle nest, and a 300m no development buffer zone around a Southern Pale Chanting Goshawk nest. Displacement of priority species due to habitat destruction during construction phase is likely to be a medium negative impact and will remain so, despite the application of mitigation measures. Mitigation measures comprise strict adherence to the recommendations of the specialist ecological study and maximum use of existing access roads with the construction of new roads kept to a minimum. Displacement of priority species due to disturbance during the operational phase is likely to be of low significance and it could be further reduced through the application of mitigation measures. Mitigation measures are the restriction of operational activities to the plant area, no access to other parts of the property unless it is necessary for wind farm related work, post-construction monitoring, and if densities of key priority species are proven to be significantly reduced due to the operation of the wind farm, engagement of the wind farm management to devise ways of reducing the impact on these species. Collisions of priority species with the turbines in the operational phase are likely to be a high negative impact but it could be reduced to medium negative through the	

	application of mitigation measures. Mitigation measures are the implementation of post-construction monitoring and, if actual collision rates indicate high mortality levels, curtailment of selective turbines. Lastly, the implementation of a 3km no development buffer zone around a Verreaux's Eagle nest, a 200m no turbine zone around water points and a 300m no development buffer zone around a Southern Pale Chanting Goshawk nest are recommended. Finally, it is concluded that, after taking into account the expected impact of proposed renewable energy projects within a 35km radius around Kronos MTS, that the cumulative impact of the proposed Aletta WEF on priority avifauna, after appropriate mitigation has been implemented, will range from minor to insignificant. The impacts of the proposed Aletta WEF on priority avifauna could be mitigated to acceptable levels, therefore the development could proceed provided that mitigation measures are strictly implemented.	
Bats	The site was first visited in July 2015 wherein two SM2BAT+ detectors were installed on one 10m mast, and one meteorological mast. The long-term monitoring study aims to identify bat species at risk of fatality to wind turbines, and patterns in their activity and distributions (temporal and spatial). A sensitivity map was drawn up indicating potential roosting and foraging habitat. The turbine layout is respective of the bat sensitivity map is deemed acceptable with regards to the	If elevated bat mortalities are found during the operational monitoring, mitigation measures may need to be implemented as outlined in **Table 142**. The affected turbines to which such mitigation may apply are 18, 28, 33, 34, 38, 41, 48 and 49. In the case of a migratory event, a mitigation schedule will be drawn up specifically for the event.

	bat monitoring study since no turbines are encroaching on any sensitive area. Four bat species were detected namely, *Tadarida aegyptiaca*, *Neoromicia capensis*, *Miniopterus natalensis*, and *Eptesicus hottentotus*. *Neoromicia capensis* and *Tadarida aegyptiaca* were most commonly detected across both of the monitoring systems. The migratory species, *Miniopterus natalensis*, was detected by all monitoring systems and is rather prevalent on site. The relative abundance of this species was highest, as detected by all monitoring systems, over the months of September - October 2015 and February - April 2016.	The Moderate bat sensitivity areas and associated buffer zones must be prioritised during operational monitoring and preferably be avoided during turbine placement, if another feasible option is available. High Bat Sensitivity areas are 'no-go' areas due to expected elevated rates of bat fatalities due to wind turbines. No turbines are allowed to be placed in High Bat Sensitivity areas and their associated buffers.
Surface Water	Ultimately, it was found that there were nine (9) watercourses (drainage lines) and twenty two (22) depressions (depression wetlands). For the depression wetlands, these were sub-divided into two sub-categories for the fifteen (15) natural depression wetlands and the seven (7) artificial (man-made) depression wetlands identified. A buffer zone of 50m for watercourses and the natural depression wetlands have been applied in consideration of the factors above. No buffer zone was applied to the artificial depression wetlands as these were not identified to be of any major ecological significance. The artificial depression wetlands would however need to be avoided and should be viewed as exclusion zones. In the context of NEMA (1998) and the EIA Regulations (2014), considering the layout of the proposed development, no listed activities will be triggered based on the wind turbine,	Specialist recommendations include the following: ▪ All stipulated mitigation measures are to be adhered to; ▪ All surface water resources and buffer zones must be avoided as far as practically possible; ▪ Where it is not possible to avoid impacting on the identified surface water resources, the relevant environmental authorisation and water use license must be applied for.

	substation and operation and maintenance building facility layout since none of these structures are directly within or within close proximity (within 32m) to the identified surface water resources. However, it is presumed that internal access roads will be required which will need to route to the respective wind turbines locations and various buildings and infrastructure to be constructed. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, there is a good chance the internal access roads and other associated infrastructure not shown on the current layout will need to cross or be within close proximity to the delineated surface water resources. Therefore, provisionally, Activities 12 and 19 of Government Notice 983 Listing Notice 1 are identified to potentially be triggered thereby requiring Environmental Authorisation. In the context of the NWA (1998) and the proposed development, a "water use" is required where construction activities will impact on a water resource. As such, for the proposed development, since there is no anticipated direct impact or any potential indirect impact based on the current wind turbine, substation and operation and building layout, it is anticipated that no water uses will be triggered. However, as stated in above, it is anticipated the internal roads and other associated infrastructure not displayed on the current layout may need to cross or be within 500m of the identified wetlands and / or watercourses thereby triggering water uses (c) and (i). The application of these water uses can however only be confirmed once the internal road layout is available.	

	It was identified that several potential impacts may affect the surface water resources within the proposed development area during the pre-construction, construction, operation and decommissioning phases. It is not anticipated that the proposed development will need to be decommissioned. Should this need to take place, the same impacts as identified for the construction phase of the proposed development can be anticipated. Hence, the same impacts are expected to occur and the stipulated mitigation measures where relevant must be employed to minimise impacts. Potential cumulative impacts were assessed given that numerous proposed and currently constructed renewable energy developments can be found in the surrounding area. As such, the direct cumulative impact of loss of surface water resources and degradation was found not to be compounded by the proposed development as the wind turbine, substation and operation and maintenance buildings were not located in any surface water resources. However, provision for potential degradation of surface water resources due to associated infrastructure was noted. Should these potential impacts be avoided / reduced as per the mitigation measures stipulated, the cumulative impact will be negligible. From an indirect cumulative impact perspective, the proposed development as a whole was not expected to contribute to the cumulative impacts of increased run-off, sedimentation and erosion since the drainage lines flow in a southerly direction and will be contained on the proposed development area, and not into any adjacent proposed or current	

	renewable energy developments being constructed. That being said, with the implementation of stipulated mitigation measures, the cumulative impact was again deemed to be negligible.	
Soils and Agricultural Potential	The agricultural potential for this area corresponds with the initial findings in the scoping report. Thus, an overall low potential for irrigation for map units Cg1, Cg2, Py1 with a low to moderate irrigation potential for map unit Py2, consisting of gravelly Plooysburg and Hutton soils, with soil depth 300-800 mm onto rock. Virtually all of the study area comprises shallow, often calcareous soils with rock outcrops. Coupled with these shallow soils, the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20 ha/large stock unit (ARC-ISCW, 2004). Two main impacts are possible. The first deals with the unavailability of land for agriculture due to the fact that a wind energy generating facility is to be established, while the second impact refers to the possibility that construction of such a facility will lead to disturbance of the topsoil and	The mitigation measures proposed are as follows: ▪ Ensure that the minimum area possible is set aside for the project infrastructure, so that the natural vegetation is undisturbed and grazing of livestock can continue on site post-construction; ▪ Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed. If bare topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilize the site until vegetation can re-establish. ▪ Regular communication between responsible officials at all sites in the vicinity is essential. ▪ Regular monitoring (at least monthly during any construction phase and approximately six-monthly thereafter) is strongly recommended to pick up any potential problems before they arise.

	surface vegetation cover, so that erosion of topsoil by wind action will increase. There are a considerable number of other power generation projects proposed for the immediate area near Copperton and Prieska. The prevailing agricultural potential is low to very low, so there will be little or no cumulative impact in that regard. However, regarding wind erosion, there is a definite possible cumulative impact regarding potential topsoil removal by wind erosion on one site, which could then be blown for a considerable distance across other sites. Two potential sites were proposed regarding positions of the substation and other infrastructure. However, there are no sensitive areas in the study area and the natural resources are very similar, so there will be no specific difference between the two sites. Due to the occurrence of shallow soils, coupled with the extremely hot and dry nature of the climate, there are no significant impacts from the project.	
Noise	The results of the investigation indicated that the predicted impact of noise during construction phase would be confined to residences within the WEF boundaries. There would be a temporary loss of “quiet” low residual noise level with a **high** intensity of noise impact on the residences at location L2 during daytime if the existing access farm road in close proximity to the residences were to be upgraded. Construction of a new road and site works at least 1 000 m from the residences would reduce the impact to **Low**.	In order to legally comply with the requirements of the NCR, the wind turbines would need to be relocated with a minimum distance of 2 600 m from any WEF boundary. However, as this would prevent the development from proceeding, it is recommended that a written application for exemption of provisions of the NCR be made to the local authority with the due consideration and approval by all affected parties.

	Based on the wind energy turbine noise emission data provided, assessment of the predicted noise during the operation phase in terms of SANS 10103:2008 indicated that the intensity of noise impact on land adjacent to the WEF boundaries would range from **Very High** close to the boundaries to **Low** at a distance of 3 000 m. The intensity of noise impact on residences within the WEF boundaries at location L2 would be **High**. At residences at locations L3 and L4, at a distance of 3 100 m beyond the WEF boundaries, the intensity of noise impact would be **Low** and **Negligible**, respectively. In terms of the National Noise Control Regulations (NCR), noise emanating from the wind energy turbines would be adjudicated as disturbing noise on land within 2 600 m from the northern, eastern and southern boundaries. Compliance with the legal requirements of the NCR would require all turbines to be set back 2 600 m from the WEF boundaries. In terms of SANS 10103:2008 the intensity of noise impact on adjacent land close to the boundaries would be **Medium**.	
Visual	The impact assessment revealed that the proposed development would have a negative low visual impact during construction and a negative medium visual impact during operation, with several mitigation measures available to reduce the visual impact.	▪ It is recommended that all mitigation measures should be implemented.

	The visual impacts are not significant enough to prevent the project from proceeding and an EA should be granted. From a visual impact perspective, only two (2) visually sensitive receptors with tourism significance have been identified within the study area, namely the Boesmansberg Guest Farm (VR 1) and the Nelspoortjie Karoo Guest Farm (VR 2). In addition, the existing electrical infrastructure and other linear elements already present within the study area have already altered the natural character of the surrounding environment to a degree and are expected to lower the visual contrast of the Aletta Wind Energy Facility slightly. The visual impact of the proposed development on most the potentially sensitive visual receptors identified within the study area was rated as being low or medium. In addition, the proposed development would have a negligible visual impact on one (1) potentially sensitive visual receptor, while a high visual impact will be experienced by three (3) potentially sensitive visual receptor locations. SiVEST is therefore of the opinion that the impacts associated with the construction and operation phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.	
Heritage and Palaeontology (Desktop)	**<u>Heritage Impact Assessment:</u>** The Heritage Scoping Report completed in February 2016 has shown that the proposed Aletta site to be developed as a Wind Energy Facility (WEF) may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.	The mitigation measures proposed are as follows: **<u>Pre-Construction</u>** ▪ A detailed walk down of the final approved layout will be required before construction commences. ▪ Any heritage features of significance identified during this walk down will require formal mitigation, permits if

	The subsequent field work completed for the HIA component in August 2016, has confirmed the presence of 3 archaeological find spots, 5 historical sites, 21 archaeological sites or resources and 3 grave sites. The archaeological sites are associated with the Early Stone Age (ESA), Middle (MSA) and Later Stone Age (LSA) and are representative of archaeological sites with a medium to high significance. The design process and methodology followed by the developer for this project enabled the heritage assessment to provide input into the proposed layouts before the impact assessment. This resulted in cognisance being taken of the positions of the heritage sites and thus the reduction of impacts at an early design phase. The comparative assessment of the alternatives has shown that an overall low impact on heritage is foreseen, as all of the heritage sites identified fall outside the proposed alternative foot prints. The application site however holds a Negative Medium Impact. Allowing for a 60m diameter construction foot print for on all turbine positions has shown that all the find spots and sites fall outside and in most case more than 100 meters away from any construction activities. One archaeological resource occurs at the option 2 substation (Rated as having low heritage significance). Substation and O&M Building Option 1 is thus the preferred	required or where possible a slight change in design could accommodate such resources. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. **<u>Palaeontology</u>** ▪ The ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Paleontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Paleontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged. ▪ The two historic spring sites indicated on the sensitivity map are of extreme importance as Geological Heritage points and these points must for at least 500m around them be declared “No-Go” zones. ▪ The recommendations must be included in the EMPr of the project. **<u>Archaeological Sites</u>**

	alternative from a heritage perspective as no heritage resources has been identified in the general area of the substation footprint. It is the specialist's considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate. It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "SAHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area." **<u>Palaeontological Desktop Assessment:</u>** The Desktop Paleontological Survey Identified that the proposed development is allocated a Moderate Paleontological Sensitivity. Geological structures associated with groundwater were mapped as well as spring sites which are part of the Heritage of this area. The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group.	▪ A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be. ▪ Sites ALE 4 and ALE 36 must be monitored during construction, as they are close to turbine construction activities. ▪ Demarcate and fence during construction if construction activities are within 100 meters from a site. ▪ Monitor find spot areas if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase. **<u>Historical Sites</u>** ▪ Demarcate sites as no-go areas. ▪ Demarcate and fence during construction if construction activities area to happened within 100 meters from a site. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. **<u>Grave Sites and cemeteries</u>**

	The allocation of a Moderate sensitivity for Paleontological Heritage to the entire study area except the two historic spring sites, which indicate Very High point sources of Groundwater Heritage. Although the Uitdraai Formation can provide new information on micro-fossils of Mokolian age, these fossils are very difficult to identify and are more of academic interest. Both the Dwyka Group and Gordonia Formations are however known for some very significant fossil finds and although scarce, the fossils can contribute significantly to our understanding of depositional environments during the Carboniferous, Permain and Quaternary ages in South Africa.	▪ Adjust the development layout (where possible) and demarcate the grave sites with at least a 5-10-meter buffer. ▪ In the event that the sites cannot be excluded from the development footprint, a grave relocation process (as described in Appendix A of the Heritage Assessment report) needs to be implemented. **<u>Cumulative Impact</u>** ▪ It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.
Socio-economic	The economy of the Siyathemba LM is in need of investment and development and the establishment of the wind facility in the area will offer such an opportunity. Furthermore, if the other proposed projects are approved, this could contribute to the growth of this sector as well as stimulate economic development further. The project will have the potential to improve the standard of living of the communities located within a 50 km radius given the commitments towards socio-economic and enterprise development. The construction and operation of the facility will result in various positive economic impacts.	▪ The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure. ▪ Consultation with the directly affected and adjacent land owners must be on-going to limit the effect on productive agricultural land. ▪ It is recommended that in order to curb the increase in property prices in the area, proper planning concerning accommodation of the construction crew must be done. ▪ Construction vehicles should only access the construction site via demarcated access roads and

	▪ It is estimated that the capital expenditure on the 140 MW wind facility will be R2.6 billion. Approximately, 128 employment opportunities will be created during the construction phase at peak construction. About 40% of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. ▪ The annual revenue generated by the plant could amount to up to R1.3 billion. Furthermore, it is expected that 39 jobs per annum will be created at the plant. Overall, the impacts discussion and evaluation revealed that no fatal flaws are present from a socio-economic perspective, preventing the proposed development from being approved and implemented. In fact, all of the expected negative socio-economic impacts are of low significance.	should not be allowed to cut across farms or vacant (agricultural) land. ▪ The project developers and affected land owners should discuss and agree on appropriate construction procedures, which will minimise disruption of current farming activities. ▪ Aim to hire as many people from the local community as possible to limit the increase in demand for accommodation. ▪ Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted / local community. ▪ Where feasible, training and skills development programmes targeted at the locals should be initiated prior to commencement of the construction phase. ▪ Knowledge sharing and on-the-job training should be promoted by the developer among the appointed contractors. ▪ Raise awareness among construction workers on health issues, including HIV/AIDS. ▪ Locals should be informed upfront about employment opportunities so that there are no unrealistic expectations on the part of the community. ▪ The project proponent should attempt to resolve issues and concerns, which they are made aware of immediately. ▪ Ensure clear communication of the project information and effective public participation processes to minimise the influx of migrant job seekers.

		▪ Movement of construction workers on and off site must be closely monitored and managed. ▪ Prior construction, rules and regulations regarding presence of construction workers on site need to be devised in consultation with the land owners of directly affected and adjacent properties. ▪ During construction the rules and regulations must be clearly communicated to all workers, personal property must be respected and avoided. ▪ Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities, local authorities and local land owners. ▪ Establish a health facility for the duration of the construction period to provide services to the construction crew and alleviate pressure on the local facilities.
Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)	This risk assessment would enable one to estimate the maximum permissible radiated emissions from the equipment installed within the Aletta wind energy facility and will be compared to known radiated emission data from the Acciona AW125/3000 Wind Turbine Generator (WTG). Acciona AW125/3000 WTG is a large turbine type and was used to show the typical impacts of a similar technology and sized turbine. The assessment and Electromagnetic Control Plan addresses mitigation actions required to reduce the radiated emissions of the AW 125 TH 100A WTG to levels acceptable for installation within the declared Karoo Central Astronomy Advantage Area. The intent of this plan is thus to	In order to evaluate the impact of the completed windfarm on the ambient emissions, reference measurements are to be done before construction and after construction. A separate test plan will be developed for that. Items identified as EMC emitters and therefore being a risk for the SKA will be analysed independently and mitigation measures will be applied. To verify overall windfarm emissions, ambient measurements should be done at the new site before construction starts. Tests points should be carefully

	ensure that the proposed Aletta wind energy facility poses a low risk of detrimental impact on the SKA by describing specific mitigation measurements to be implemented in order to achieve 40 dB of attenuation, as agreed with SKA South Africa. In addition, this plan concerns itself with the goal of eliminating causes of electromagnetic interference (EMI), which can adversely affect the performance of the SKA Radio telescope.
	
	The current Electromagnetic Compatibility (EMC) requirement is a 30dB reduction in radiated emissions to ensure the cumulative emission level of a wind farm is within the requirements of SKA. This requirement is based on measurements on the Acciona AW 125 TH100A WTG at the Gouda facility in South Africa and Barosoain windfarm, Navarra, Spain. Very similar design will be used for the Copperton/ Garob facilities.
	
	To prevent an impact on the SKA Project, Biotherm Energy has reviewed the facility lay-out to increase the distance from the closest turbine to the closest SKA infrastructure from 20km to 25km. The number of turbines has also been reduced from the initial 125 turbines to 60 turbines.
	
	As mitigation techniques are source and coupling path specific, tests were be done on a current WTG to confirm the suspected noise sources. The results indicated shielding required at frequencies in the FM Radio band as well as other controlled frequency bands, especially in the nacelle area.
		selected based on test equipment sensitivity with the objective to observe the increase in ambient emissions as construction progresses.
		
		Final site tests will be done on completion of the project and results should be compared to results in the Electromagnetic Interference Path Loss and Risk Assessment Report to prove the effectiveness of the mitigation techniques applied to the turbine. Although not anticipated, proper mitigation measures on identified emitters will be studied and implemented if final test shows emissions exceeding the SKA threshold.
		
		<u>Lighting</u>
		All lights in the at least the tower (due to the height) and in the nacelle should be LED or incandescent types. Due to the arcing nature of strobe lights, aircraft warning light for Garob and Copperton windfarms will be LED type. The synchronization among these obstruction light will be done through GPS. Fluorescent lights in the tower and nacelle will be replaced by LED. By implementing the suggested mitigation measures, the impact on the SKA project will be reduced. Where possible, the mitigation measures will be verified by means of laboratory tests.
		
		The following mitigation principles have been provided:
		▪ **<u>Cable Emissions (DM)</u>**
		    o Shield wires
		    o Control loop areas

	With regards to the Convertor Cabinet, test results obtained at the current installation including a 10dB safety margin shows no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect highlighted a few frequencies that will require additional attenuation. Further analysis of the frequencies above the 0dB line proved that they are ambient frequencies in the FM, TV and cell phone band. The shielding effectiveness of the concrete tower was not taken into account. No additional shielding of the bottom converter cabinet would therefore be required. With regards to the Bottom Control Cabinet, test results obtained at the current installation including a 10dB safety margin shows that no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect, highlighted the frequencies that will require additional attenuation of 12dB maximum excluding the FM radio frequencies. Further analysis of these signals proved that they are ambient signals from intentional transmitters. No additional shielding of the bottom control cabinet would therefore be required. With regards to the Top Control Cabinet, when taking cumulative effect into consideration, a significant amount of shielding is required. This is the combined effect of the cables entering and exiting the Top Control Cabinet and equipment mounted in the cabinet. Further analysis of the highest peaks revealed that they can be attributed to FM radio stations, TV and GSM intentional transmitters. However, not all signals that require attenuation could be	▪ **Cable Emissions (CM)** o Ferrites and absorbers o Control loop areas ▪ **Enclosure Shielding** o Improve shielding – EMC Gaskets – Conductive viewing aperature – Cooling aperature shield

	attributed to intentional transmitters. Mitigation should include shielded cabinets, shielded cable trays and the use of absorptive cable sleeves. Laboratory tests will be done to narrow down the source possibilities. Although site measurements were done, there is always the risk of interference signals (A) being masked by a higher amplitude interference signal (B). Signal A will then only become apparent once signal B has being mitigated. As the wind turbine generator and control equipment is a matured design, mitigation will be limited to non-invasive techniques.	
Traffic	As part of the traffic assessment haulage routes were compared. Route Alternative 1 and Route Alternative 4 were deemed to be the preferred options. Route Alternative 1 avoids the Van Rhyns Pass and the Piekenierskloof Pass, however, there is a railway bridge on the N7 (located approximately 42km southeast of the town of Nuwerus) which may be a possible obstruction. As such, Route Alternative 4 was deemed to be the preferred option as it doesn't have any gravel roads and is much shorter than the other alternatives. Based on the available information, it was calculated that the development will generate 6845 trips over an 18 month period. It was assumed that two (2) turbines will be delivered to site each week which roughly equates to three (3) deliveries per day. Fifteen normal heavy and light vehicles will also travel to and from site daily but, over a much shorter distance.	In order to avoid the railway bridge on the N7 (located approximately 42km southeast of the town of Nuwerus) which may be a possible obstruction, an application to use the facility road adjacent to the N7 must be investigated. The existing gravel track off the R357, which is currently the farmer's access road, will need upgrading and extension and will need to be suitably maintained. Re-gravelling may be necessary as a maintenance measure, from time to time, throughout the operational life of the plant. Should damage be caused by the transport vehicles along the access roadway, it should be assessed and mitigating maintenance should be initiated.

	Access to the site will be via an existing gravel track off the R357, which is currently the farmer's access road, approximately 34km from the N10 intersection. Sight distance at the access is more than adequate and the pavement structure seems to be sound and with little to no defects. It is expected that the community of Prieska will participate in the construction phase of this development. From a traffic point of view, the total daily construction traffic is deemed to be very low and will not significantly impact this community. The cumulative effect on the community was rated as a positive low impact.. The impact of the construction traffic on the general traffic and the surrounding communities along the haulage route is considered to be low. The level of service on the roadways on which the components are transported may experience some additional delay. All the components will be transported by truck from Saldanha or Coega harbour to the site using the defined routes with possible minor deviations. These vehicles are classified as oversize vehicles and permits must be obtained in order to transport the turbine components. The access to the site is on road R357 which is a Provincial road and will necessitate the involvement of the Northern Cape provincial roads and transport department.	Additional delays experienced by the level of service on the roadways on which the components are transported can be mitigated by: ▪ Allowing the general traffic to pass the transport vehicle at regular intervals. ▪ The abnormal vehicles should not travel in groups of two or more so as to limit the delays caused by the relatively slow vehicles. Permits must be obtained for the oversized vehicles in order to transport the turbine components. SANRAL Western / Southern Region will need to be contacted in order to obtain consent for the abnormal load transport on their roadways. Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period.

	The cumulative impact and significance of the development of the wind energy farm is considered to be low negative and low positive impacts when traffic and surrounding community parameters, respectively, are examined.	

The above mentioned specialist studies were conducted to address the potential impacts relating to the proposed development that were identified as being required during the scoping phase. An impact assessment was conducted to ascertain the level of each identified impact, as well as 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 exist as a result of the proposed project. Additionally, the specialists comparatively assessed the alternatives as provided in **Figure iv**, the results of the comparative assessment are summarised below in **Table ii**.

Table ii: Summary of comparative assessment

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	FATAL FLAWS
SUBSTATION AND O&M BUILDING ALTERNATIVES			
Option 1	Biodiversity	NO PREFERENCE	No Fatal Flaws
	Avifauna	NO PREFERENCE	No Fatal Flaws
	Bats	NO PREFERENCE	No Fatal Flaws
	Surface Water	NO PREFERENCE	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Noise	NO PREFERENCE	No Fatal Flaws
	Heritage	PREFERRED	No Fatal Flaws
	Palaeontology (Desktop)	NO PREFERENCE	No Fatal Flaws
	Visual	NO PREFERENCE	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No Fatal Flaws
Option 2	Biodiversity	NO PREFERENCE	No Fatal Flaws
	Avifauna	NO PREFERENCE	No Fatal Flaws
	Bats	NO PREFERENCE	No Fatal Flaws
	Surface Water	NO PREFERENCE	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Noise	NO PREFERENCE	No Fatal Flaws
	Heritage	FAVOURABLE	No Fatal Flaws
	Palaeontology (Desktop)	NO PREFERENCE	No Fatal Flaws
	Visual	NO PREFERENCE	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No Fatal Flaws

As depicted in **Table ii** above, the two (2) 132kV onsite substation and O&M building site alternatives are very similar in terms of which is the environmentally preferred alternative. Almost all of the specialists found there to be no preference between the two (2) alternatives, with the only exception being the heritage specialist's preference for Option 1. The 132kV onsite substation and O&M building Option 2 was however deemed to be a favourable option, as despite the fact that a heritage site occurs at this site it is deemed to have a low significance. Therefore both of the alternatives mentioned above are considered to be acceptable, from an environmental perspective.

During the EIA it was established that the Aletta Wind Energy Facility layout takes most the sensitive areas identified by the specialists into account. A sensitivity map has been compiled based on the negative mapping / sensitivity assessment exercise that was undertaken by all the specialists. These are indicated in **Figure v** below.

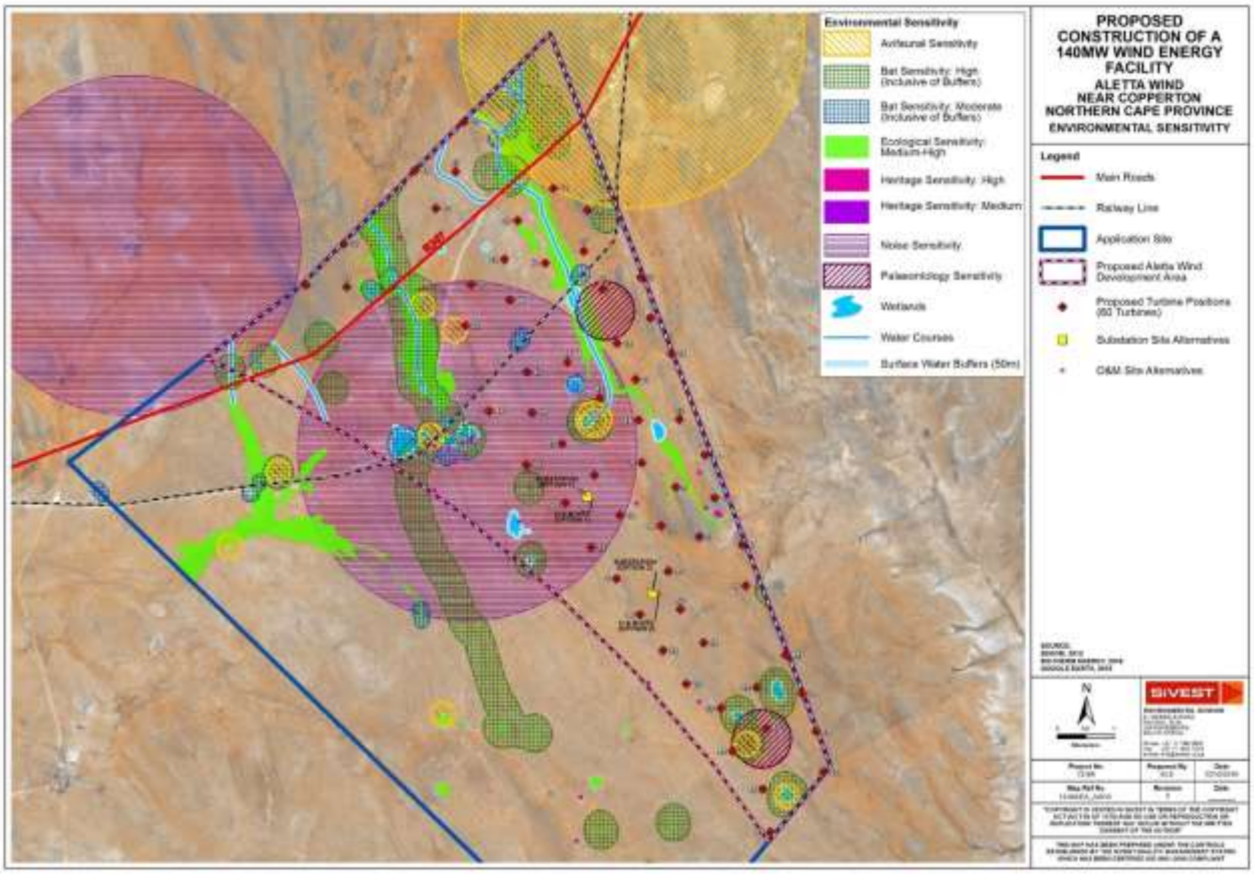

Figure v: Aletta Wind Energy Facility layout alternatives with environmentally sensitive areas

Additionally, several no-go areas were also identified by some of the specialists. A layout map indicating the identified no-go areas is provided in **Figure vi** below.

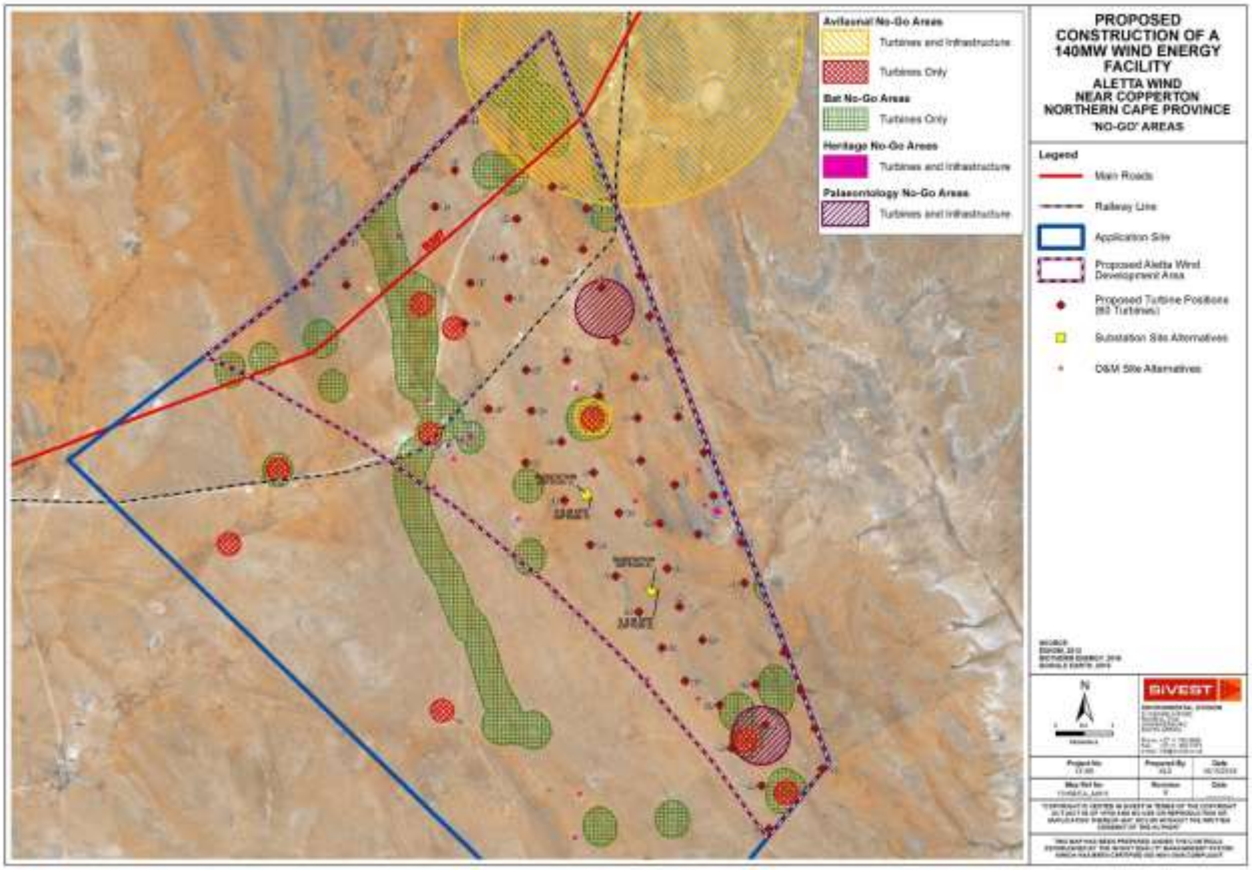

Figure vi: Aletta Wind Energy Facility layout alternatives with no-go areas

Although no fatal flaws were identified the layout was amended slightly in order to avoid all no-go areas. The preferred site layout in relation to the no-go areas identified by the specialists is indicated in **Figure vii** below.

It should be noted that micrositing may still be required within the authorised development area during the detailed design phase. This is to enable the avoidance of any additional sensitive areas, unidentified features on site or any design constraints when the project reaches construction.

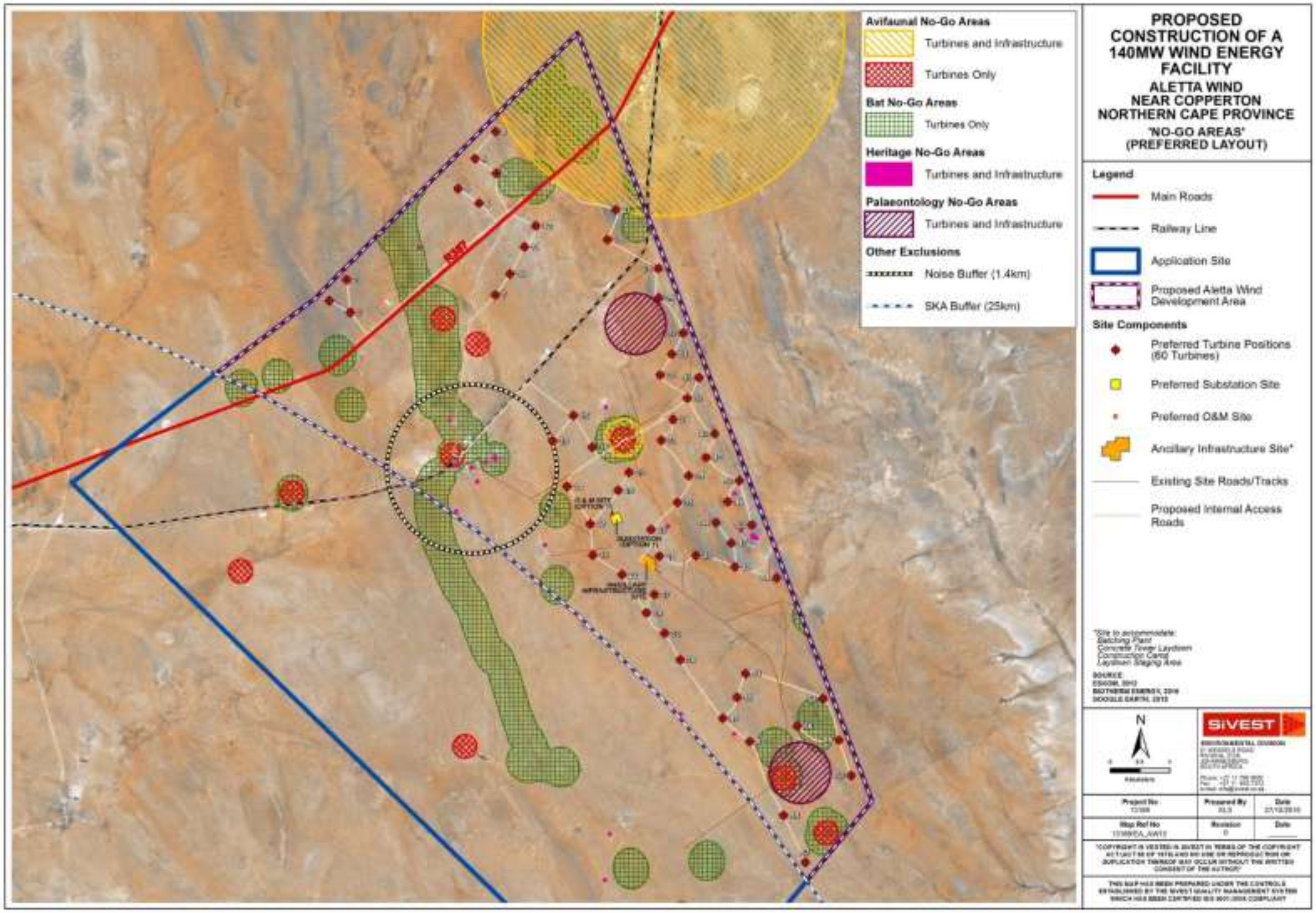

Figure vii: Preferred Site Layout in relation to no-go areas

It is important to note that the preferred site layout provided above is only the EIA phase layout and therefore not the final layout for the proposed development. This is due to the following reasons:

- The technology is constantly changing where higher yielding a more efficient turbines are being bought into the marked and as a result the Developer cannot commit to a specific turbine, and associated layout, at this stage.
- The Engineering, Procurement and Construction (EPC) Contractor has not been appointed and hence the turbine manufacturer is unknown. The EPC contractor is only appointed once the project has been selected as a Preferred Bidder.
- The final turbine manufacturer is unknown and hence the final turbine generation capacity is unknown. The turbine generation capacity directly determines how many turbines will be present in the project area. A 2MW turbine will result in a layout with 70 turbines, where as a 3MW turbine will result in a layout with 47 turbines.
- The relocation, adding or removing of a single wind turbine has an impact on the entire wind farm. With a single change a new yield assessment and model must be conducted to determine the highest yielding layout. Hence a facility with 50 turbines will have a completely different layout to a facility with 70 turbines. The EPC contractor may also insist on their own optimised layout for the facility.
- The current project has four 500m corridors where turbines have been preliminary excluded from. Depending on the final power line corridor selection, turbines may be relocated to be within the remaining corridors.
- If surrounding wind projects are bid and selected as Preferred Bidders before the Aletta facility, then the adjacent wind projects final layouts may include turbines on the boundary of the Aletta facility and hence these neighbouring turbines will have to be considered into the final Aletta facility layout once it has been selected as a Preferred Bidder.
- As the turbine positions are still not final the road and ancillary infrastructure layouts are also subjected to change.

It should also be noted that the specialist sensitivities and no-go areas will be incorporated into the layout design when completing the final layout. In addition, a 1.4km buffer will be placed around the land owner's house. This is 450m further then the original EIA phase layout.

It is the opinion of the EAP that the information and data provided in this DEIAr is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Further, it is the opinion of the EAP that based on the findings of the EIA that the proposed project should be granted an EA and allowed to proceed provided the following conditions are adhered to:

- The substation and O&M building should be constructed within the preferred substation and O&M building sites for Option 1.
- All feasible and practical mitigation measures recommended by the various specialists must be implemented.

- All micro siting of the turbines and associated infrastructure must be repositioned within the authorised buildable area and must exclude all no-go areas identified by the specialists.
- Where applicable monitoring should be undertaken to evaluate the success of the mitigation measures recommended by the various specialists.
- Final EMPr should be approved by DEA prior to construction.
- The final layouts should be submitted to the DEA for approval prior to commencing with the activity.

SiVEST as the EAP is therefore of the view that:

- An environmentally preferred substation site, as well as an O&M building site has been identified which is less environmentally sensitive compared to the other site considered during the EIA phase.
- 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 proposed project can be mitigated to acceptable levels.

The date on which the activity will commence cannot be determined at this stage as they are based on the timeframes dictated by the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) bid windows. The date of the next round of bid submissions has not yet been announced. The construction of the Aletta wind energy facility is dependent on being selected as a preferred bidder. The project will therefore require an authorisation of at least 5 years.

It is trusted that the DEIAr provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE ALETTA 140MW WIND ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT 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 Assessment 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

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 1830

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).

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
BLSA	- Bird Life South Africa
CARA	- Conservation of Agricultural Resources Act
CBA	- Critical Biodiversity
CISPR	- International Special Committee of Radio Interferences
DEA	- Department of Environmental Affairs
DEIAr	- Draft Environmental Impact Assessment Report
DM	- District Municipality
DoE	- Department of Energy
DSR	- Draft Scoping Report
DWS	- Department of Water and Sanitation
EAP	- Environmental Assessment Practitioner
ECA	- Environmental Conservation Act No. 73 of 1989
ECP	- Emissions Control Plan
EHS	- Environmental, Health, and Safety
EIA	- Environmental Impact Assessment
EIAr	- Environmental Impact Assessment Report
EMC	- Electromagnetic Compatibility
EMI	- Electromagnetic Interference
EMPr	- Environmental Management Programme
ENPAT	- Environmental Potential Atlas
EP	- Equator Principles
EPC	- Engineering, Procurement and Construction
EPFI	- Equator Principles Financial Institutions
ERA	- The Electricity Regulation Act No. 4 of 2006
ESA	- Ecological Support Areas
FD	- Frequency Domain
FEIAr	- Final Environmental Impact Assessment Report
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
IFC	- International Finance Corporation
IPP(s)	- Independent Power Producers
IUCN	- International Union for the Conservation of Nature and Natural Resources
KSW	- Key Stakeholder Workshop
kV	- Kilo Volt
MSA	- Middle Stone Age
MW	- Megawatt
NEA	- The National Energy Act No. 34 of 2008
ERA	- The Electricity Regulation Act No. 4 of 2006
IRP	- Integrated Resource Plan
NCR	- National Noise Control Regulations
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
NPAES	- National Parks Area Expansion Strategy
OHL	- Overhead Line
OHSA	- Occupational Health and Safety Act No. 85 of 1993
RE	- Renewable Energy
REIPPP	- Renewable Energy Independent Power Producer Procurement Programme
PoS	- Plan of Study
PM	- Public Meeting
PPA	- Power Purchase Agreement
PPP	- Public Participation Process
PV	- Photovoltaic
REFIT	- Renewable Feed-In Tariff Programme
RFI	- Radio frequency interference
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
SANRAL	- South African National Roads Agency SOC Limited
SDF	- Spatial Development Framework
SG	- Surveyor General

SKA	- Square Kilometre Array
SPVs	- Special Purpose Vehicles
TL	- Terrain Loss
VIA	- Visual Impact Assessment
WETFEPA	- Wetland Freshwater Priority Areas
WEF	- Wind Energy Facility
WTG	- Wind Turbine Generator
WUL	- Water Use License

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE ALETTA 140MW WIND ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 INTRODUCTION

BioTherm Energy (Pty) Ltd (hereafter referred to as BioTherm) intends to develop the Aletta wind energy facility and associated infrastructure near Copperton, Northern Cape Province of South Africa (**Figure 1**). SiVEST Environmental Division has been appointed as independent environmental assessment practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the proposed energy facility and associated infrastructure. The overall objective of the project is to generate electricity to feed into the national grid. The proposed project will consist of a 140MW export capacity wind energy facility.

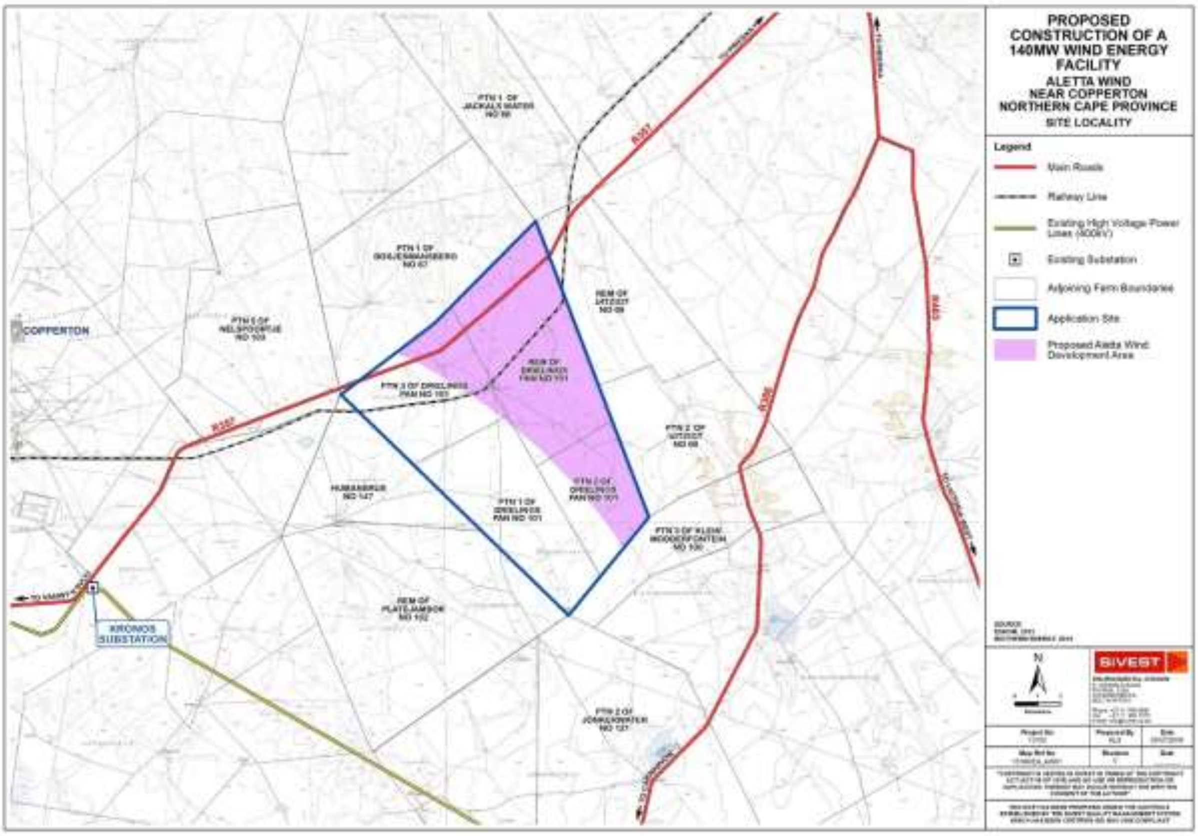


Figure 1: Site Locality

Additionally, BioTherm are proposing to develop the associated Aletta substation and power line, both with a capacity of up to 132kV. This associated electrical infrastructure will require a separate Environmental Authorisation and is being conducted as a part of a separate Basic Assessment (BA) process. The Aletta power line has been included in the wind energy facility EIA for background information but will be authorised under a separate BA to allow for handover to Eskom. The Aletta onsite substation will include an Eskom portion and an Independent Power Producer (IPP) portion, hence the substation has been included in the wind energy facility EIA and in the substation and power line BA to allow for handover to Eskom. Although the wind energy facility and the electrical infrastructure will be assessed separately, a single public participation process is being undertaken to consider both of the proposed developments. The potential environmental impacts associated with both developments will be assessed as part of the cumulative impact assessment. The DEA reference number allocated for the Aletta substation and power line has not yet been allocated by the DEA. This will be provided in the Final Environmental Impact Assessment Report (FEIAr).

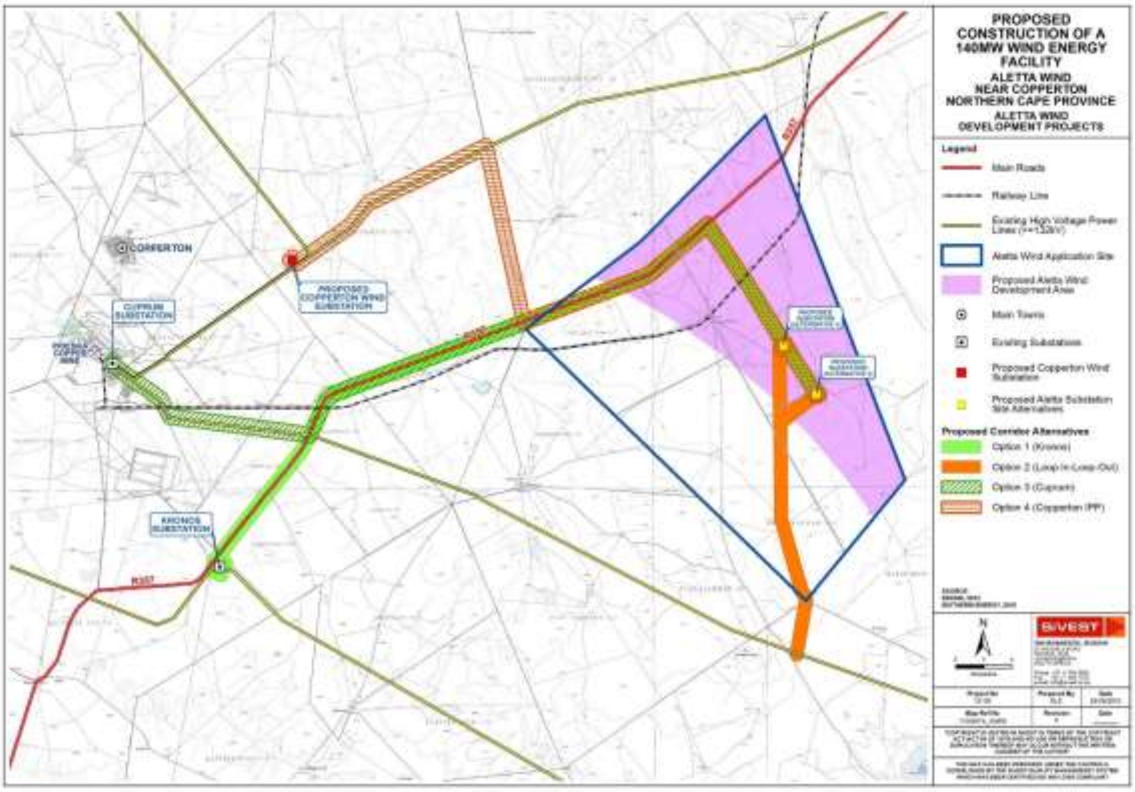


Figure 2: Combined layout map showing the proposed Aletta Wind Energy Facility development as well as the proposed on-site Aletta substation and associated 132kV power line which is part of a separate BA process

The proposed development requires Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA). However, the provincial authority will also be consulted (i.e. Northern Cape Department of Environment and Nature Conservation (NC DENC)). The EIA for the proposed development will be conducted in terms of the EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on the 8th of December 2014. In terms of these

regulations, a full EIA is required for the proposed project. All relevant legislations and guidelines (including Equator Principles) will be consulted during the EIA process and will be complied with at all times.
This report has been compiled in accordance with World Bank standards and the Equator Principles. The Equator Principles ("EP") is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing (Equator Principles, 2013). This wind energy facility development is considered a Category B project. 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, 2013). The project will also comply with the International Finance Corporation's (IFC) Social and Environmental Performance Standards (2012) and General Environmental Health and Safety (EHS) Guidelines (2007).

1.1 Structure of this Report

This DEIAr is structured as follows:

- **Section 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.
- **Section 2** details the approach used to undertake the study i.e. the scoping study, authority consultation and the DEIAr.
- **Section 3** elaborates on the assumptions and limitations pertaining to the EIA process for the proposed development.
- **Section 4** provides explanation to the need and desirability of the proposed project by highlighting issues such as security of power supply; the appropriateness of the selected site; local employment as well as the regional and local income profile.
- **Section 5** gives detailed technical descriptions of the proposed wind energy facility as well as the alternatives involved.
- **Section 6** provides a description of the region in which the proposed development is intended to be located. Although the Section 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 phase are also summarised.
- **Section 7** describes the Public Participation Process (PPP) undertaken during the EIA Phase and tables issues and concerns raised by Interested and Affected Parties (I&APs).
- **Section 8** documents the findings of the specialist studies and associated potential impacts of the proposed wind energy facility and associated infrastructure.
- **Section 9** presents a rating of each environmental issue before and after mitigation measures.
- **Section 10** identifies recommendations from the specialists that have a bearing on the layout alternatives as well as proposed mitigation measures.
- **Section 11** identifies potential cumulative impacts per environmental issue (specialist study).
- **Section 12** gives a comparative assessment of all identified alternatives based on the various environmental issues (specialist studies).

- **Section 13** provides a description of the environmental monitoring and auditing process to be undertaken for the proposed wind energy facility.
- **Section 14** presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.
- **Section 15** summarises the findings and recommendations per specialist study and provides the overall conclusion.
- **Section 16** lists references indicated in the DEIAr.

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 report are detailed in **Table 1** below.

Table 1: Project Team

Name and Organisation	Role
Andrea Gibb – SiVEST	Environmental Assessment Practitioner (EAP) and Visual
Stephan Jacobs - SiVEST	Environmental Consultant / Public Participation Practitioner and Visual
David Hoare – David Hoare Consulting	Biodiversity
Chris van Rooyen – Chris van Rooyen Consulting	Avifauna
Werner Marais and Monika Moir – Animalia	Bats
Shaun Taylor – SiVEST	Surface Water
D.G. Paterson – ARC Institute for Soil, Climate and Water	Agricultural Potential
Adrian Jongens – Jongens Keet Associates	Noise
Wouter Fourie – PGS	Heritage
Gideon Groenewald – PGS	Palaeontology (Desktop)
Elena Broughton and Memory Madondo – Urban-Econ Development Economists	Socio-economic
Callie Fouché – Interference Testing and Consultancy Services (Pty) Ltd (ITC)	Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)
Dirk van der Merwe – Bvi Consulting Engineers	Traffic
Nicolene Venter – Zitholele Consulting	Senior Public Participation Practitioner
Kerry Schwartz – SiVEST	GIS and Mapping and Visual

As per the requirements of the NEMA (2014), the details and level of expertise of the persons who prepared the DEIAr are provided in **Table 2** below.

Table 2: Expertise of the EAP

Environmental Practitioner	SiVEST (Pty) Ltd – Andrea Gibb
Contact Details	andreag@sivest.co.za
Qualifications	BSc Landscape Architecture and BSc (Hons) Environmental Management
Expertise to carry out the EMPr	Andrea has 8.5 years' work experience and specialises in undertaking and managing Environmental Impact Assessments (EIAs) and Basic Assessment (BAs), primarily related to energy generation and electrical distribution projects. She also specialises in undertaking visual impact and landscape assessments, by making use of ArcGIS technology and field surveys. She has extensive experience in overseeing public participation and stakeholder engagement processes and has been involved in environmental baseline assessments, fatal flaw / feasibility assessments and environmental negative mapping / sensitivity analyses. From a business and administrative side, Andrea is actively involved in maintaining good client relationships, mentoring junior staff and maintaining financial performance of the projects she leads. **Environmental Impact Assessments and Basic Assessments:** ▪ EIA for the proposed construction of a 75MW Solar Photovoltaic (PV) Power Plant near Dennilton, Limpopo Province. ▪ EIA for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province. ▪ BA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province. ▪ BA for the proposed construction of two 132kV power lines and associated infrastructure from Silverstreams DS to the Olien MTS near Lime Acres, Northern Cape Province. ▪ BA for the proposed Construction of the SSS1 5MW Solar Photovoltaic (PV) Plant on the Western Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province. ▪ BA for the proposed Construction of the SSS2 5MW Solar Photovoltaic (PV) Plant on the Eastern Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province. ▪ BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the proposed Bophirima Substation to the existing Schweizer-Reneke Substation, North West Province. ▪ BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the Mookodi Substation to the existing Magopela Substation, North West Province. ▪ BA for the proposed Mookodi Integration Phase 2: Proposed Construction of the Mookodi - Ganyesa 132kV power line, proposed Ganyesa Substation and Havelock LILO, North West Province. ▪ Amendment of the Final Environmental Impact Report for the Proposed

	Mookodi 1 Integration Project near Vryburg, North West Province. ▪ BA for the proposed 132kV power line and associated infrastructure for the proposed Redstone Solar Thermal Energy Plant near Lime Acres, Northern Cape Province. ▪ BA for the proposed construction of a 132kV power line and substation associated with the 75MW Photovoltaic (PV) Plant on the Farm Droogfontein (PV 3) in Kimberley, Northern Cape Province. ▪ BA for the proposed establishment of a Learning and Development Retreat and an Executive Staff and Client Lodge at Mogale's Gate, Gauteng Province. ▪ Amendment application in order to increase the output of the proposed 40MW PV Facility on the farm Mierdam to 75MW, Northern Cape Province. ▪ BA for the proposed construction of a power line and substation near Postmasburg, Northern Cape Province. ▪ BA for the proposed West Rand Strengthening Project – 400kV double circuit power line and substation extension in the West Rand, Gauteng. ▪ EIA for the proposed construction of a wind farm and PV plant near Prieska, Northern Cape Province. ▪ Public Participation assistance as part of the EIA for the proposed Thyspunt Transmission Lines Integration Project – EIA for the proposed construction of 5 x 400kV transmission power lines between Thyspunt to Port Elizabeth, Eastern Cape Province. ▪ EIA assistance for the proposed construction of three Solar Power Plants in the Northern Cape Province. ▪ Public Participation as part of the EIA for the proposed Delareyille Kopela Power Line and Substation, North West Province. ▪ Public Participation as part of the EIA for the Middelburg Water Reclamation Project, Mpumalanga Province.
Environmental Consultant	SiVEST (Pty) Ltd – Stephan Jacobs
Contact Details	stephanj@sivest.co.za
Qualifications	BSc Environmental Sciences and BSc (Hons) Environmental Management and Analysis
Expertise to carry out the EMPr	Stephan joined SiVEST in May 2015 and holds the position of Graduate Environmental Consultant in the Johannesburg office. Stephan specialises in the field of Environmental Management and has been involved in the compilation of Environmental Impact Assessments (EIAs) and Basic Assessments (BAs). Stephan has also assisted extensively in the undertaking of field work and the compilation of reports for specialist studies such as surface water and visual impact assessments. Stephan also has experience in Environmental Compliance and Auditing and has acted as an Environmental Control Officer (ECO) for several infrastructure projects.

	Project Experience: ▪ Environmental Control Officer (ECO) for the Polokwane Integrated Rapid Public Transport System (IRPTS), Limpopo Province. ▪ BA for the construction of a Non-Motorised Transport (NMT) Training and Recreational Park adjacent to the Peter Mokaba Stadium in Polokwane, Limpopo Province. ▪ BA for the Proposed Expansion of the Tissue Manufacturing Capacity at the Twinsaver Kliprivier Operations Base, Gauteng Province. ▪ Environmental Control Officer (ECO) for Phase 1 and Phase 2 of the Newmarket Retail Development, Gauteng Province. ▪ Environmental Review of the Xakwa Coal Operations, adjacent to the proposed Eastside Junction Development. ▪ Environmental Due Diligence for the Woodlands and Harrowdene Office Parks in Woodmead, Gauteng Province. ▪ Visual Impact Assessment for the Helena Solar PV Plant, Northern Cape Province. ▪ Visual Impact Assessment for the Nsoko Msele Integrated Sugar Project, Swaziland. ▪ Visual Impact Assessments for the proposed construction of the Sendawo Solar 1, Sendawo Solar 2 and Sendawo Solar 3 Photovoltaic (PV) Energy Facilities near Vryburg, North West Province. ▪ Visual Impact Assessment for the proposed construction of the Sendawo Substation and Associated 400kV Power Line near Vryburg, North West Province. ▪ Visual Impact Assessment for the proposed construction of the 3000MW PhilCo Green Energy Wind Farm and Associated Infrastructure near Richmond, Northern Cape Province. ▪ Visual Impact Assessment for the proposed construction of the Aletta 140MW Wind Energy Facility neat Copperton, Northern Cape Province. ▪ Visual Impact Assessment for the proposed construction of the Aletta Substation and associated 132kV Power Line near Copperton, Northern Cape Province. ▪ Visual Impact Assessment for the proposed construction of the Eureka 140MW Wind Energy Facility and associated Infrastructure near Copperton, Northern Cape Province. ▪ Visual Impact Assessment for the proposed construction of the Eureka Substation and associated 132kV Power Line neat Copperton, Northern Cape Province. ▪ Basic Visual Impact Assessment for the proposed construction of up to a 132kV Power Line and Associated Infrastructure for the Rooipunt Solar Thermal Power Plant near Upington, Northern Cape Province. ▪ Basic Visual Impact Assessment for the proposed construction of up to a 132kV Power Line and Associated Infrastructure for the proposed Kalkaar

	Solar Thermal Power Plant near Kimberly, Free State and Northern Cape Provinces. ▪ Surface Water Assessment for the Steve Tshwete Local Municipality, Mpumalanga Province. ▪ Surface Water Delineation and Assessment for the proposed coal Railway Siding at the Welgedacht Marshalling Yard and associated Milner Road Upgrade near Springs, Ekurhuleni Metropolitan Municipality.

Please refer to **Appendix 2** for CV's of each team member. Declarations of Independence and the EAP Affirmation are included in **Appendix 4**.

1.3 Key Legal and Administrative Requirements Relating to the Proposed Development

1.3.1 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (Act No. 107 of 1998) was promulgated in 1998 but has since been amended on several occasions from this date. This Act replaces parts of the Environment Conservation Act (Act 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 December 2014 (Government Gazette No. 38282 of 4th December 2014).

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

In terms of the newly released EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on 8th December 2014, a full EIA is required for the proposed project.

1.3.2 NEMA EIA Requirements

Sections 24 and 44 of the NEMA make provision for the promulgation of regulations that identify activities which may not commence without an environmental authorisation, the result being that NEMA now governs the EIA process with the said promulgation of EIA Regulations in December 2014 (Government Gazette No. 38282 of 04 December 2014). This EIA has therefore been undertaken in accordance with the NEMA EIA 2014 Regulations which are contained in four Government Notices (GN R 982, 983, 984, and 985) which came into effect on 8th December 2015.

In terms of these Regulations, a full Environmental Impact Assessment (EIA) 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. 983 – 985 of the 4th December 2015 are of relevance to the project in question. All of the Listed Activities identified in terms of Sections 24(2) and 24D include:

Table 3: Listed activities in terms of the NEMA Regulations

Activity number of the relevant notice:	**Listed activity as described in GNR 983, 984 and 985**	**Description of Listed Activity**
GN R. 983 Item 11	*The development 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*	**An onsite IPP substation will be constructed as part of the wind energy facility. The proposed IPP onsite substation will be located outside an urban area and will have a capacity of 132kV.**
GN R. 983 Item 12	*The development of :* *xii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*	**The proposed project will entail the development of buildings and other infrastructure exceeding 100 square metres in size. This activity will not be triggered by the wind turbines, substation and O&M building since none of these structures are planned to be directly within or within close proximity (within 32m) to the identified surface water resources. However, internal access roads will be required which will need to route to the respective wind**

		turbines locations and to the O&M building and infrastructure. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, the internal access roads and other associated infrastructure will need to cross or be within close proximity to the delineated surface water resources.
GN R. 983 Item 19	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-* *(i) a watercourse;* *But excluding where such infilling, depositing , dredging, excavation, removal or moving-* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	**The impact phase surface water assessment revealed that there are surface water features located within the development area. This listed activity will not be triggered by the wind turbines, substation and O&M building since none of these structures are planned to be within the identified surface water resources. However, internal access roads will be required which will need to route to the respective wind turbines locations, O&M building and infrastructure. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, the internal access roads and other associated infrastructure may need to cross the delineated surface water resources. Should construction activities take place within a watercourse soil will need to be removed.**
GN R. 983 Item 24	*The development of-* *ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*	**On site roads will be required for the proposed development. The width of these roads will be 4m to 6m, however road widths greater than 8 meters will be required for turning circles.**
GN R. 983 Item 28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development:*	**The proposed project site is currently used for sheep farming, and the proposed project will result in an area greater than 1 hectare being transformed into an industrial land use.**

	(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	
GN R. 983 Item 56	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre -* *(ii) where no reserve exists, where the existing road is wider than 8 metres –* *excluding where widening or lengthening occur inside urban areas.*	**It is likely that existing access roads will need to be upgraded in order to access the site. The required width and length of the expansion will be determined during the EIA process.**
GN R. 984 Item 1	*The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within an urban area.*	**It is proposed that a wind energy facility with a maximum export capacity of 140MW will be constructed.**
GN R. 984 Item 15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	**The proposed development will transform more than 20 hectares of indigenous vegetation. The area occupied by each wind turbine will be up to 0.5 hectares and there are proposed to be up to 60 turbines as well as associated infrastructure. Clearance will also be required for the proposed IPP substation, O&M building, internal access roads and other associated infrastructure.**
GN R. 985 Item 4	The development of a road wider than 4 metres with a reserve less than 13,5 metres. *(a) In the Northern Cape Province* *i Outside urban areas, in:*	**Internal roads will be constructed and these are planned to be more than 4m wide. According to the National Parks Area Expansion Strategy (NPAES), the central part of the proposed application site has been identified as a priority area for inclusion in future protected areas. It**

	(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;* *(gg) 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 a biosphere reserve.*	**should however be noted that the area on site shown as being included in the NPAES includes a small portion of the hills as well as mostly plain areas. Based on the field assessment of this site the specific areas selected for inclusion in the NPAES are not unique to that specific location and could be accommodated in adjacent areas. The hills on site were considered to all have equivalent biodiversity patterns. Some of the plains in the selected area were also considered to be slightly compromised by existing activities on site (farm-house, roads and livestock impacts).**
GN R. 985 Item 14	*The development of-* *(xii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs-* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse* *(a) In the Northern Cape Province* ii *Outside urban areas, in:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area*	**The proposed project will entail the development of buildings and other infrastructure exceeding 10 square metres in size. This activity will not be triggered by the wind turbines, substation and O&M building since none of these structures are planned to be directly within or within close proximity (within 32m) to the identified surface water resources. However, internal access roads will be required which will need to route to the respective wind turbines locations and to the O&M building and infrastructure. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, the internal access roads and other associated infrastructure will need to cross or be within close proximity to the delineated surface water resources. According to the National Parks Area Expansion Strategy (NPAES), the central part of the proposed application site has been identified as a priority area for inclusion in future protected areas. It should however be noted that the area on site shown as being included in the**

	identified in terms of NEMPAA or from the core areas of a biosphere reserve.	**NPAES includes a small portion of the hills as well as mostly plain areas. Based on the field assessment of this site the specific areas selected for inclusion in the NPAES are not unique to that specific location and could be accommodated in adjacent areas. The hills on site were considered to all have equivalent biodiversity patterns.**
GN R. 985 Item 18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *(a) In the Northern Cape Province* ii *Outside urban areas, in:* *(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;* *(gg) 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 area of a biosphere reserve; or* *(ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined*	**Existing access roads will need to be upgraded in order to access the site. According to the National Parks Area Expansion Strategy (NPAES), the central part of the proposed application site has been identified as a priority area for inclusion in future protected areas. It should however be noted that the area on site shown as being included in the NPAES includes a small portion of the hills as well as mostly plains areas. Based on the field assessment of this site the specific areas selected for inclusion in the NPAES are not unique to that specific location and could be accommodated in adjacent areas. The hills on site were considered to all have equivalent biodiversity patterns. Internal access roads will be required which will need to route to the respective wind turbines locations and to the O&M building and infrastructure. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, the internal access roads and other associated infrastructure will need to cross or be within close proximity to the delineated surface water resources.**

1.3.3 Environmental Impact Assessment Guideline for Renewable Energy Projects, DEA Notice 989 of 2015

The purpose of this document is primarily to provide guidance on the environmental management legal framework applicable to renewable energy operations and all the role players in the sector. The guideline is principally intended for use by the following stakeholder groups:

- Public Sector Authorities (as regulator and/or competent authority);
- Joint public sector authorities and project funders, e.g., Eskom, IDC, etc.
- Private Sector Entities (as project funder/developer/consultant);
- Other interested and affected parties (as determined by the project location and/or scope).

This guideline seeks to identify activities requiring authorisation prior to commencement of that activity, and provide an interface between national EIA regulations and other legislative requirements of various authorities.

The guidelines are applicable for the construction, installation and/or development of the following renewable energy projects:

  - Concentrating Solar Power Energy facility;
  - Wind Farm;
  - Hydropower Station; and
  - Photovoltaic Power Facility.

As the proposed development is for a wind energy facility it is subject to the recommendations proposed in the guidelines.

1.3.4 National Energy Act No. 34 of 2008

The National Energy Act (Act no, 34 of 2008), promulgated in 2008, has, as one of its key objectives, the promotion of diversity of supply of energy and its sources. From this standpoint, the Act directly references the importance of the renewable energy (RE) sector, with a mention of the wind energy sector included. The aim is to ensure that the South African economy is able to grow and develop, fast tracking poverty alleviation, through the availability of a sustainable, diverse energy mix. Moreover, the goal is to provide for the increased generation and consumption of RE (Republic of South Africa, 2008).

1.3.5 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 National Environmental Management Act (Act No 107 of 1998).

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

1.3.6 National Water Act No. 36 of 1998, as amended

The National Water Act (NWA) No 36 of 1998 was promulgated on the 20th 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 socio-economic 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.

1.3.7 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004 as amended)

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 project.

The NEMBA is relevant to the proposed project as the construction of the wind energy facility 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.

1.3.8 National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003 as amended)

The overarching aim of the National Environmental Management: Protected Areas Act (NEMPAA) No. 57 of 2003, within the framework of NEMA, is to provide for:

- provide for the declaration and management of protected areas;
- provide for co-operative governance in the declaration and management of protected areas;
- effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity;
- provide for a representative network of protected areas on state land, private land and communal land;
- promote sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas;
- promote participation of local communities in the management of protected areas, where appropriate; and
- provide for the continued existence of South African National Parks.

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

The National Forest Act (NFA) was enacted to:

- Provide for the protection, management and utilisation of forests;
- The protection of certain plant and animal life;
- The regulation of trade in forest produce;
- The control and management of a national hiking way system and National Botanic Gardens.

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 GN 908 of 21 November 2014. 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 indigenous vegetation may be required and a license in terms of the NFA may be required for this to be done.

1.3.10 Conservation of Agricultural Resources Act No. 43 of 1983

The Conservation of Agricultural Resources Act (CARA) No. 43 of 1983 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 projects as the construction of the power line and the substation 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.

1.3.11 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.

1.3.12 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 project.

1.3.13 Civil Aviation Act No. 13 of 2009

The Civil Aviation Act No. 13 of 2009 controls and regulates aviation within South Africa. It provides for the establishment of a South African Civil Aviation Authority and independent Aviation Safety Investigation Board in compliance with Annexure 13 of the Chicago Convention. It gives effect to various conventions related to aircraft offences, civil aviation safety and security, and provides for additional measures directed at more effective control of the safety and security of aircrafts, airports and matters connected thereto.

Although the Act is not directly relevant to the proposed development, it should be considered as the establishment of a wind energy facility may impact on aviation and air traffic safety if located directly within aircraft flight paths.

ATNS (Air Traffic and Navigation Services Company Limited) and the Civil Aviation Authority will be consulted and the required approvals will be obtained prior to construction.

1.3.14 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.

1.3.15 Astronomy Georgaphic 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 Kilometre radius of the centre 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.

BioTherm initially appointed MESA to conduct a Topographical Analysis Assessment for Aletta wind energy facility in order to determine whether the planned wind facility development could have any influence on the SKA.

BioTherm then appointed ITC to conduct an Electromagnetic Interference Path Loss and Risk Assessment based on the 80 turbine layout. This risk assessment was based from measurements taken at the Gouda Windfarm. This initial high level risk assessment was conducted to enable one to estimate the maximum permissible radiated emissions from the equipment installed within the Aletta wind energy facility, compared to known radiated emission data from the Acciona AW125/3000 (WTG. Acciona AW125/3000 WTG is a large turbine type and was used to show the typical impacts of a similar technology and sized turbine. The report concluded that based on the current SKA location information, a first order impact analysis shows a possible interference scenario between the Aletta wind energy facility and the nearest SKA installation at 21.43km separation distance. In order to negate the risk to an acceptable level, it was recommended that all equipment to be installed on site must comply with levels of 10 to 20dB below the

EN 55022 Class B limit as the primary mitigation measure. Where equipment exceeds this threshold, additional shielding and filtering should be implemented to reduce the electromagnetic emissions from the wind farm. Shielding and filtering solutions are available to ensure installed plant equipment emissions remain within SKA risk tolerances. The results of the assessment do however show that required levels of 10 to 20 dB below the CISPR 22 Class B limit should be achievable.

The full Topographical Analysis Assessment and the Path Loss and Risk Assessment Report was sent to the SKA. In the letter dated 18 March 2016, the SKA stated that the facility posed a high risk to the SKA and that a detailed emission measurements campaign must be conducted and an Emissions Control Plan, which provides sufficient evidence and proof of the mitigation required and that it is technically achievable must be compiled.

BioTherm subsequently appointed ITC to conduct a detailed Electromagnetic Interference Path Loss and Risk Assessment including an Emissions Control Plan (ECP) to address the mitigation actions required to reduce the radiation emissions of the wind turbine generator levels to levels acceptable for installation within the Karoo Central Astronomy Advantage Area. ITC previously worked on the Copperton and Garob Wind Energy Facilities of which were selected as Preferred Bidders under Round 4.5 of the REIPPP program. Both these Wind Energy Facilities are adjacent to the proposed Aletta Wind Energy Facility. The Electromagnetic Interference Path Loss and Risk Assessment (including an ECP) concluded that although site measurements were done, there is always the risk of interference signals (A) being masked by a higher amplitude interference signal (B). Signal A will then only become apparent once signal B has been mitigated. As mitigation techniques are source and coupling path specific, tests were done on a current WTG to confirm the suspected noise sources. The results indicated shielding required at frequencies in the FM Radio band as well as other controlled frequency bands, especially in the nacelle area.

With regards to the Convertor Cabinet, test results obtained at the current installation including a 10dB safety margin shows no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect highlighted a few frequencies that will require additional attenuation. Further analysis of the frequencies above the 0dB line proved that they are ambient frequencies in the FM, TV and cell phone band. The shielding effectiveness of the concrete tower was not taken into account. No additional shielding of the bottom converter cabinet would therefore be required.

With regards to the Bottom Control Cabinet, test results obtained at the current installation including a 10dB safety margin shows that no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect, highlighted the frequencies that will require additional attenuation of 12dB maximum excluding the FM radio frequencies. Further analysis of these signals proved that they are ambient signals from intentional transmitters. No additional shielding of the bottom control cabinet would therefore be required.

With regards to the Top Control Cabinet, when taking cumulative effect into consideration, a significant amount of shielding is required. This is the combined effect of the cables entering and exiting the Top Control Cabinet and equipment mounted in the cabinet. Further analysis of the highest peaks revealed that they can be attributed to FM radio stations, TV and GSM intentional transmitters. However, not all signals that require attenuation could be attributed to intentional transmitters. Given that the nacelle houses different equipment in a confined space and the difficulty in performing tests in the nacelle while the system is operational mitigation should include shielded cabinets, shielded cable trays and the use of absorptive cable sleeves. Laboratory tests will be done to narrow down the source possibilities.

The Electromagnetic Interference Path Loss and Risk Assessment Report (including an ECP) which was compiled at the request of the SKA is included in **Appendix 6K**.

In addition to the above, as discussed in section 5.2, BioTherm moved the turbines so that the separation distance between the nearest SKA station was increased from 20km to 25km and the number of turbines was further reduced from the originally planned 120 to 60.

The SKA were provided with the opportunity to comment on the more detailed Electromagnetic Interference Path Loss and Risk Assessment Report including the ECP (refer to proof in **Appendix 5I**). On 14 October 2016, further comments were received from the SKA, stating that based on the information provided, the proposed Aletta Wind Energy Facility represents a medium risk of detrimental impact, considering the significant amount of shielding required which may be a technical challenge. The control plan, as provided, was developed for the Acciona AW125 TH 100A WTG, and is therefore only relevant and acceptable if BioTherm were to adopt this model of wind turbine. The control plan was developed to achieve up to 40dB of attenuation and should it be verified that this is achieved through implementation of the control plan, and the expected emissions do not exceed those that have been measured and assessed in the plan, then the risk of detrimental impact would be reduced.

All correspondence with the SKA is included in the Comments and Response Reports (C&RRs) included in **Appendix 5E** and the letters received from the SKA are included in **Appendix 5D**. The Topographical Analysis Assessment and Path Loss and Risk Assessment Reports which were undertaken during the scoping phase are also included in **Appendix 11**.

1.3.16 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 as amended)
- Development Facilitation (Act No. 67 of 1995)
- The Hazardous Substances Act (Act No. 15 of 1973)
- Water Services Act (Act No. 108 of 1998)
- Electricity Regulation Act (Act No. 4 of 2006 as amended)
- Municipal Systems Act (Act No. 32 of 2000)
- Mineral and Petroleum Resource Development Act (Act No. 28 of 2002 as amended)
- Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998)

1.4 Key Development Strategies and Guidelines

1.4.1 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 proposed wind energy facility falls within the Siyathemba Local Municipality (LM), which is located within the greater Pixley ka Seme District Municipality (DM). The Siyathemba LM IDP for 2014/2015 identified alternative energy development as an anchor economic activity, and highlighted renewable energy development as an opportunity for the municipality. Additionally, energy has been identified as a priority growth sector. The Pixley ka Seme DM IDP for 2013/2014 references the National Development Plan's proposal to procure about 20,000MW of renewable electricity by 2030. The IDP also identifies the need for the attraction and retention of investors, which can largely be through the development of renewable energy projects.

It is therefore evident that the proposed development is aligned with the goals of the municipal IDPs in the study area.

1.4.2 Draft Integrated Energy Plan for the Republic of South Africa, 2013

The Draft Integrated Energy Plan (IEP), developed by the DoE, was undertaken to determine the best way to meet current and future energy service needs in the most efficient and socially beneficial manner, while:

- Maintaining control over economic costs;
- Serving national imperatives such as job creation and poverty alleviation; and
- Minimising the adverse impacts of the energy sector on the environment.

The IEP takes into consideration the crucial role that energy plays in the entire economy and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple objectives, some of which include:

- To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector;
- To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power facilities and refineries to be built and the prices that should be charged for fuels);
- To guide investment in and the development of energy infrastructure in South Africa; and
- To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

1.4.3 Integrated Resource Plan, 2010 and updated 2013

The Integrated Resource Plan (IRP) was created in order to plan for projected national electricity demand. Whilst the medium-term power generation mix will continue to lean heavily on the use of fossil fuels, the Revised Balanced Scenario (RBS) of the 2010 Integrated Resource Plan (IRP) includes for a total additional supply capacity of 17.8GWh from renewable sources by 2030. It recommends continuing with the current renewable bid programme with additional annual rounds (of 1000 MW PV capacity; 1000 MW wind capacity and 200 MW CSP capacity), with the potential for hydro at competitive rates.

1.4.4 Department of Energy White Paper on Renewable Energy, 2003

The Department of Energy (DoE) gazetted its White Paper on Renewable Energy in 2003, and introduced it as a "policy that envisages a range of measures to bring about integration of renewable energies into the mainstream energy economy." At that time the national target was fixed at 10 000GWh (0.8Mtoe) renewable energy contribution to final energy consumption by 2013. The White Paper proposed that this would be produced mainly from biomass, wind, solar and small-scale hydropower. It went on to recommend that this renewable energy should to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. Since the White Paper was gazetted, South Africa's primary and secondary energy requirements have remained heavily fossil-fuel dependant, both in terms of indigenous coal production and use, as well as the use of imported oil resources. Alongside this, the projected electricity demand of the country has led the National utility Eskom, to embark upon an intensive build programme to secure South Africa's longer-term energy needs, together with an adequate reserve margin.

1.4.5 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:

i. The National Energy Act of 2008 (No. 34 of 2008); and
ii. The Electricity Regulation Act (ERA) of 2006 (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. The table 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	1183	0	805	400	100	300
2024	250	1600	283	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:

i. Request for Qualifications (RFQ)
ii. Request for Proposals (RFP)
iii. Negotiation with the preferred bidder(s).

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

1.4.6 The Northern Cape Provincial Growth and Development Strategy (NC PGDS)

The importance of developing the renewable energy sector in the Northern Cape was first acknowledged in the Northern Cape Provincial Growth and Development Strategy (NC PGDS). The NCnPGDS makes reference to the need to ensure availability of affordable energy. It notes, "in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured." At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NC PGDS notes that, "development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which economic opportunity and activity is generated in the Northern Cape". The NC PGDS also notes that "sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation". In this regard, care needs to be taken to ensure that renewable energy facilities do not impact negatively on the region's natural environment.

1.4.7 The Northern Cape Provincial Spatial Development Framework (SDF)

In the Northern Cape Provincial Spatial Development Framework (SDF) of 2011, the Northern Cape provincial government acknowledges that the major energy challenge faced by the province is finding a balance between ensuring electricity security and addressing issues around climate change. The Northern Cape Provincial SDF (2011) states that the energy sector could benefit the economy significantly through created economic spin-offs or multiplier effects. This will, however, require innovative planning to provide the necessary infrastructure and associated amenities to accommodate the industry in an efficient manner (Dennis Moss Partnership, 2012).

2 APPROACH TO UNDERTAKING THE STUDY

The Environmental Impact Assessment (EIA) was undertaken in accordance with the EIA 2014 Regulations listed in Government Gazette No. 10328 of 4 December 2014 (GN 982, 983, 984 and 985 of 4 December 2014, as amended), in terms of Section 24 and 44 of the National Environmental Management Act, (No 107 of 1998) (NEMA) 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 as well as the studies which were required to be undertaken as part of the EIA-phase of the project. The Draft Scoping Report (DSR) was made available for public review from Thursday 30 June 2016 to Monday 01 August 2016. Comments received on the Draft Scoping Report were included in the Final Scoping Report (FSR) which was submitted to the DEA on Friday 12 August 2016. The DEA accepted the FSR and EIA Plan of study on Wednsday 14 September 2016 and requested for additional information to be included in the DEIAr. SiVEST has responded to the DEAs request for additional information indicating how this DEIAr complies with the information required by the DEA. Refer to **Appendix 3** for FSR Acceptance Letter and SiVEST's response thereto.

The following studies were taken through into the EIA Phase:

- Biodiversity (flora and fauna)
- Avifauna
- Bats
- Surface Water
- Soils and Agricultural Potential
- Noise
- Visual Impact
- Heritage and Palaeontology
- Socio-economic Impact
- Traffic
- Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)

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:

- An Application and the DSR were submitted to the DEA on the 30th of June 2016.
- The Department confirmed receipt of the Application and DSR on the 5th of July 2016 and the following reference number was allocated to the proposed development: **14/12/16/3/3/2/945**
- Comments on the DSR were received on the 20th of July 2016.
- The Final Scoping Report (FSR) was submitted to the DEA on the 12th of August 2016 and the Department confirmed receipt of the FSR on the 15th of August 2016.
- Acceptance of the FSR and the Plan of Study (PoS) for the EIA was received on the 14th of September 2016.

As part of the letter from the DEA accepting the FSR, it was requested that additional information be included in the DEIAr. The table below provides details as to how this DEIAr fulfils the main information requested by the DEA in the FSR acceptance letter. For a further details, refer to Appendix 3 for the FSR Acceptance Letter.

Table 5: Compliance with the DEA requirements detailed in the FSR acceptance letter

Additional Information Required by the DEA	Notes / Comments
All comments and recommendations made by all stakeholders and I&APs in the draft scoping report and submitted as part of the final scoping report must be taken into consideration when preparing an EIAr in respect of the proposed development.	The Comments and Response Report details how I&APs comments and recommendations have been taken into consideration. The Comments and Response Report is included in **Appendix 5E**. All correspondence between authorities and I&APs is included in **Appendix 5D**.
All mitigation measures and recommendations in the specialist studies must be addressed in the Final Impact Assessment Report (FEIAr) and EMPr.	Specialist recommendations and mitigation measures are included in **Sections 9** and **10**, as well as in **Section 15.1**, the summary of findings. All mitigation measures are detailed in the EMPr, included as **Appendix 8**.
Comments from all relevant stakeholders must be submitted to the DEA with the FEIAr.	All comments from stakeholders are included in the comments and response report and appended to this report. See **Appendix 5D** and **5E**. A record of distribution to Organs of States, including attempts made to obtain comments, is included in **Appendix 5I**.
The EAP is required to address all issues raised by Organs of State and I&APs prior to the submission of the FEIAr to the DEA.	All comments and issues raised by Organs of State and I&APs are included and responded to in the comments and response report and appended to this report. See **Appendix 5E**. All

	correspondence between Organs of State and I&APs is included in **Appendix 5D**.
Proof of correspondence with the various stakeholders must be included in the DEIAr. If the EAP is not able to obtain comments, proof should be submitted to the DEA of the attempts that were made to obtain comments.	Proof of correspondence with stakeholders is included in **Appendix 5B** and **5D**. Proof of attempts made to obtain comments will be included in the **Section 7** of the FEIAr and in **Appendix 5I** of the FEIAr.
The EAP must, in order to give effect to Regulation 8, give registered I&APs access to, and an opportunity to comment on the report in writing within 30 days before submitting the FEIAr to the DEA.	The EAP will give I&APs an opportunity to comment on this DEIAr within 30 days before submitting the FEIAr. See **Section 7** for a description of the PPP followed.
The DEIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	The listed activities that are being applied for as part of this project are detailed in **Section 1**. Impacts and mitigation measures identified by the specialists are included in **Section 9**, and mitigation measures are also detailed in **Section 10**.
The listed activities represented in the EIAr and the application form must be the same and correct.	The listed activities represented in the EIAr and application form will be the same and correct. The listed activities that are being applied for as part of this project are detailed in **Section 1**. A revised application form will be submitted to the DEA with the FEIAr.
The EAP must specify which sub item in terms of GNR 983 Item 56 applies as the DEA cannot authorise both, and the impacts relating to the specific activity must be adequately addressed.	Sub item (i) has been removed from the listed activities which will require authorisation. Impacts and mitigation measures identified by the specialists are included in **Chapter 9**, and mitigation measures are also detailed in **Chapter 10**.
Following a review of the Topographical Analysis and the Path Loss and Risk Assessment Reports compiled by Messa Solutions and Interference Testing and Consulting Services (ITC) respectively, SKA-SA indicated that both reports pointed out that a significant amount of mitigation would be required and that given the calculated path loss between the proposed facility and the nearest SKA station, a requirement on the emissions of the wind facility is specified between 10dB and 20dB below CISPR-22 Class B emission limits. Consequently, SKA-SA indicated that based on current risk and available information, the proposed facility remains a high risk to the SKA and further pointed out	These issues were noted and have been addressed in the detailed Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan) which was undertaken for the proposed development. The Electromagnetic Interference Path Loss and Risk Assessment Report (Including Emission Control Plan) is included in **Appendix 6K**. The SKA were provided with the opportunity to comment on the more detailed Electromagnetic Interference Path Loss and Risk Assessment Report including the ECP

that detailed emission measurements and EMC control plans which provide sufficient evidence and proof of the determined mitigation required, and that it is technically achievable, would warrant a review of the high risk rating. The DEA noted the Path Loss and Risk Assessment (including an Emission Control Plan) report which was compiled by Interference Testing and Consulting Services (ITC). However, comments regarding this report must be sought from SKA-SA and must form part of the FEIAr.	(refer to proof in **Appendix 5I**). On 14 October 2016, comments were received from the SKA, stating that based on the information provided, the proposed Aletta Wind Energy Facility represents a medium risk of detrimental impact, considering the significant amount of shielding required which may be a technical challenge. The control plan, as provided, was developed for the Acciona AW125 TH 100A WTG, and is therefore only relevant and acceptable if BioTherm were to adopt this model of wind turbine. The control plan was developed to achieve up to 40dB of attenuation and should it be verified that this is achieved through implementation of the control plan, and the expected emissions do not exceed those that have been measured and assessed in the plan, then the risk of detrimental impact would be reduced. Comments received from SKA-SA have also been included in the Comments and Response Report which is included in **Appendix 5E**. In addition, proof of all consultation with SKA-SA is included in **Appendix 5D**.
The DEA requested that the terms of reference of the Traffic Impact Assessment must be expanded to include the following: ▪ Evaluate the impacts of the proposed development on existing road network and traffic volumes. The study must determine the specific traffic needs during the different phases of implementation, namely wind turbine construction and installation, operation and decommissioning; ▪ Identify the position and suitability of the preferred access road alternative; ▪ Evaluate the roadway capacity of the road network; ▪ Confirm the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites; ▪ Confirm freight and transport requirements during construction, operation and maintenance;	The terms of reference of the Traffic Impact Assessment was expanded accordingly in order to include the information the DEA requested. The Traffic Impact Assessment Report includes all information requested and is included in **Appendix 6J**.

▪ Propsoed origins and destinations of equipment; and ▪ Determine (Abnormal) Permit requirements if any.	
Due to the number of similar applications in the area, all the specialist assessments must include a cumulative environmental impact statement. Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.	All the specialist assessments include a cumulative environmental impact statement. The identified cumulative impacts were assessed as requested by the DEA. **Section 11** provides a detailed summary of all of the cumulative impacts potentially associated with the proposed project.
The cumulative impacts significance rating must inform the need and desirability of the proposed development.	This was noted and done accordingly. **Section 4** provides details of the project need and desirability and **Section 11** provides a detailed summary of all of the cumulative impacts potentially associated with the proposed project.
Detailed cumulative impact assessments must be provided in the DEIAr for all specialist studies conducted. The specialist studies must provide proof that other specialist reports that were were conducted for renewable energy projects in the area were reviewed and indicate how the recommendations, mitigation measures and conclusions have been taken into considertation when the conclusion and mitigation measures were drafted for this project.	Detailed cumulative impact assessments have been provided in the DEIAr for all the specialist studies conducted. The cumulative impact assessments were conducted to include all the information which was requested by the DEA. **Section 11** provides a detailed summary of all of the cumulative impacts potentially associated with the proposed project.
The DEA has requested that the DEIAr must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa, of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites. The need and desirability must take into account cumulative impacts of the proposed development in the area.	A detailed description of the need and desirability of the proposed activity which addresses the issues raised by the DEA has been provided in the DEIAr. Project need and desirability is included in **Section 4**, and in the discussion of alternatives in **Section 5.2**. The desirability of the development at the proposed location compared to other sites is discussed in **Section 5.2.1.**
Two (2) specialist studies were undertaken by in-house specialists i.e. Surface Water Impact Assessment and Visual Impact Assessment. These studies must be peer-reviewed by external specialists. The format of each peer-review must address the following: ▪ A CV clearly showing expertise of the peer reviewer;	The two (2) specialist studies which were undertaken by in-house specialists, namely the Surface Water Impact Assessment and Visual Impact Assessment, will be peer-reviewed by external specialists. The peer-reviewed versions of these specialist studies will be included in the FEIAr. In addition, the

▪ Acceptability of the terms of reference; ▪ Is the methodology clearly explained and acceptable; ▪ Evaluate the validity of the findings (review data evidence); ▪ Discuss the suitability of the mitigation measures and recommendations; ▪ Identify any short comings and mitigation measures to address the short comings; ▪ Evaluate the appropriateness of the reference literature; ▪ Indicate whether a site-inspection was carried out as part of the peer review; and ▪ Indicate whether the article is well-written and easy to understand.	format of each peer-review will address the comments made by the DEA.
The DEIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions. A sample of the minimum information required is listed under point 2 of the EIA information required for wind energy facilities included in the FSR acceptance letter.	The required technical details are tabulated and included at the beginning of the report.
The DEIAr must provide the four (4) corner's coordinates for the proposed development site (note that if the site has numerous bend points, each bend point's coordinates must be provided) as well as the start middle and end point of all linear activities.	All project co-ordinates have been included. The co-ordinates are included in the executive summary, **section 6** and in **Appendix 9**.
The DEIAr must provide the following: ▪ Clear indication of envisioned area for the proposed wind energy facility; i.e. placing of wind turbines and all associated infrastructure should be mapped at an appropriate scale. ▪ Clear description of all associated infrastructure. This description must include, but is not limited to: o Internal roads infrastructure; and o All supporting onsite infrastructure such as laydown area, guard house and control room etc. o All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.	The layout map is included in **section 5** and in A3 in **Appendix 7**. The description of the associated infrastructure, internal roads and details regarding all possible locations and sizes of the proposed substations are included in **section 5**.

The DEIAr must also include a Comments and Response Report (C&RR) in accordance with Appendix 3 of the EIA Regulations, 2014.	A Comments and Response Report (C&RR) has been compiled for the proposed development in accordance with Appendix 3 of the EIA Regulations, 2014. The C&RR is included in **Appendix 5E**.
The DEIAr must include all the detail inclusive of the PPP in accordance with Regulation 41 of the EIA Regulations.	The public participation processes (PPP) will be done in accordance with Regulation 41 of the EIA Regulations. All information pertaining to the PPP undertaken for the proposed development is included in **Appendix 5**.
Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies need to be provided.	The future plans for the site are detailed in the beginning section of this report before the executive summary.
It is imperative that the relevant authorities are continuously involved throughout the EIA process as the development property possibly falls within geographically designated areas in terms of GN R. 985. In addition, a graphical representation of the proposed development within the respective geographical areas must be provided.	The relevant authorities have been continuously involved throughout the EIA process. These authorities will also remain involved throughout the rest of the EIA process. All correspondence with the relevant authorities, is included in **Appendix 5D** and **5I**. A geographical representation of the proposed development within the respective geographical areas is included in **Appendix 7**.
The DEA has requested Information on the services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided.	Proof of the services agreements will be provided in the FEIAr. BioTherm have been in consultation with the Siyathemba Local Municipality regarding water supply, waste disposal and sewage disposal. They are still awaiting formal feedback from Mr Jakob Basson at the Siyathemba Municipality. While a wind turbine will generate electricity at its rated or nameplate capacity, electrical losses in the electrical cables, used to convey the power to the substation (collector system), losses in the substation equipment and internal consumption must be taken into account when determining the maximum export capacity at the point of connection to the national grid. A typical windfarm will be designed to have losses of less than 2.5% at maximum generation. So for example a windfarm consisting of 56 2.5MW turbines

	have a nameplate capacity of 140MW but only (a maximum of) 136.5MW will be exported to the national grid due to the 2.5% of internal losses. During construction, before the wind farm starts to generate electricity, electricity from the national grid will be used to provide electricity to the buildings and equipment (internal consumption). Once the wind farm start to generate electricity, electricity for internal consumption will be provided by the wind turbines and is part of the 2.5% losses described above. During operations, internal consumption will also be provided by the wind turbines. During periods of no wind, electricity for internal consumption will be drawn from the national grid. BioTherm will obtain agreements from Eskom once the project is selected as a preferred bidder.
The DEA required that the wind resource data be submitted as part of the DEIAr. The wind resource data must be a summary of the wind resource available in the study area and motivation that the site has a good wind resource to sustain the WEF must also be provided. In addition, whilst the information may be deemed to be confidential, your attention is drawn to Regulation 10 of the EIA Regulations, 2014 which stated that *"An applicant must provide the competent authority with all information that reasonably has or may have the potential of influencing and decision with regard to an application."*	The wind resource data for the site are detailed in the beginning section of this report before the executive summary.
The Department of Water and Sanitation (DWS) must be consulted during the course of the process. Proof of consultation must be provided for in the DEIAr.	The DWS were consulted accordingly during the course of the process. Proof of this consultation is included in **Appendix 5D and 5I**.
The DEIAr must provide an indication of the internal access roads and the impacts associated with them must be adequately assessed in the DEIAr and EMPr.	The specialist studies have assessed the impact of the internal access roads and the EMPr includes mitigation measures to reduce the impact of these roads. The internal roads associated with the wind energy facility are

	shown on the final preferred layout map in **Section 12**, as well as in **Appendix 7**. The EMPr is included in **Appendix 8**. It has been recommended by the EAP that the final layout of the proposed development should be submitted to the DEA for approval prior to commencing with the activity. Micrositing of the internal road may be required within the authorised development area during the detailed design phase. This is to enable the avoidance of any additional sensitive areas, unidentified features on site or any design constraints when the project reaches construction.
The DEA has requested a copy of the final site layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following: ▪ Wind Turbine positions and its associated infrastructure; ▪ Permanent laydown area footprint; ▪ Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible); ▪ Wetlands, drainage lines; rivers; streams and water crossing of roads and cables indicating the type of bridging structures that will be used; ▪ The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; ▪ Substation)s) and/or transformer(s) sites including their entire footprint; ▪ Connection routes (including pylon positions) to the distribution/transmission network; ▪ All existing infrastructure on the site, especially roads; ▪ Buffer areas; ▪ Buildings, including accommodation; and ▪ All "no-go" areas.	The project description (**Section 5**) details all of the project components shown on various maps throughout the report. Specific technical details may not be available at this stage as they will be determined by the EPC during the detailed design phase. The preferred site layout in relation to the Sensitive and No-go Areas are included in **Section 12.** All applicable A3 maps are also included in **Appendix 7**. It should be noted that micrositing may be required within the authorised development area during the detailed design phase. This is to enable the avoidance of any additional sensitive areas, unidentified features on site or any design constraints when the project reaches construction.

The DEA has requested an environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	The environmental sensitivity map is included in **Section 12** and in A3 in **Appendix 7**.
The DEA has requested a map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	The environmental sensitivity map including layouts is included in **Section 12** and in A3 in **Appendix 7**.
A shapefile of the preferred development layout/footprint must be submitted to the DEA. The shapefile should be created according to the specifications detailed in the FSR acceptance letter.	The shapefiles will be provided according the specifications in the FSR acceptance letter and submitted to the DEA with the FEIAr.
An EMPr must be submitted to the DEA as part of the DEIAr and must include the requirements specified in the FSR acceptance letter.	An EMPr is included in **Appendix 8** and includes the requirements specified by the DEA in the FSR acceptance letter.
The EAP must provide a detailed motivation if any of the EMPr requirements, as specified in the FSR acceptance letter, is not required by the proposed development and not included in the EMPr.	The comment is noted. The EMPr has been written in terms of the requirements specified in the FSR acceptance letter.
The EAP is required to submit an avifauna and bat pre-construction monitoring report together with the DEIAr. Baseline monitoring must be undertaken for a period of 12 months. The avifauna and bat pre-construction monitoring must be conducted in accordance with the minimum requirements guidelines produced by Bird Life South Africa and the South African Bat Advisory Panel. The baseline monitoring programme for avifauna and bats must cover the entire site as well as the height of the entire facility. i.e. you may be required to install more monitoring masts at height.	An avifauna and bat pre-construction monitoring report has been submitted together with the DEIAr. The avifauna and bat pre-construction monitoring reports are included in **Appendix 6B** and **6C** respectively. The avifauna and bat pre-construction monitoring was conducted in accordance with the minimum requirements guidelines produced by Bird Life South Africa and the South African Bat Advisory Panel and the respective baseline monitoring programmes covered the entire site as well as the height of the entire facility.
The EAP must ensure that all the relevant Listing Notice activities are applied for, that the Listing Notice activities applied for are specific and that they can be linked to the development activity or infrastructure in the project description.	A description and reason of the listed activities applied for are included in **Section 1.3**, the project description is included in **Section 5.1**.
The EAP is reminded that should the EIAr fail to comply with the requirements of the FSR acceptance letter, the project will be refused in accordance with the EIA Regulations, 2014.	The comment is noted. The DEIAr will comply with the requirements of the FSR acceptance letter, as detailed in this table.
The applicant is reminded to comply with the requirements of Regulation 45 with regard to the time period allowed for complying with the requirements of the Regulations, and Regulations 43 and 44 with	All regulated timeframes will be complied with. A description of the public participation process to be followed is included in **Section 7**.

regard to the allowance of a comment period for interested and affected parties on all reports submitted to the DEA.	
The DEA will undertake a site inspection prior to or upon receipt of the DEIAr for comment.	The comment is noted.
The DEA has reiterated that, should the application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then the DEA will not be able to make nor issue a decision in terms of the application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999. Comments from SAHRA and/or the provincial department of heritage must be provided in the DEIAr.	The relevant officials from the SAHRA have been included on the project database, notified of the project progress and sent copies of the Scoping phase Heritage Report and DSR. Comments from SAHRA on the impact phase Heritage Report and the DEIAr will be included in the FEIAr.
The DEA has requested that two (2) electronis copies (CD/DVD) and two (2) hard copies of the DEIAr and FEIAr must be submitted to the DEA.	Two (2) electronic copies (CD/DVD) and two (2) hard copies of the report will be submitted to the DEA.
The DEA attached information to the FSR acceptance letter which must be used in the preparation of the DEIAr. This will enable the Deaprtment to speedly review the DEIAr and make a decision on the application.	The information attached to the FSR acceptance letter will be used in the preparation of the DEIAr.
The EAP is reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, which stipulates that no activity may commence prior to an Environmental Authorisation being granted by the DEA.	The comment is noted, and no activity will commence prior to the Environmental Authorisation being granted by the DEA.

A record of all authority consultation is included within **Appendix 3**.

Consultation with other relevant authorities was and is also being undertaken via meetings and telephonic consultation in order to actively engage them and provide them with information and gain their feedback.

Authorities and key stakeholders consulted include the following:

- National Authorities;
- Provincial Authorities;
- Siyathemba Local Municipality;
- Pixley Ka Seme District Municipality;
- Government Structures such as SAHRA, SANRAL, Telkom, etc.;

- Agriculture Associations such as Agri SA;
- Regional and local media (advertisements and public documents e.g. BID);
- Business and commerce;
- Environmental bodies / NGOs;
- Department of Environmental Affairs (DEA): Biodiversity Section;
- Community representatives, CBOs, development bodies;
- Landowners;
- Sentech;
- Square kilometre Array (SKA);
- Civil Aviation Authority (CAA); and
- Air Traffic Navigation Services (ATNS).

The full list of authorities and key stakeholders that have been consulted is included in **Appendix 5I**.

2.3 Environmental Impact Assessment Report

The EIA 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 NEMA EIA Regulations (GN. R. 982) state that the objective of the environmental impact assessment process is to, through a consultative process:

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the--
    (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    (ii) degree to which these impacts-
        (aa) can be reversed;
        (bb) may cause irreplaceable loss of resources, and
        (cc) can be avoided, managed or mitigated;
(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
(g) identify suitable measures to avoid, manage or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

The content requirements for an Environmental Impact Assessment Report, as well as details of which section of the report fulfils these requirements, are shown in **Table 6** below.

Table 6: Content requirements for an Environmental Impact Assessment Report

Content Requirements	Applicable Section
(a) details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Details of the EAP and full project team are included in **Section 1.2**. The expertise (including curriculum vitae) of the EAP and full project team are include in **Appendix 2**.
(b) the location of the activity, including- (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	The location of the proposed project is detailed in on **page *iii*** of the report, as well as in **section 6.1**.
(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	A map of the regional locality is shown in **Section 6.1**, and the site locality is shown in **Section 5.1**. Additionally, all project maps are included in **Appendix 7**. Coordinates are shown on **page *iii*** of the report, as well as in **Section 6.1**.
(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered; (ii) a description of the activities to be undertaken, including associated structures and infrastructure;	The listed and specified activities triggered as per NEMA are detailed in **Section 1.3.2**. The technical project description is included in **Section 5**. This includes a description of activities to be undertaken, including associated structures and infrastructure.
(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	A description of all key legal and administrative requirements is provided in **Section 1.3**, this includes an explanation of how the proposed development complies with the requirements. Key development strategies and guidelines and their applicability to

	the proposed project are detailed in **Section 1.4**.
(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	The need and desirability of the proposed project is discussed in **Section 4**, including the need and desirability of the activity at the location as proposed.
(g) a motivation for the preferred development footprint within the approved site;	The site specific suitability is discussed in **Section 4.4**.
(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and	A description of the alternatives considered in terms of the Regulations is included in **Section 5.2** and a full description and comparative assessment of the alternatives considered is included in **Section 12**. The public participation process followed is detailed in **Section 7**. Additionally, all public participation documents are included in **Appendix 5**. This includes a summary of issues raised by I&APs, and the responses to their comments. A full description of the environmental attributes within the application site is included in **Section 6** and **8**. The impacts and risks associated with each alternative are assessed in **Section 9.2**. The methodology used in identifying the impacts and risks associated with each alternative is included in **Section 9.1**. The positive and negative impacts that the proposed activity will have on the environment are discussed in **9.2**. Potential mitigation measures are included in **section 10**. The inclusion of alternatives is discussed in **section 5.2** and in **section 12**. A concluding statement indicating the preferred alternatives is contained in **section 12**.

(x) a concluding statement indicating the preferred alternative development location within the approved site;	
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	The process undertaken to assess the impacts as well as the assessment of impacts by each specialist are shown in **Section 9**. Each environmental issue and risk is tabulated in **section 9.2** and an assessment of the significance of each issue before and after mitigation measures is included.
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be avoided, managed or mitigated;	The impact rating system contained in **Section 9.1.2** details the methodology for determining the significance of an impact. This includes the points (j) (i to vii) of **Appendix 3**. The assessment of each risk identified by the specialists is contained in **Section 9.2**.
(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	All relevant specialist findings are included in **Section 8**, with all recommended mitigation measures detailed in **Section 10**. The mitigation measures have been incorporated into the EMPr which is contained in **Appendix 8**. The tabulated summary of key specialist findings and recommendations is included in **Section 15.1** and in the executive summary.
(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the	**Section 15** contains a tabulated summary of the key findings in each specialist assessment andthe positive and negative impacts associated with the activity, which were identified by each specialist, are also summarised in table form in

preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	the section. **Section 12** also contains a map showing the final preferred layout superimposed with sensitive and no-go areas and buffers where required.
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	The recommended mitigation measures associated with each impact are included in section 9, and overall specialist recommendations and mitigation measures are included in **Section 10**. These measures are contained in the EMPr which can be found in **Appendix 8**.
(n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	The final proposed alternatives are included in **Section 12**, including a comparative assessment by the specialists.
(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Any aspects identified by specialists or the EAP that should be included as conditions of the authorisation are identified in **Section 15** and in the executive summary.
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	All assumptions and limitations are highlighted in **Section 3**.
(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	A reasoned opinion as to whether or not the proposed activity should be authorised, including conditions if required, is included in **Section 15** and in the executive summary.
(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	The period required for the environmental authorisation, as well as the date on which the activity and post construction monitoring will be concluded is discussed in **Section 15** and the executive summary.
(s) an undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	The EAP affirmation is included in **Appendix 4**.

(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	If applicable, details of any financial provisions for the management of negative environmental impacts are included in **Section 10**, **Section 15** and the executive summary.
(u) an indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	If required, the details of, and motivation for, any deviation from the FSR plan of study will be detailed in **Section 2.1**. At this stage, no deviation from the approved scoping report and plan of study is anticipated.
(v) any specific information that may be required by the competent authority; and	As part of the letter of acceptance for the FSR the DEA detailed specific information requirements. These requirements are tabulated in **Section 2.2**, along with an explanation of how the requirements are met. All correspondence from the DEA is included in **Appendix 3**.
(w) any other matter required in terms of section 24(4)(a) and (b) of the Act.	All requirements in terms of section 24(4)(a) and (b) of the Act have been met in this report.

3 ASSUMPTIONS AND LIMITATIONS

- It is assumed that 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 (I&APs) individually, however, every effort has / is been 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.
- It is assumed that the information provided by the various specialists is unbiased and accurate.
- The following assumptions, uncertainties and gaps in knowledge were encountered by the various specialists:

- Biodiversity:
    - Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.
    - This study excludes invertebrates, avifauna and bats, all of which are addressed in separate specialist studies.

- Avifauna:
    - A total of 37 full protocol lists have been completed to date for the 9 pentads where the study area is located (i.e. lists surveys lasting a minimum of two hours each). This is a fairly comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, geberal knowledge of the area, SABAP1 records (Harrison *et al*. 1997) and the results of the 12-months pre-construction monitoring.
    - Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
    - To date, few comprehensive studies (other than a number of environmental impact reports), and no peer-reviewed scientific papers, are available on the impacts wind farms have on birds in South Africa. The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle[2]. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of

serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

- Even in the international arena predicted mortality rates are often significantly off the mark, indicating that this is still a fledging science in many respects, even in developed countries like Spain with an established wind industry (Ferrer *et al*. 2012).
- Priority species were taken from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al*. 2012).
- The study area was defined as the area which comprises the application site and immediate environs (see Figures 3 -5 of the Avifauna report).
- No comprehensive assessment was undertaken of the various power line connection alternatives. This will form part of a separate Environmental Impact Assessment (EIA).
- The information on proposed WEFs in the study area was received from SiVEST and from the official DEA website. The assessment was made on this basis, but it cannot be guaranteed that these are the only proposed WEF developments.

- Bats:
  - Distribution maps of South African bat species still require further refinement such that the bat species proposed to occur on the site (that were not detected) are assumed accurate. If a species has a distribution marginal to the site, it was assumed to occur in the area. The literature based table of species probability of occurrence may include a higher number of bat species than actually present.
  - The migratory paths of bats are largely unknown, thus limiting the ability to determine if the wind farm will have a large scale effect on migratory species. This limitation however will be overcome with this long-term sensitivity assessment.
  - The satellite imagery partly used to develop the sensitivity map may be slightly imprecise due to land changes occurring since the imagery was taken.
  - Species identification with the use of bat detection and echolocation is less accurate when compared to morphological identification, nevertheless it is a very certain and accurate indication of bat activity and their presence with no harmful effects on bats being surveyed.
  - It is not possible to determine actual individual bat numbers from acoustic bat activity data, whether gathered with transects or the passive monitoring systems. However, bat passes per night are internationally used and recognized as a comparative unit for indicating levels of bat activity in an area.
  - Spatial distribution of bats over the study area cannot be accurately determined by means of transects, although the passive systems can provide comparative data for different areas of the site. Transects may still possibly uncover high activity in areas where it is not necessarily expected and thereby increase insight into the site.
  - Exact foraging distances from bat roosts or exact commuting pathways cannot be determined by the current methodology. Radio telemetry tracking of tagged bats is required to provide such information if needed.
  - Costly radar technology is required to provide more quantitative data on actual bat numbers as well as spatial distribution of multiple bats.

- Surface Water:

- This short term once-off surface water assessment has only focused on the identification and delineation of surface water resources within the proposed development area. Identification and delineation of surface water resources in the wider area outside of the proposed development area have not been undertaken.
- Given the short term once-off nature of the assessment, the assessment should not be undertaken to be a fully comprehensive study on vegetation species occurrence within the surface water resources.
- Surface water resources were initially identified and delineated at a desktop level. These were then groundtruthed and verified in the field work phase. The initial delineations undertaken at a desktop level were refined following findings made in the field work phase.
- A Global Positioning System (GPS) device was used to groundtruth surface water resources as well as for delineation purposes. The GPS is expected to be accurate from 5m up to 15m depending on meteorological conditions.
- Aquatic studies of fish, invertebrates, amphibians etc. have not been included in this report. Nor have water quality, hydrological or groundwater studies been included.
- Wetland or river health, present ecological status (PES), ecosystem services and the ecological importance (EI)/ecological sensitivity (ES) categories have not been assessed for identified surface water resources. Only desktop information in terms of PES/EI/ES (where available) from the databases were provided as per the scoping assessment information.
- Application of the DWAF (2005) delineation guidelines are limited for the delineation of drainage lines and pan wetlands in arid and semi-arid regions due to the intermittent nature of flow which is poorly accommodated in the methodology and application thereof.
- As a separate independent avifaunal impact assessment has been undertaken for the proposed development, the assessment of potential impacts as related to avi-fauna have not been included in this assessment. It is therefore assumed that all avi-faunal impacts (including that related to waterfowl associated with wetlands and other surface water resources) will have been adequately covered in the avi-faunal impact assessment.

- Agricultural Potential and Soils:
  - No specific assumptions and limitations were identified by the agricultural potential and soils specialist.

- Noise:
  - It is proposed to install wind energy turbines with a hub height of up to 120m and rotor diameter up to 150 m. Noise emission data for 150 m rotor diameter were not made available. The present study was based on noise data made available for turbines with 125 m rotor diameter. This might result in under predicting the noise levels as generally noise emission levels are a function of rotor blade tip speeds that increase with increased rotor diameter.

- Visual:
  - Wind turbines are very large structures by nature and could impact on receptors that are located relatively far away, particularly in areas with very flat terrain. For the purpose of

this visual assessment, the study area is assumed to encompass a zone of 8km from the proposed application site. This area was assigned, as the height of the development in combination with distance are critical factors when assessing visual impacts. Beyond 8km, the wind energy facility may still be visible; however the degree of visual impact would diminish considerably and thus the need to assess the impact on potential receptors beyond this distance would not be warranted. This is demonstrated in Figure 5 of the Visual Impact Assessment Report, which provides a visual simulation of how a wind energy facility could potentially appear from a distance of approximately 8km away. As indicated, from this distance haze may impede views toward the structures, making them appear to blend with the horizon and reducing the visual contrast between the turbines and landscape.

- The identification of visual receptors has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Thereafter a site visit was undertaken from the 27th to the 29th of July 2016 in order to verify the sensitive visual receptors within the study area and assess the visual impact of the development from these receptor locations. Due to the extensive area covered by the study area, a number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic locations within natural settings.
- During the site visit, some of the local landowners confirmed that a few of the farmsteads / residential dwellings identified during the scoping phase of this study have been abandoned and no one is currently residing within them. No further assessment was therefore undertaken from these abandoned farmsteads / residential dwellings and they were eliminated from the list of potentially sensitive receptor locations for the purpose of the EIA phase study.
- Due to access limitations during the site visit, the impact rating assessment of the proposed development on some of the potentially sensitive visual receptor locations was undertaken via desktop means. Although the use of these farmsteads / residential dwellings could not be established during the field investigation, they were still regarded as being potentially sensitive to the visual impacts associated with the proposed wind energy facility and were assessed as part of the VIA.
- No viewsheds were generated during this visual study, as the topography within the study area is relatively flat. Within this context, minor topographical features, vegetative screening, or man-made structures would be important factors which would influence the degree of visibility and which would not be factored in by the viewsheds.
- Due to the varying scales and sources of information as well as the fact that only 20m contours were available to establish the Digital Terrain Model (DTM); maps and visual models may have minor inaccuracies. As such, only large scale topographical variations have been taken into account and minor topographical features or small undulations in the landscape may not be depicted on the DTM.

- A matrix has been developed to assist in the assessment of the potential visual impact at each receptor location. The limitations of quantitatively assessing a largely subjective or qualitative type of impact should be noted. The matrix is relatively simplistic in considering five main parameters relating to visual impact, but provides a reasonably accurate indicative assessment of the degree of visual impact likely to be exerted on each receptor location by the proposed wind energy facility. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. The results of the matrix should be viewed in conjunction with the visualisation modelling to gain a full understanding of the likely visual impacts associated with the proposed development.
- The assessment of receptor-based impacts has been based on the turbine layout provided by the proponent. It is however recognised that this layout is a preliminary one, and is subject to changes based on a number of potential factors, including the findings of the EIA studies. The turbine locations may thus move, which may result in greater or lesser visual impacts on receptor locations.
- A cumulative impact assessment has been undertaken to provide a representation of the number of proposed renewable energy facilities likely to be visible from each potentially sensitive receptor location, if they were all constructed. Factors affecting visibility, such as localised screening from trees or topographical undulations have not been factored into the cumulative impact assessment.
- Visualisation modelling from all potential receptor locations has not been undertaken. An indicative range of locations were selected for modelling purposes to provide an indication of the possible impacts from different locations within the study area. It should be noted that this modelling is specific to the location, and that even sites in close proximity to one another may be affected in different ways by the proposed wind energy facility. The visual models represent a visual environment that assumes all vegetative clearing will be restored to its current state after the construction phase. This is however, an improbable scenario as some trees and shrubs may be removed which may reduce the accuracy of the models generated. At the time of this study the proposed project was still in its early planning stages. Therefore, the turbine layouts, as provided by BioTherm, may change and the infrastructure associated with the facility has not been included in the models.
- No feedback related to the visual environment has been received during the scoping and EIA phase public participation processes. Should any feedback be received, this report will be updated accordingly.
- Operational and security lighting will be required for the proposed wind energy facility and the associated infrastructure proposed within the development footprint. At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed at a detailed level. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.
- At the time of undertaking the visual study no specific information was available regarding the design and layout services and infrastructure associated with the proposed development. The potential visual impact of the typical infrastructure associated with a wind energy facility has been assessed.

- It should be noted that the 'experiencing' of visual impacts in subjective and largely based on the perception of the viewer or receptor. A number of broad assumptions were made in terms of the sensitivity of the receptors to the proposed development. This is usually dependent on the use of the facility and the economic dependency on the natural / untransformed quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and residential dwellings within natural / rural settings. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact will be experienced.
- Most rainfall within the area occurs from November to March, during the summer months. The fieldwork was however undertaken at the end of July 2016, during winter. During winter months, the visual impact of the proposed development may be greater, particularly from farmhouses surrounded by tall deciduous trees. As such, the surrounding vegetation is expected to provide the minimal potential screening.
- The weather conditions in the study area also have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. The fieldwork was undertaken during cloudy overcast weather conditions. These conditions would make the wind turbines appear to contrast less with the surrounding environment than they would contrast on a typical sunny day. As such, where conditions are overcast and the wind turbines are against the cloudy (white) sky, there will be less of a visual contrast than on a clear day. As such, the weather conditions during the time of the study were taken into consideration when undertaking the impact rating for each identified sensitive and potentially sensitive receptor locations (**section 4.1**).
- No layout information could be sourced for each proposed renewable energy facility planned in close proximity to the proposed 140MW Aletta Wind Energy Facility. The distance of the potentially sensitive receptor locations from the actual layout could therefore not be utilised to determine whether the receptor is likely to be visually exposed to the development. As such, the distance from the farm on which each development is proposed was used to calculate the cumulative visual impact.

- Heritage:
  - Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the development area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.
  - The impact assessment conducted for heritage sites assumes the possibility of finding heritage resources during the project life.

- Palaeontology:
  - The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used

were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.
    - These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:
        - An underestimation of the palaeontological significance of a given study area due to ignorance of significance recorded or unrecorded fossils preserved there, or
        - An overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

- Socio-Economic:
    - The secondary data sources used to compile the socio-economic baseline (demographics, dynamics of the economy) although not exhaustive, can be viewed as being indicative of broad trends within the study area.
    - The study was done with the information available to the specialist within the time frames as well as the budget specified.
    - Possible impacts and stakeholder responses to these impacts cannot be predicted with complete accuracy, even when circumstances are similar and these predictions are based on research and years of experience, taking the specific set of circumstance into account.
    - It is assumed that the motivation, and ensuing planning and feasibility studies for the project, were done with integrity and that all information provided to the specialist by the project proponent and its consultants to date is accurate.
    - It is assumed that the project description and infrastructure components as discussed above are reasonably accurate. These details were used to assess the potential impacts.
    - With regard to the in-person interviews undertaken the following assumptions are made:
        - Questions asked during the interviews were answered accurately.
        - The degree of the perceived possible significance of concerns raised by some of the respondents were rated by them truthfully.
        - That the attitudes of the respondents towards the project will remain reasonably stable over the short- to medium- terms.

- Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan):
    - No specific assumptions and limitations were identified by the electromagnetic interference specialist.

- Traffic:
    - It is assumed that labour will commute from Prieska as it is the nearest town to provide amenities.

- The operation and maintenance personnel will in all probability be stationed in the town of Prieska.
- It is assumed that the portion of average daily traffic that occur during the design hour (30th highest volume) is no more than 10% (K=10).
- It is assumed that the decommissioning trip generation would be equal to that of the construction and installation with full loads running in the reverse direction. The road network would need to be assessed at that stage.
- With regards to route clearance, it was reasoned that if the wind blade vehicle can turn at each intersection, every other vehicle will be able to, since it is the largest component to be transported to site.
- Traffic delays are estimates only and is considered to be acceptable.

4 PROJECT NEED AND DESIRABILITY

4.1 National Renewable Energy Requirement

In 2010 South Africa (SA) had 44,157MW of power generation capacity installed. Current forecasts indicate that by 2025, the expected growth in demand will require the current installed power generation capacity to be almost doubled to approximately 74,000MW (SAWEA: 2010).

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. Despite the worldwide concern regarding GHG emissions and climate change, South Africa continues to rely heavily on coal as its primary source of energy, while most of the countries renewable energy resources remain largely untapped (DME, 2003). There is therefore an increasing need to establish a new source of generating power in SA within the next decade.

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. 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.

The REIPPP programme and the competitiveness nature of the bidding process has resulted in significant lowering of solar and wind tariff prices since 2011. Solar PV, for example, was bid with tariffs of R2.80/kWh at the inception of the REIPPPP in 2011, to 60c/kWh at present. Further projects will increase the competitive nature of the REIPPP program and further result in cost savings to South African consumers.

The REIPPP has been premised on the following principles:

- Ensuring energy security using cost competitive solutions to create diversity in our energy mix
- Stimulating the economy by creating decent and sustainable jobs
- Catalysing local manufacturing and ensuring, that over the medium term, South Africa becomes the gateway to Africa for renewable energy component manufacturing
- Creating an opportunity to develop a market for Independent Power Producers to contribute to an energy balance that is economically, socially and environmentally sound

BioTherm aim to have a tariff that is very competitive within the current economic environment having taken into consideration the current exchange rates and interest rate.

BioTherm Energy is a leading South African renewable energy project developer, and was the only South African developer to be operating three projects from the first round of the REIPPP, where it continues to meet its economic development obligations.

Socio-economic development and enterprise development provides undeniable value for money to Government as it helps to alleviate some of the pressure on State coffers in terms of what it can achieve at both a local and national level. The BioTherm has committed to initiating its economic development activities upon the Project being selected as a Preferred Bidder.

4.2 National Renewable Energy Commitment

In support of the need to find solutions for the current electricity shortages, the increasing demand for energy, as well as the need to find more sustainable and environmentally friendly energy resources, South Africa has embarked on an infrastructure growth programme supported by various government initiatives. These include the National Development Plan (NDP), the Presidential Infrastructure Coordinating Commission (PICC), the Department of Energy's Integrated Resource Plan, the National Strategy for Sustainable Development, the National Climate Change Response White Paper, the Presidency of the Republic of South Africa's Medium-Term Framework, and the National Treasury's Carbon Tax Policy Paper.

The Government's commitment to growing the renewable energy industry in South Africa is also supported by the *White Paper on Renewable Energy* (2003) which sets out the Government's principals, goals and objectives for promoting and implementing renewable energy in South Africa. In order to achieve the long term goal of achieving a sustainable renewable energy industry, the Department of Energy has set a target of contributing 17,8*GW* of renewable energy to the final energy consumption by 2030. This target is to be produced mainly through, wind and solar; but also through biomass and small scale hydro (DME, 2003; IRP, 2010).

4.3 Wind Power Potential in South Africa and Internationally

Onshore wind energy technology is the most commonly used and commercially developed renewable energy technology in South Africa, wind is abundant and inexhaustible (DEA Guideline for Renewable Energy, 2015). Wind energy is one of the lowest-priced renewable energy sources and is economically competitive (www.wasaproject.info).

4.4 Site Specific Suitability

The selection of a potential wind project development area includes several key aspects including environmental constraints and opportunities, wind resource, grid connection suitability, competition, topography and access as shown in the process flow diagram. If one of these vital aspects cannot be met then the entire wind farm development cannot proceed into the development phase.

Figure 3: Process flow diagram showing the selection criteria used in the selection of a potential wind project development area.

Environment

Environmental is a key aspect that BioTherm considers when evaluating a wind project. The project should be developed in a sustainable and ecologically friendly manner ensuring its development has the least possible impact on the land on which it will be built. The regional farms were evaluated by BioTherm before the selection of these specific farms and it was concluded that development on these farms would result in the least impact of regional fauna and flora.

The site is not located within a Protected Area, Important Birds Area or Nature Reserve. No perennial rivers or wetlands are located within the project site.

Certain farms in the region, which are located in the lower areas have increased biodiversity which are deemed sensitive and other farms show increased biodiversity.

Wind Energy Resource

Wind resource is one of the main drivers of project viability across South Africa. This specific project site has been identified by BioTherm through a pre-feasibility desktop analysis based on the estimation of the wind energy resource. This region of the Northern Cape Province in South Africa has one of the highest wind resource potentials. The project site receives an annual mean wind resource of approximately 7 - 8m/s, this makes this region ideally suited for the development of a wind farm. This high resource ensures the best value for money is gained for the economy of South Africa. The general area would experience a similar resource, but as resource is only one driver of site selection, the other aspects should be considered when holistically evaluating a project.

Grid Connection Suitability

Grid connection suitability is the next element which drives the project location. Long connection lines have increased environmental impacts as well as add increased costs to the project development. The Aletta project site has good grid connection potential as the project has four possible points of connection within close proximity, thereby minimising the need for an extensive grid network upgrade or long power line. The Wind farm can connect to either the Kronos Substation, Cuprum Substation, the proposed Copperton Wind or Garob IPP Substations or Loop in Loop out onto the numerous powerlines boarding the site.

Topography and Access

The project site is flat with an average slope of 0.3%, of which is suitable for the development of a wind project. The flatter land scape makes construction easier and hence reduced the EPC costs making the project even more viable.

The project development area can be accessed easily via the tarred R357 national road which runs along the northern boundary of the site. There is an existing gravel road which can be upgraded prior to construction and operations to allow for direct access to the project development area.

Land Availability

The final key criteria which refines the site selection on a micro level include competition, topography and access. The project site has a flat arid topography which is suitable for the development of a wind project. With the high wind resources in the area and good grid connection this area has been targeted for development from Developer for several years. This has resulted in large tracks of land being signed up and hence being unviable for development. This results in limited land available for development. BioTherm, however, though speaking with local land owners identified parcels of land suitable for development.

The region does have several ongoing EIA developments, however, only two 140MW wind projects have been selected preferred bidders in the region. Such developments, could cumulatively have positive or negative impacts which needs to be taken into consideration when determining the desirability of the project at the current location The identified cumulative impacts were assessed as detailed in **Section 11** and it was established that the cumulative impacts can be suitably addressed. The project site can be accessed easily via the tarred R357 regional road. Upgrade of the district gravel road will be done by the current preferred bidder projects to allow for direct access to site.

The proposed wind energy facility is situated on the Portions 1, 2, 3, and the Remainder of the Farm Drielings Pan No.101. The farm is used for commercial sheep farming. The proposed project is not envisioned to impact farming activities after the construction phase had been completed. The site is therefore considered to be suitable from a land use perspective.

4.5 Local Need

The Northern Cape Province faces numerous socio-economic and developmental challenges, which are not unique to the Province and are observed throughout the country. Reducing poverty through social development and achieving a sustainable economic growth in the Province through diversification and transformation of its economy are at the forefront of the provincial government's developmental objectives (Northern Cape Government, 2008; Office of the Premier of the Northern Cape, 2012).

The Northern Cape Province is endowed with biological diversity, mineral resources, and renewable energy sources such as solar and wind. Therefore, the achievement of its developmental objectives is envisaged to be done by capitalising on the local resources and specifically, the development of the agriculture and agro-processing, mineral extraction and mineral beneficiation, fishing and aquaculture, manufacturing, and tourism industries (Northern Cape Government, 2008; Office of the Premier of the Northern Cape, 2012).

Ensuring availability of inexpensive energy is seen to be fundamental to growing competitive industries in the Province (Northern Cape Government, 2008). However, provincial government advocates the development of the energy sector in the Province through "the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments" (Northern Cape Government, 2008). This implies the use of renewable energy sources and natural gas fields that the Province enjoys (Northern Cape Government, 2008). Provincial strategic documents specifically promote the development of large-scale renewable energy projects, similar to the one under analysis, which among others, would contribute to renewable energy targets set by national government and allow to secure supply, tackle climate change and address the needs of the Province (Office of the Premier of the Northern Cape, 2012).

Harnessing renewables is also seen to contribute towards alleviation and reduction of poverty in the Province. One of the interventions that underpins the provincial approach to poverty eradication is "utilisation of natural resources in a sustainable manner", which in turn implies the transition to greater exploitation of renewables, including wind (Northern Cape Government, 2008).

Considering the above, it can be concluded that the development of the proposed project follows the provincial priorities and developmental objectives. From a spatial perspective, the project also does not appear to raise any red flags. The area where the project is proposed to be located is designated for agricultural land use. The review of the vision for the development of the agricultural sector in the Province further suggests that the area is suitable for forestry or grazing, where development of non-agricultural activities is not prohibited but should follow sustainable development principles.

Similar to the Province, the district and local municipalities where the proposed project is to be established, also face challenges of poverty, unemployment, and income inequality. Therefore, the municipalities' developmental priorities largely coincide:

- In order to optimise the resources directed at addressing these challenges, the Pixley ka Seme District set eight development priorities for the municipality (Pixley ka Seme District Municipality, 2014). These priorities are envisaged to be achieved through, among others, good service delivery, human and natural resource development, integrated rural and urban planning, employment creation and the development of a vibrant tourism industry (Pixley ka Seme DM, 2014, Pixley Ka Seme DM, 2013).
- The Siyathemba LM also prioritises an optimal distribution of resources, economic development through job creation and poverty reduction strategies, and effective and efficient service delivery to propel the development in the municipality (Siyathemba LM, 2014). Economic development is envisaged to be achieved through the support and growth of the priority sectors such as the agricultural, mining, manufacturing, tourism and retail sectors. Alternative energy sources have also been identified to be an anchor economic activity in the municipality that could propel local economic development through its linkages with other sectors.

It is clear that the proposed project is in line with the overall objectives of sustainable resource usage and economic development in the area.

When it comes to renewable energy development, both the Pixley ka Seme and Siyathemba municipalities' strategic documents largely focus on solar energy projects. The Siyathemba LM, and specifically the area outside Prieska, has already been designated for the establishment of a solar park (1 GW) and the municipality has already allocated communal land for this project (Siyathemba LM, 2014). The focus on solar energy projects is most probably attributed to the limited knowledge of the wind resource potential in the Northern Cape at the time of the formulation of the Provincial SDF, which informed local strategic documents and specifically the location of the renewable energy corridor area and its focus on solar energy projects.

Notably, limited reference to wind energy projects in the strategic documents of the local government do not in any way reduce the importance of wind energy project developments in the municipalities of Pixley ka Seme and Siyathemba. As mentioned earlier, such projects are seen in support of the government's objective to exploit renewable energy sources for the purpose of developing the local economies and assist the district municipality in entrenching its position as a renewable energy hub. This is also confirmed by the fact that a number of wind energy facilities have already been approved for the development in the area under the RE IPPPP.

From a spatial framework perspective, the local municipality does not have an approved SDF. Therefore, assessing whether the proposed project is in contradiction with the spatial vision for the area where it is proposed to be developed is not possible. It should be mentioned though, that agriculture and tourism are considered by local government to be important contributors to the future growth and development of the local economy as well as towards achieving sustainable use of resources. This means that a land use analysis will need to be undertaken to determine whether the proposed project would limit the growth potential for the above-mentioned two sectors.

After considering the reviewed documentation, the proposed wind facility is in alignment with national, provincial and local objectives, plans and strategies relating to socio-economic development of the areas under analysis. There were no fatal flaws or contraventions identified as all spheres of government prioritise the development of renewable energy projects. The proposed project fits well with the plans to diversify the provincial, district and local economies through investment in renewable energy projects.

The developer recognises that the establishment of the Aletta Wind Energy Facility will have immense benefits within the town of Copperton, Northern Cape and the country as a whole. It will not only be addressing the need for clean energy but will also address the socio-economic needs of the communities surrounding the project site.

Copperton resembles the main characteristics of the Northern Cape Province, with a large land surface area and very small population. The town was previously known for its copper and zinc mineral reserves hence mining was the main economic activity and main source of employment in the region. The region has recently become a hot spot for renewable energy projects and economic and employment trends have followed suit. With the abandonment of the mines, the region has been exposed to high out-migration due to a lack of employment opportunities. The unemployment rate is approximately 25% in the Siyathemba Local Municipality, in which Copperton resides, based on 2011 Stats SA census. The Northern Cape's unemployment statistics are even higher, recorded at 27.8% in the first quarter of 2016 based on Stats SA.

The proposed project has the potential of addressing some of the socio-economic challenges faced by this abandoned mine region as well as those faced by the country as whole.

The construction and operation of the project will create employment opportunities for local community members as well as surrounding communities. The project will also enable the growth of the economy through increased industrialisation, rural development and local content which are positive spin offs of the establishment of such a project. Further to this, the project will contribute to the growing renewable energy industry which, through operational projects, is continually investing in programmes focused on community and small business development with benefits flowing directly to local community members and South African people.

As part of the REIPPPP, if the Facility is selected as a Preferred Bidder within the bidding process, not only will it commit to job creation within the local communities, it will also be required to spend funds during the operations phase on the local communities, on programmes of a socio-economic nature and those that develop enterprises.

5 TECHNICAL PROJECT DESCRIPTION

5.1 Project Description

The proposed project will encompass the installation of a wind turbines and associated infrastructure, in order to generate electricity that is to be fed into the National Grid. The facility will have a maximum export capacity of 140MW. The total area of the application site is approximately 11 003 hectares (ha). Within this application site the Aletta Wind Energy Facility development area has a total area of approximately 5639 ha. The total combined footprint of the Operations and Maintenance (O&M) buildings will not exceed 300m^2 and the 132kV onsite Aletta IPP Substation will occupy a footprint area of approximately 2.25 ha. The final design details are yet to be confirmed. These details will become available during the detailed design phase of the project.

5.1.1 Wind Farm Components

BioTherm is proposing the establishment of a wind energy facility (namely the Aletta Wind Energy Facility) on the development site near Copperton (**Figure 4**). As mentioned, the objective of the proposed development is to generate electricity to feed into the national grid. The proposed wind energy facility will have a maximum export capacity of 140MW.

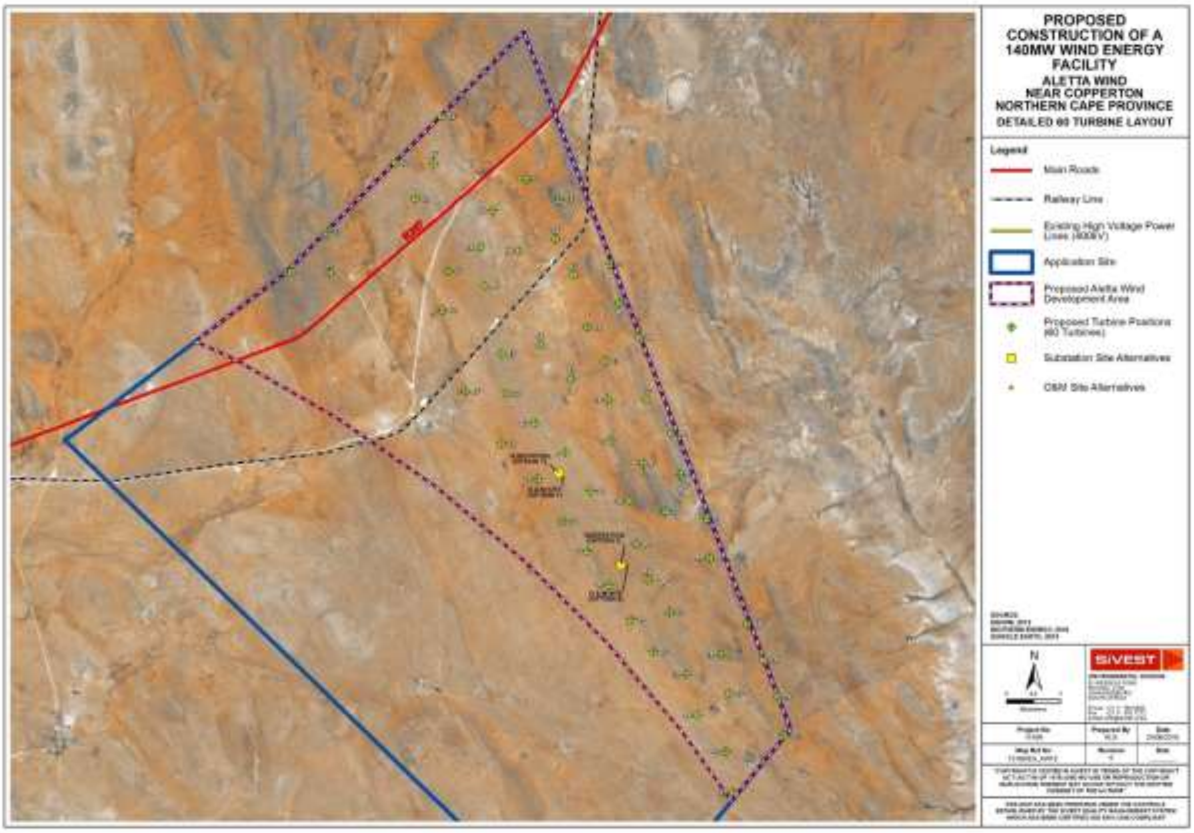


Figure 4: Proposed Aletta Wind Energy Facility Layout

The key technical details and infrastructure required is presented in the table below (**Table 7**).

Table 7: Aletta Wind Energy Facility technical summary

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for the proposed project
Alettta Wind Energy Facility (WEF)	14/12/16/3/3/2/945	▪ Portion 1 of Drielings Pan No.101 ▪ Portion 2 of Drielings Pan No.101 ▪ Portion 3 of Drielings Pan No.101 ▪ Remainder of Drielings Pan No.101 Development Area: 5 639 ha	▪ **60 wind turbines** with a total export capacity of up to 140MW. Turbines will have a hub height of up to 120m and a rotor diameter of up to 150m. ▪ **132kV onsite Aletta IPP Substation** ▪ The turbines will be connected via **medium voltage cables** to the proposed 132kV onsite Aletta IPP Substation. ▪ Internal **access roads** are proposed to be between 4m to 6m wide. ▪ A temporary construction **lay down area**. ▪ A **hard standing area / platform** per turbine. ▪ The **operations and maintenance buildings**, including an on-site spares storage building, a workshop and an operations building. ▪ **Fencing** (if required) will be up to 5m where required and will be either mesh or palisade. ▪ Permanent **wind measurement mast**.

As previously mentioned, BioTherm are also proposing to develop the associated Aletta substation and power line, both with a capacity of up to 132kV. This associated electrical infrastructure will require a separate Environmental Authorisation and is being conducted as a part of a separate Basic Assessment (BA) process. The Aletta power line has been included in the wind energy facility EIA for background information but will be authorised under a separate BA to allow for handover to Eskom. The Aletta onsite substation will include an Eskom portion and an Independent Power Producer (IPP) portion, hence the substation has been included in the wind energy facility EIA and in the substation and power line BA to allow for handover to Eskom. Although the wind energy facility and the electrical infrastructure will be assessed separately, a single public participation process is being undertaken to consider both of the proposed developments. The potential environmental impacts associated with both developments will be assessed as part of the cumulative impact assessment. The DEA reference number allocated for the Aletta substation and power line has not yet been allocated by the DEA. This will be provided in the Final Environmental Impact Assessment Report (FEIAr).

5.1.2 Turbines

The total proposed development area is approximately 5 639 hectares. The wind turbines and all other project infrastructure will be located strategically within the development area based on environmental constraints. The size of the wind turbines will depend on the development area and the total generation capacity that can be produced as a result. The wind turbines will therefore likely have a hub height of up to 120m and a rotor diameter of up to 150m (**Figure 5**). The blade rotation direction will be clock-wise. Each wind turbine will have a foundation diameter of up to 20m, and will be approximately 3m deep, however, these dimensions may be larger if geotechnical conditions dictate as such. The area occupied by each wind turbine will be up to 0.5 hectares (85m x 60m). The excavation area will be approximately 1 000m² in sandy soils due to access requirements and safe slope stability requirements. A hard standing area / platform of approximately 2 400m² (60m x 40m) per turbine will be required for turbine crane usage. There will be approximately 60 wind turbines constructed with a total generation capacity of up to 140MW. The electrical generation capacity for each turbine will range from 2 to 4MW depending on the final wind turbine selected for the proposed development. It must be noted that the final selection for the turbine type will be conducted after the project has been selected as a Preferred Bidder project under the Department of Energy's (DoEs) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). This is as a result of technology constantly changing as time progresses.

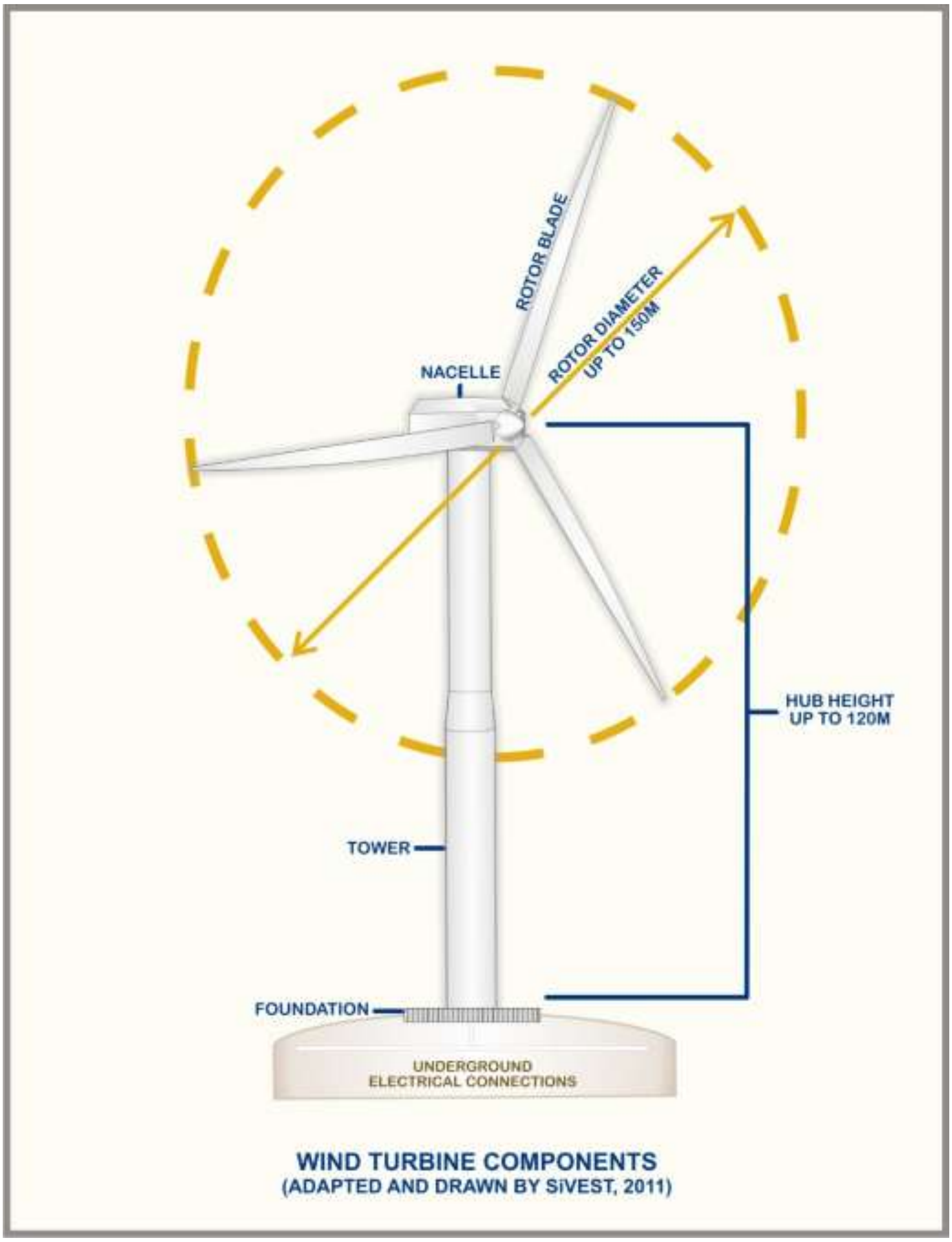


Figure 5: Typical Connections of a Wind Turbine

5.1.3 Electrical Connections

The wind turbines will be connected (Figure 6) to the proposed onsite Aletta 132kV substation using buried (up to a 1.5m depth) medium voltage cables except where a technical assessment of the proposed design suggests that overhead lines are more appropriate such as over rivers, gullies and long runs. Where overhead power lines are to be constructed, self-supported or H-pole tower types will be used. The height will vary depending on the terrain, but will ensure minimum Overhead Line (OHL) clearances with buildings, roads and surrounding infrastructure will be maintained. The dimensions of the specific OHL structure types will depend on electricity safety requirements. The exact location of the towers, the selection of the final OHL structure types and the final designs will comply with the best practise and SANS requirements.

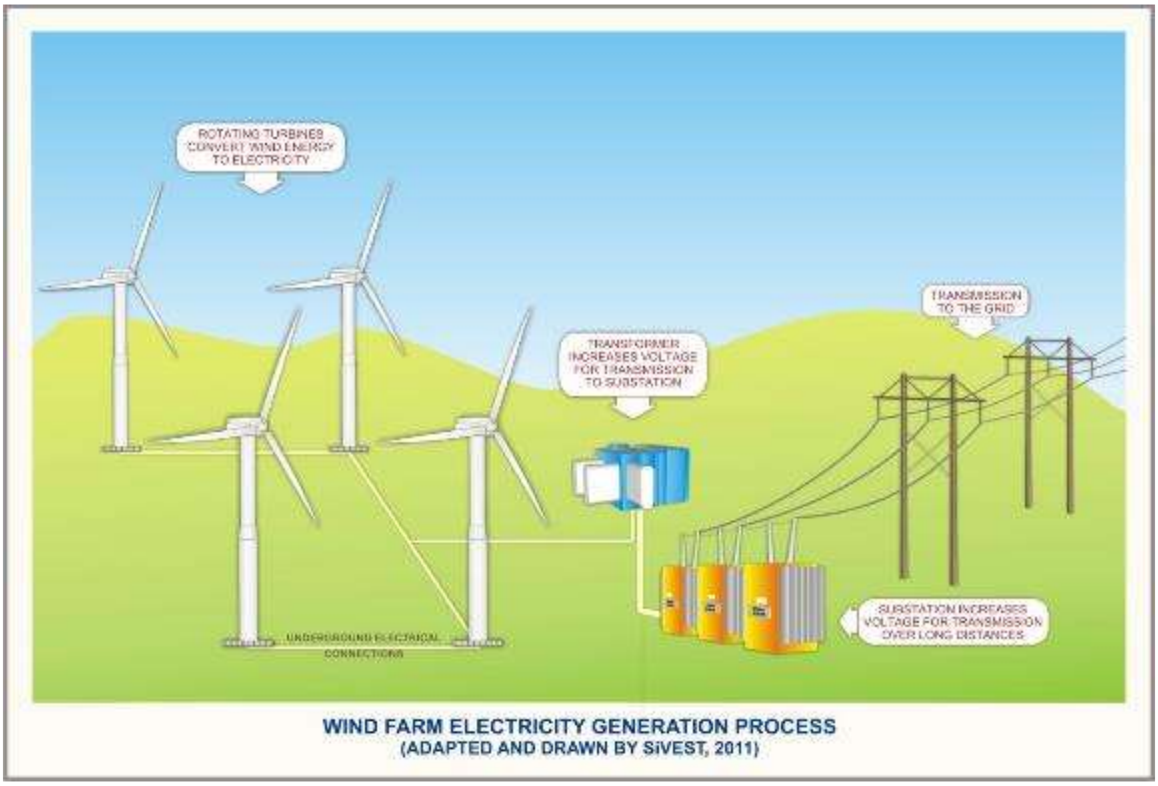


Figure 6: Conceptual Wind Energy Facility Electricity Generation Process showing Electrical Connections

5.1.4 Roads

The internal access roads are proposed to be between 4m to 6m wide and approximately 60km in total. This will include the net load carrying surface excluding any V drains that might be required. Double width roads will be required in strategic places for vehicle passing or turning.

5.1.5 Temporary Construction Area

The temporary construction lay down area will be approximately 2 400m² (60m x 40m). The lay-down / staging area will be approximately 11 250m² whilst the lay-down area for concrete towers (only if required) will be approximately 40 000m².

5.1.6 *Operation and Maintenance (O&M) Buildings*

The operation and maintenance buildings will include an on-site spares storage building, a workshop and operations building with a total combined footprint that will not exceed 300m^2. The operation and maintenance buildings will be situated in proximity to the wind farm substation due to requirements for power, water and access.

5.1.7 *Other Associated Infrastructure*

Other associated infrastructure includes the following:

- Fencing (if required) will be up to 5m where required and will be either mesh or palisade.
- Permanent wind measurement mast.

5.2 Alternatives

As per Chapter 1 of the EIA regulations (2014), feasible and reasonable alternatives are required to be considered during the EIA process. Alternatives are defined at "different means of meeting the general purpose and requirements of the activity" These alternatives may include:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of the activity;
(d) The technology to be used in the activity;
(e) The operational aspects of the activity; and
(f) The option of not implementing the activity.

Each of these alternatives are discussed in relation to the proposed project in the sections below.

5.2.1 *The property on which or location where it is proposed to undertake the activity*

As described in **section 2.3.1** in the Final Scoping Report (FSR), prior to the initiation of the EIA, BioTherm conducted feasibility assessments on several potential wind farm sites throughout South Africa. Some of these sites are shown in **Table 8**.

Table 8: Project Alternatives Assessed by BioTherm

Project name	Location	Province	Wind Speed	Capacity	Hectares	Feasibility Fatal Flaws Identified
Sweet Valley	Memel	Free State	7.2	140MW	10 000	**Environmental Sensitivity**: BirdLife SA screened site, do not support. Site in Important Bird and Biodiversity Area. Rudd's Lark, Crowned Cranes (Endangered) and Wattled Cranes. Within 10km of Seekoeivlei Nature Reserve Ramsar site.
Newcastle Wind	Newcastle	KwaZulu Natal	7.5	140MW	6000	**Environmental Sensitivity and Land**: BirdLife SA screened site, do not support. Site in Important Bird Area. There is a single land owner, however, there are issues with the Title Deeds of which are currently subjected to a long legal process.
Utrecht Wind	Utrecht	KwaZulu Natal	7	140MW	11 500	**Environmental Sensitivity**: BirdLife SA screened site, do not support. Site in Important Bird Area. The Blood River Vlei (good habitat for Grey Crowned Cranes and many other water birds) is about 10km south of the Utrecht site.
Britannia Bay	Vredenburg	Western Cape	8	140MW	268	**Competition**: 268ha secured. Neighbouring land all secured by other Developers. No room for expansion.
Kuruman Wind	Kuruman	Northern Cape	7.2	140MW	12 000	**Grid**: High connection costs.
Springbok East	Springbok	Northern Cape	7	140MW	13 000	**Grid**: High connection costs.
Springbok North	Springbok	Northern Cape	7	140MW	6000	**Grid and Land**: High connection costs. Numerous land owners
Humansdorp Wind	Humansdorp	Eastern Cape	7.5	140MW	8000	**Grid**: Currently insufficient capacity. High grid connection costs.

No site alternatives for this project are being considered during the EIA. The placement of wind energy installations is dependent on several factors, all of which are favourable at the proposed site location. These include wind resource, land availability, climate, topography, grid connections and access to the site. The project site has been identified by BioTherm through a pre-feasibility desktop analysis based on the estimation of the wind energy resource, land availability and grid connections. The project site has access to the national grid via either the existing Kronos or Cuprum Substations, or the proposed Copperton Wind or Garob IPP Substations. The Kronos substation is the technically preferred option as this is the likely point of connection that will be selected by Eskom, however the other alternatives have also been assessed. The project site has a relatively flat topography which is suitable for the development of a wind energy facility. The project site is easily accessible via the N10 national road and the R357 from Prieska. The site is therefore considered highly suitable for the proposed development and no other locations are being considered.

5.2.2 The type of activity to be undertaken

No other activity alternatives are being considered. Renewable energy development in South Africa is highly desirable from a social, environmental and development point of view. Wind energy installations are suitable for the site because of the high wind resource.

5.2.3 The design or layout of the activity

Prior to the start of the EIA, BioTherm intended to construct 125 turbines on the Aletta site. This number of turbines provided flexibility in that turbines of 1-1.5MW could be considered, however consideration of the Square Kilometre Array (SKA) necessitated the reduction of the 125 turbines to a proposed 80 turbine layout. Although the reduction of the number of turbines equated to a reduction in capacity, this design amendment was done taking environmental considerations into account. The proposed 125 turbine layout and the proposed 80 turbine layout are shown in Figure 7 and Figure 8 below.

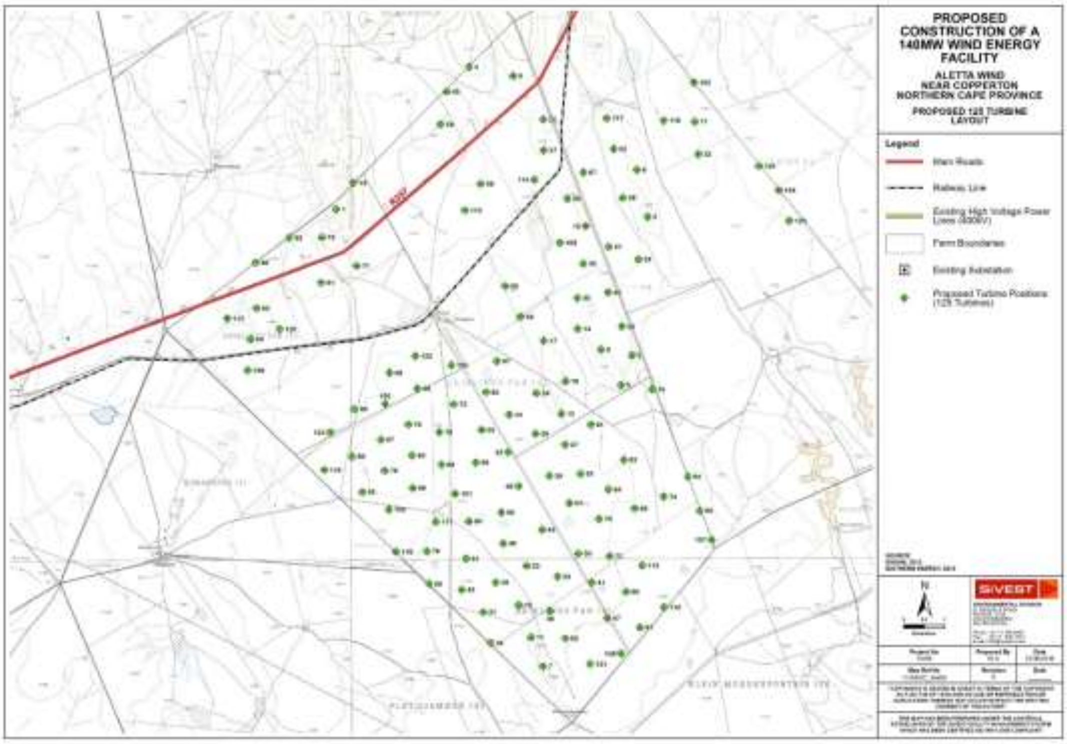


Figure 7: Proposed Aletta 125 turbine layout

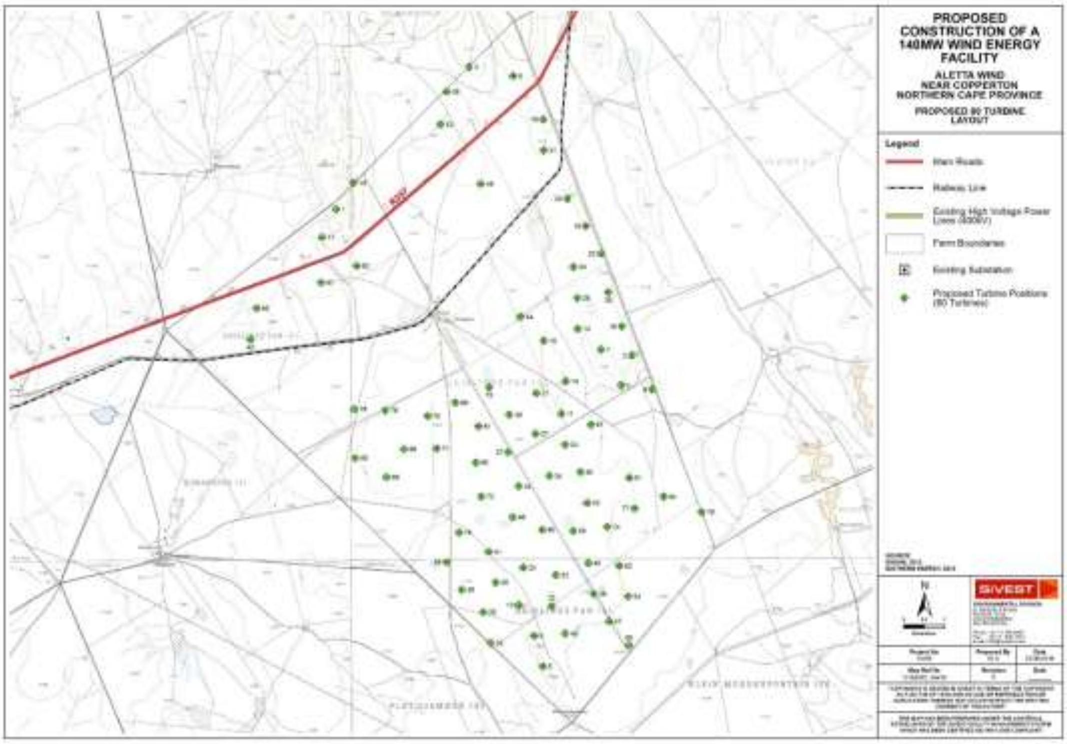


Figure 8: Proposed Aletta 80 turbine layout

In an attempt to increase the separation distance between the nearest SKA station from 20km to 25km a 60 turbine layout was determined and compared to the 80 turbine layout during the scoping phase. In addition, alternative locations were assessed for the onsite substations and O&M buildings. The assessment of the turbine layouts, substations and O&M building alternatives were based on both environmental constraints and design factors. Various environmental specialists assessed the site during the scoping phase. Their assessments encompassed the entire proposed development site and included the identification of sensitive areas. These sensitive areas were used during the scoping phase to perform a preliminary comparison of layout alternatives.

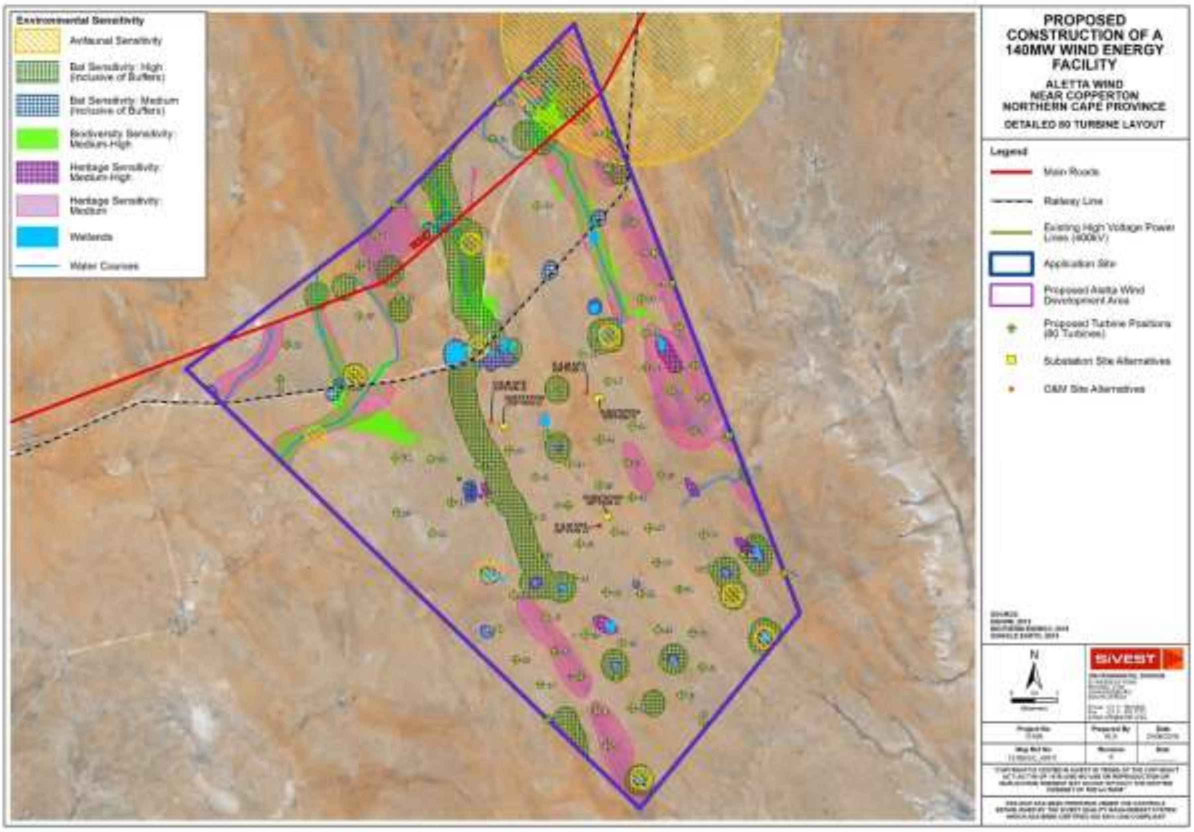


Figure 9: Proposed Aletta 80 Turbine Layout Alternatives and Environmental Sensitivity

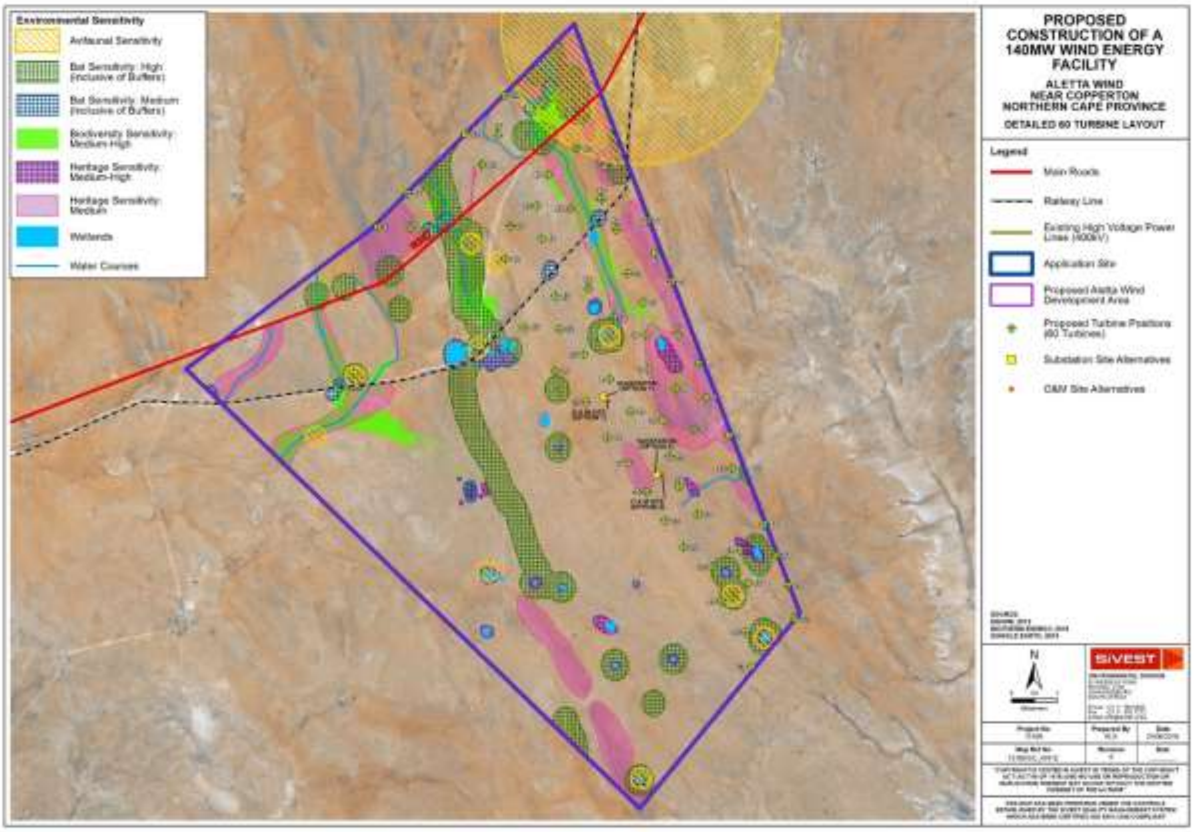


Figure 10: Proposed Aletta 60 Turbine Layout Alternatives and Environmental Sensitivity

The 60 turbine layout was clearly selected as the preferred alternative as per the scoping phase specialist findings. Although 60 turbine Substation and O&M Buildings Option 1 was slightly preferred over Option 2, both alternatives were favourable and it was recommended that both alternatives be taken through to the EIA phase for further assessment. These layouts are presented in **Figure 11**. These EIA phase layout alternatives have been extensively investigated. The EIA phase layout alternatives, including maps, are presented in **Section 12**. The selected preferred layout alternative will be based on both environmental constraints and design factors.

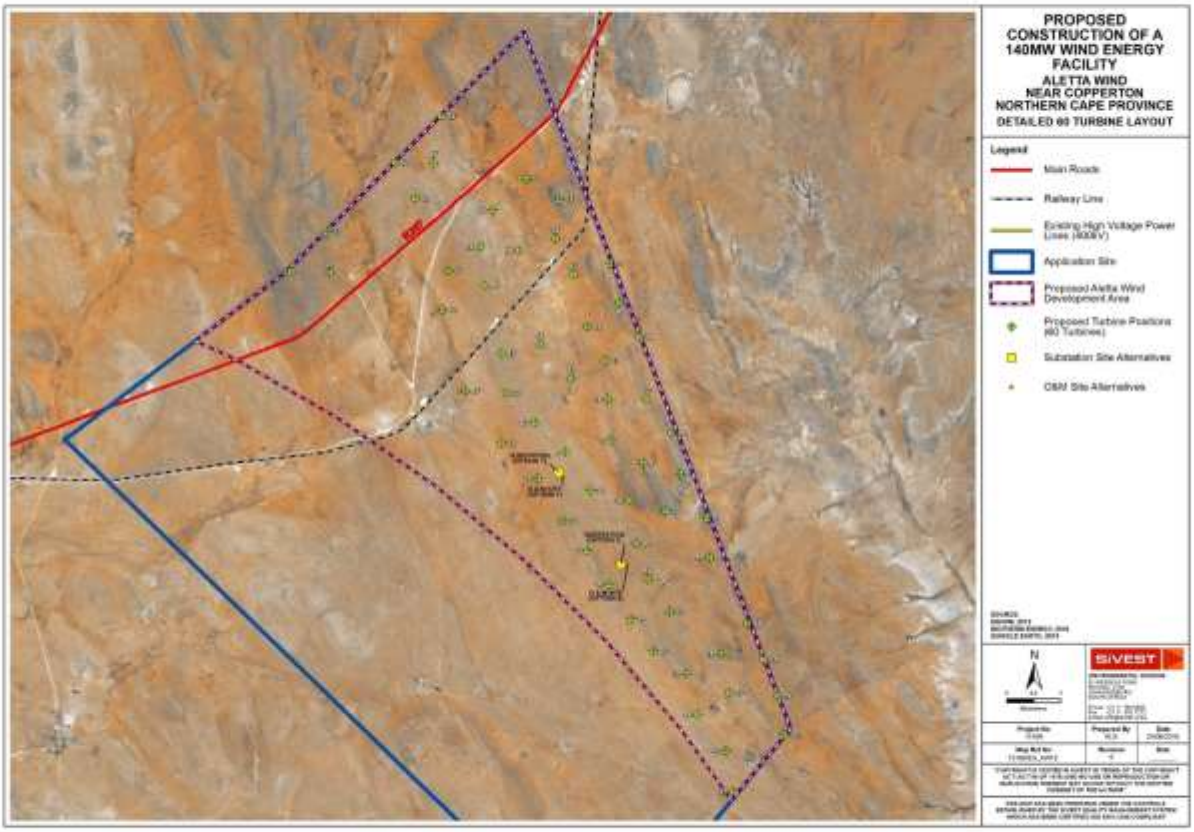


Figure 11: Proposed EIA Phase Layout Alternatives

5.2.4 The technology to be used in the activity

The technology selected for the Aletta wind energy facility was based on environmental constraints, technical and economic considerations. The size of the wind turbines will depend on the development area and the total generation capacity that can be produced as a result. Therefore no technology alternatives will be considered during the EIA. The choice of technology used will ultimately be determined by technological and economic factors at a later stage.

5.2.5 The operational aspects of the activity

No operational alternatives were assessed in the EIA.

5.2.6 The option of not implementing the activity

The option of not implementing the activity, or the **'no-go'** alternative, is considered in the EIA. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although wind energy is not the only solution to solving the energy crisis in South Africa, not establishing the proposed wind energy facility 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 could contribute to addressing the problem. 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.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

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.

The proposed project is located within the Northern Cape Province, approximately 17km east of Copperton. It falls within the Siyathemba Local Municipality that forms part of the Pixley ka Seme District Municipality (**Figure 12**). The proposed development will be accessed by the R357 which traverses the northern section of the proposed application site. The corner point co-ordinates for the development area, as well as the centre point co-ordinates for the development area and associated infrastructure are included in **Table 9, Table 10** and **Table 11** respectively.

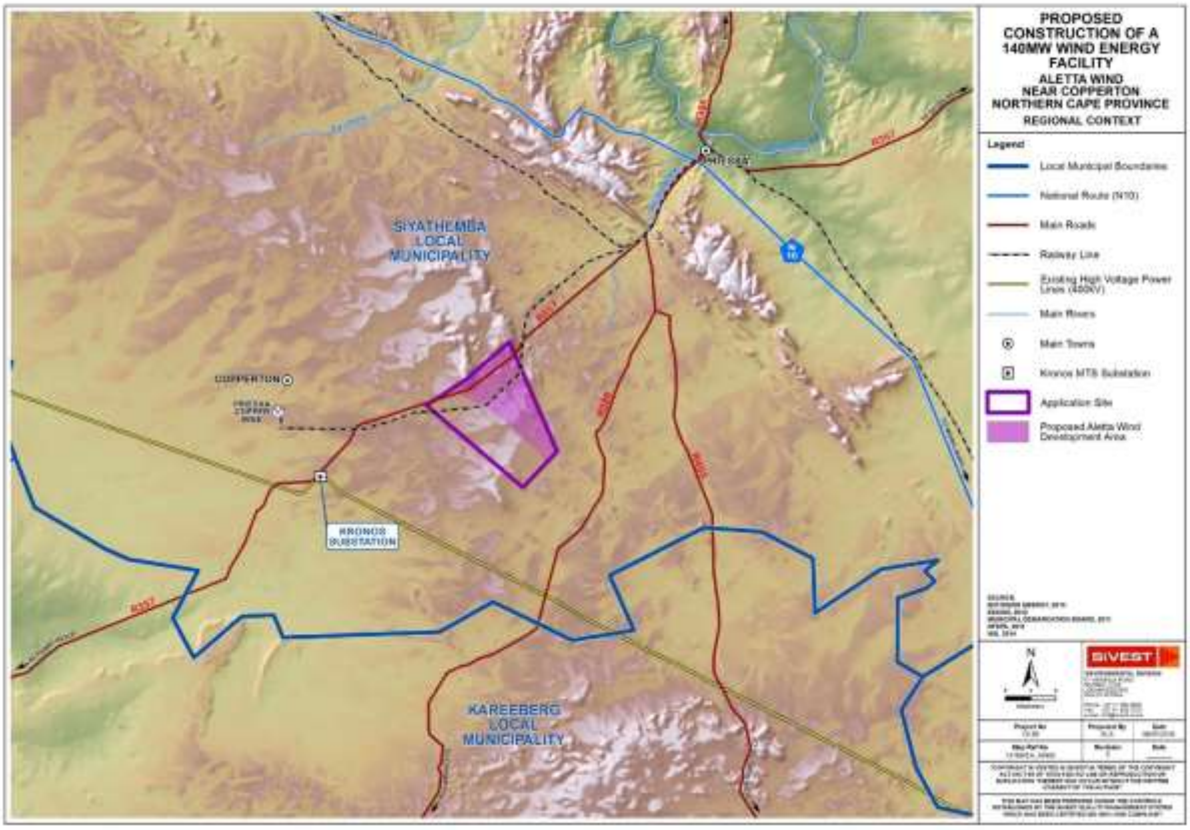


Figure 12: Regional Study Area.

6.1 Study Site Description

The site that is proposed for the Aletta wind energy facility near Copperton is located on the following properties:

- Portion 1 of the Farm Drielings Pan No. 101, cadastral number: C06000000000010100001;
- Portion 2 of the Farm Drielings Pan No. 101, cadastral number: C06000000000010100002;
- Portion 3 of the Farm Drielings Pan No. 101, cadastral number: C06000000000010100003; and
- Remainder of the Farm Drielings Pan No. 101, cadastral number: C06000000000010100000.

Table 9: Development Area Corner Points

ALETTA WIND: DEVELOPMENT AREA		
CORNER POINT COORDINATES (DD MM SS.sss)		
POINT	**SOUTH**	**EAST**
AD_01 (NW)	S29° 55' 57.522"	E22° 28' 39.802"
AD_02 (NE)	S29° 52' 51.794"	E22° 32' 27.848"
AD_03 (SE)	S29° 59' 52.858"	E22° 35' 30.970"
AD_04 (SW)	S30° 0' 36.296"	E22° 34' 49.743"

AD_05 (CENTRE)	S29° 56' 31.212"	E22° 32' 27.034"

Table 10: Development Area Centre Points

DEVELOPMENT AREA			
PHASE	**AREA (HECTARES)**	**CENTRE POINT COORDINATES**	
		SOUTH	**EAST**
ALETTA WIND ENERGY FACILITY DEVELOPMENT AREA			

Table 11: Associated Infrastructure Centre Points

ALETTA WIND: COMPONENTS		
CENTRE POINT COORDINATES (DD MM SS.sss)		
COMPONENT	**OPTION 1**	**OPTION 2**
SUBSTATION	S29° 57' 17.823"	S29° 58' 13.487"
	E22° 32' 50.861"	E22° 33' 33.860"
O&M SITES	S29° 57' 20.921"	S29° 58' 13.765"
	E22° 32' 54.174"	E22° 33' 38.344"

The application site as shown on the locality map below comprises Portion 1, Portion 2, Portion 3 and Remainder of the Farm Drielings Pan No. 101. The total area of the application site is approximately 11 003 hectares. Within the application site the Aletta Wind Energy Facility development area has a total area of approximately 5 639 hectares (**Figure 13**). Portion 1, Portion 2, Portion 3 and Remainder of the Farm Drielings Pan No. 101 are used primarily for livestock rearing (i.e. sheep farming). There is one (1) homestead which can be found within the proposed application site. This homestead is being occupied by the owner of the above-mentioned properties. In addition, two (2) other buildings can also be found within the proposed application site. These two (2) buildings are currently uninhabited and no one lives in these dwellings. During the site visit, it was however discovered that one (1) of these buildings belongs to the owner of the above-mentioned properties and that this dwelling is sometimes used as accommodation for individuals that have to undertake specific tasks (such as erecting fences) on the farm. The owner of the properties mentioned above has however indicated that this dwelling might be used as a home for one (1) of their family members in the future. In addition, the other building is currently being used as a holiday home by a family member of the owner of the above-mentioned properties. It was indicated that this family member has inherited this dwelling from their father and might occupy it permanently in the future. It should be noted that no relocation is envisaged and the land owner is in favour of the proposed project.

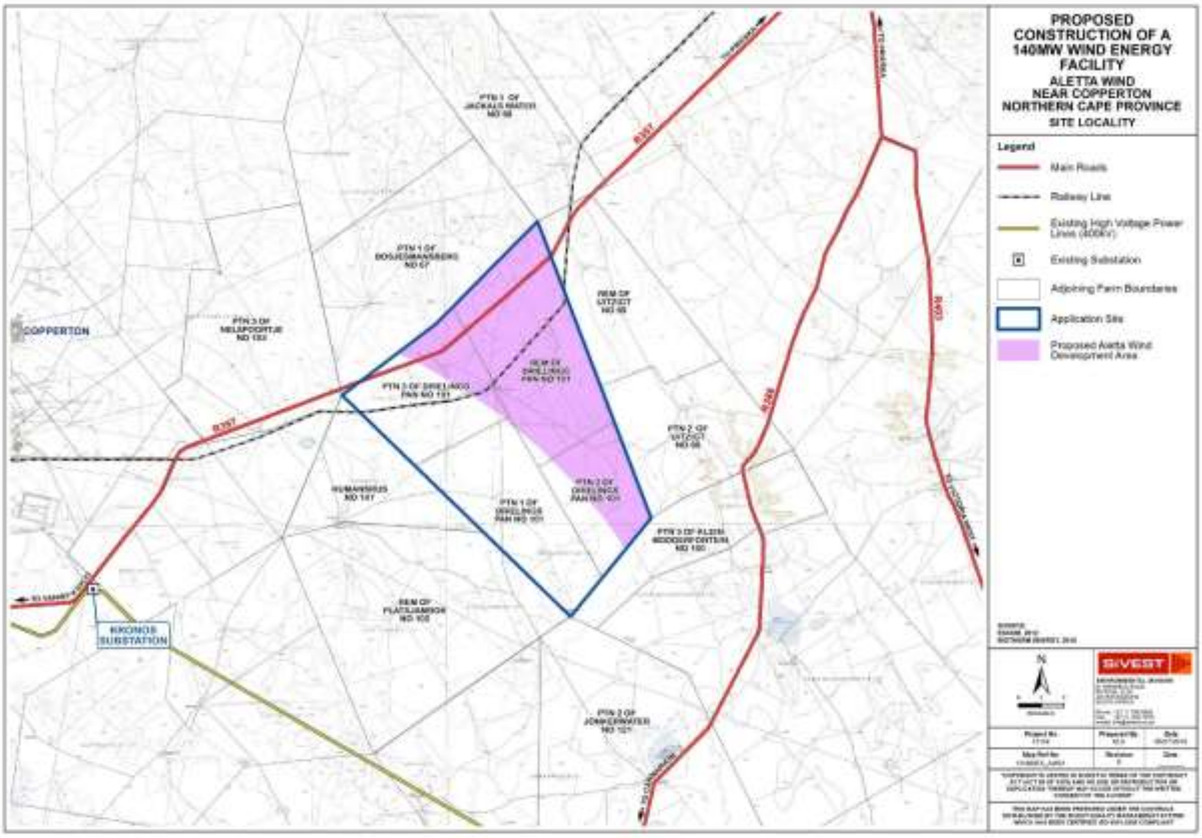


Figure 13: Site Locality

Please note that all maps within the report are included in **Appendix 7** and are in A3 format.

6.2 Land Use

Much of the application site and surrounding area is characterised by natural unimproved vegetation which is dominated by low shrubland (**Figure 14**). The highly arid nature of the area's climate has resulted in livestock rearing (i.e. sheep farming) being the dominant activity within the area. As such, the natural vegetation has been retained across the vast majority of the surrounding area (**Figure 15**).

The nature of the climate and corresponding land use has also resulted in low stocking densities and relatively large farm properties across the area. Therefore the majority of the area is very sparsely populated, and relatively little human-related infrastructure exists.

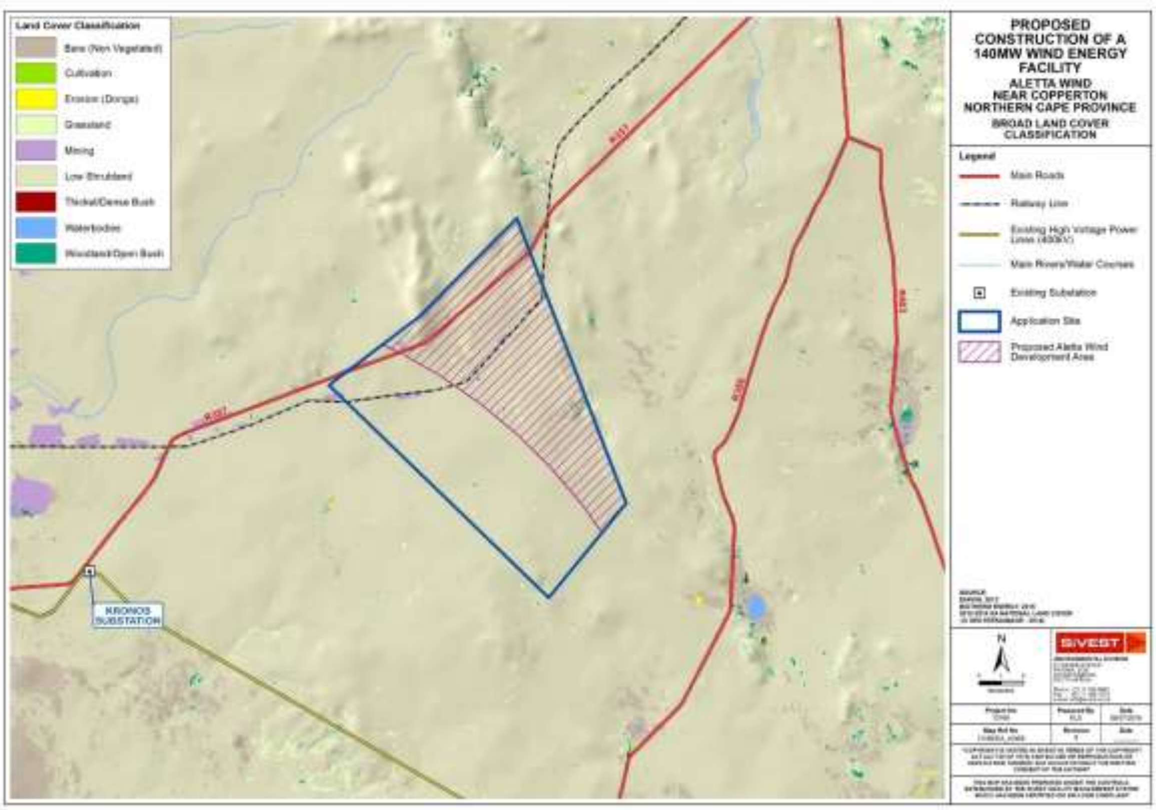


Figure 14: Land Use of the Application Site and Surrounding Area

Figure 15: Typical natural undeveloped grazing land found within the surrounding area

Built form in areas where livestock rearing occurs is limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines, fences and the remnants of disused workers' dwellings. It must also be noted that the R357 tar road traverses the northern section of the proposed application site while the R386 gravel road can be found to the south-east of the proposed application site. In addition, several existing high voltage power lines can be found within the surrounding area (**Figure 16**), while a railway line also traverses the northern section of the application site. It should however be noted that this is an old railway line which is no longer operational (**Figure 17**).

Figure 16: View of the existing high voltage power lines found within the surrounding area

Figure 17: View of the non-operational railway line which traverses the northern section of the application site. Note that no railway tracks are present.

The closest built-up areas include the small mining town of Copperton as well as the old Prieska Copper Mine which was closed in 1996. Copperton is located approximately 15km to the north-west of the application site while the old Prieska Copper Mine is located approximately 14km west. In addition, the ABB Solar Facility (**Figure 18**) can also be found within close proximity to the Prieska Copper Mine. Within the above-mentioned parts of the surrounding area, greater human influence is visible in the form of mining infrastructure and electricity transmission infrastructure. The infrastructure associated with the now-defunct mine still exists, with the headgear, as well as an old slimes dams being prominent landmarks. It should be noted that patches of degraded land can be found within the application site, as well as to the south-east, south and west of the site respectively. These areas of degraded land appear to be localised along the R357 and R386 roads, as well as the railway line. In addition, very small areas characterised by cultivation can be found to the south-west and north-east of the application site respectively.

Figure 18: View of the ABB Solar Facility which is found within close proximity to the Prieska Copper Mine.

6.3 Topography and Slope

The topography within and in the immediate vicinity of the proposed application site is characterised by a flat to gently undulating landscape (typical of much of the Karoo), that gently slopes down in a south-easterly direction. In addition, the topography in the wider area is characterised by a mix of level plains with some relief, as well as areas of slightly more undulating relief, including some plains with open hills or ridges. In the wider area beyond the boundaries of the surrounding area, a low mountain range marks a change in topography; with the Doringberge forming a line of hills to the north-east of the application site (**Figure 19**).

Figure 19: Topography within the application site and surrounding area

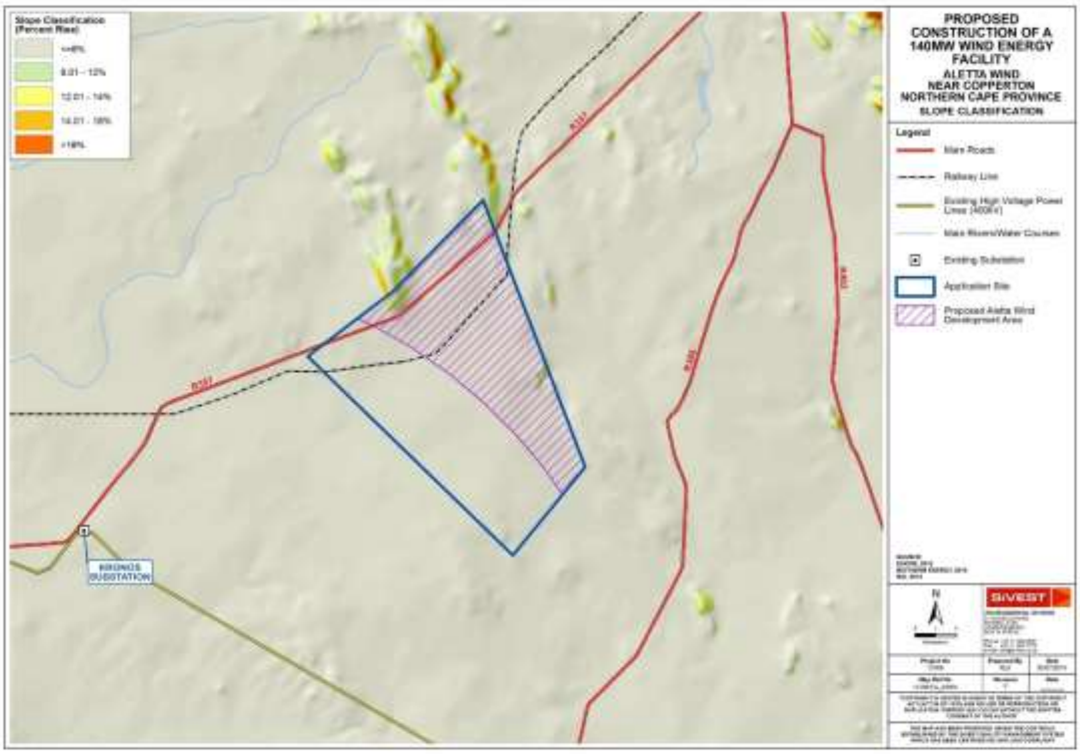


Figure 20: Slope of the application site and surrounding area

6.4 Climate

The climate of the study area (Monnik & Malherbe, 2005) can be regarded as warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 198 mm, of which 138 mm, or 69%, falls from November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is over 2 100 mm per year, peaking at over 8.5 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 31.6ºC and 11.8ºC for January to 15.9ºC and 1.0oC for July respectively. The extreme high temperature that has been recorded is over 42ºC and the extreme low –10.0ºC. Frost occurs most years on 30-40 days on average between early May and mid-September.

6.5 Geology

The geology of the area comprises quartzite of the Uitdraai Formation, Olifantshoek sequence (Geological Survey, 1977).

The distribution of the geological units in the area is shown in **Figure 21**.

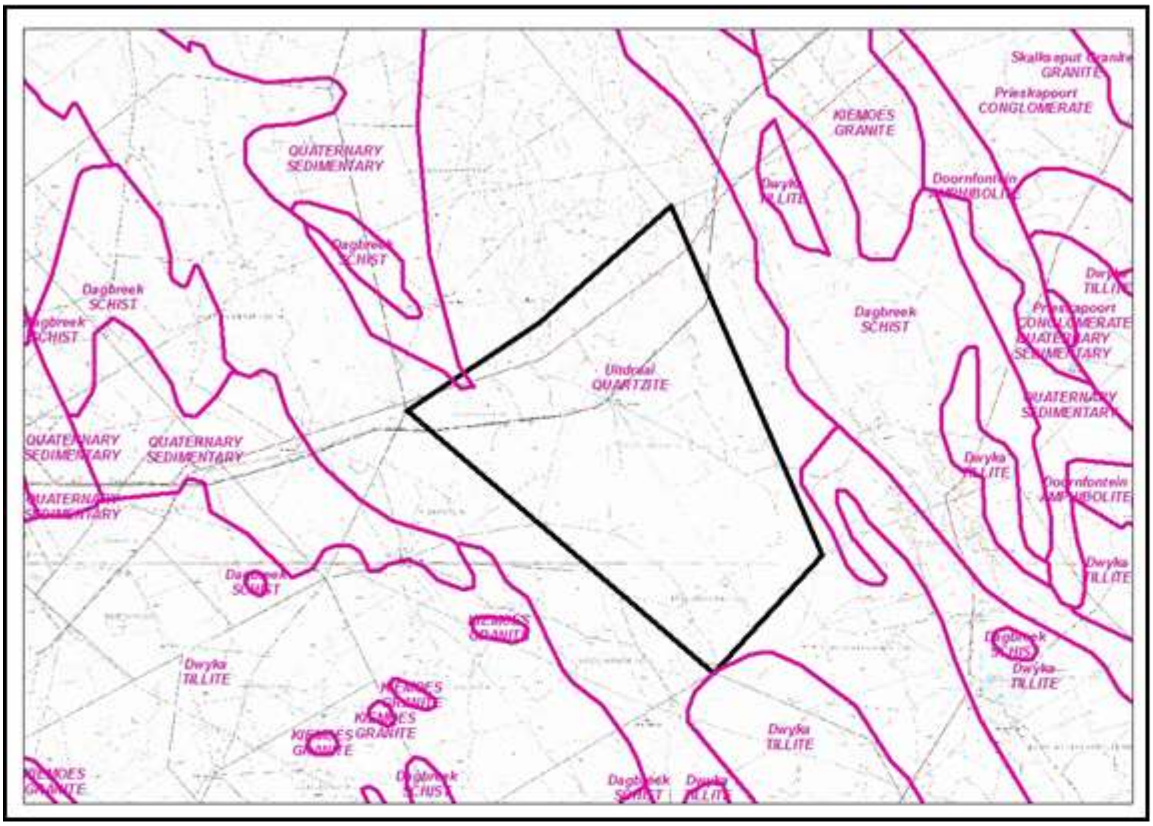


Figure 21: Geology

6.6 Biodiversity (Flora and Fauna)

The Biodiversity Assessment was conducted by David Hoare (**Appendix 6A**). The environmental baseline from a biodiversity perspective is presented below.

6.6.1 Broad vegetation types of the region

The sites fall within the Nama-Karoo Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al*. 2006). This map shows six vegetation types occurring within the broad study area, of which only two are affected directly by the proposed project alternatives. These vegetation types are described in more detail below.

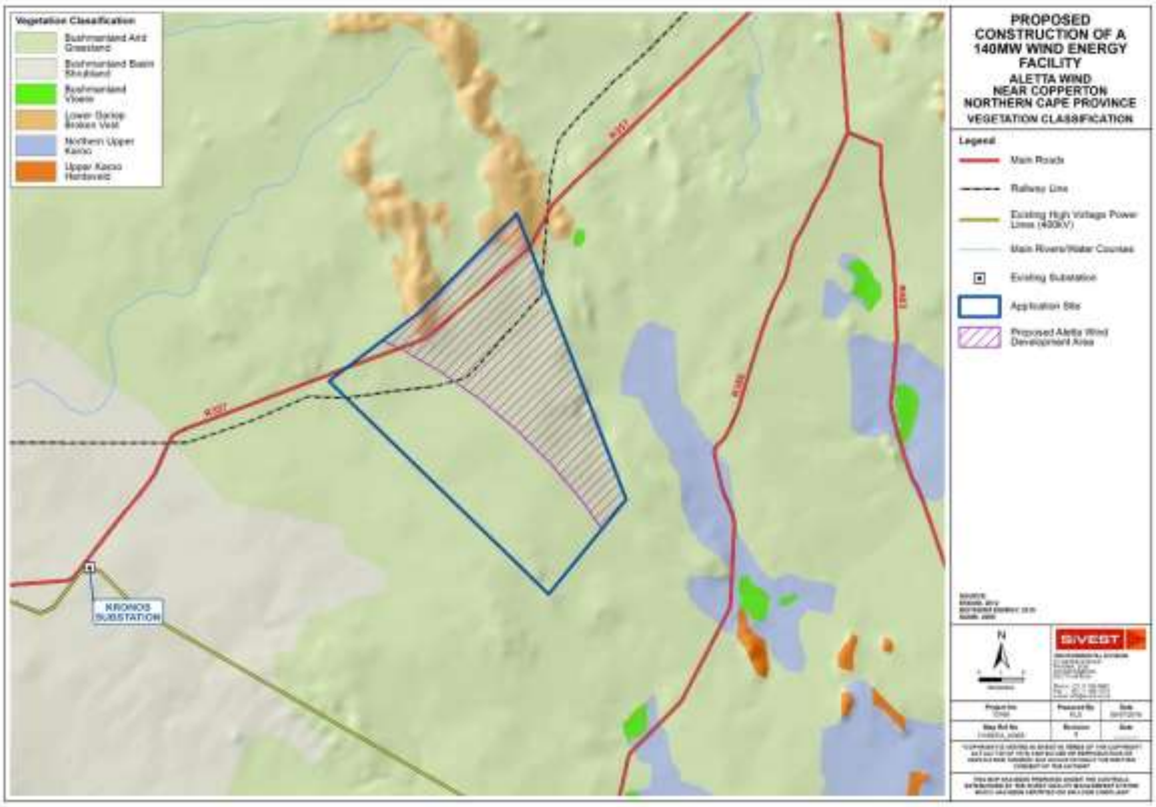


Figure 22: Vegetation of the Study Area.

6.6.2 Bushmanland Arid Grassland

This vegetation type occurs on extensive, relatively flat plains and is sparsely vegetated by tussock grasses, including *Stipagrostis ciliata*, *Aristida adscensionis*, *Aristida congesta*, *Enneapogon desvauxii*, *Eragrostis nindensis*, *Schmidtia kalahariensis* and *Stipagrostis obtusa*. In some years after good rains there are abundant displays of annual herbs (Mucina et al. 2006). There are no known endemics in this vegetation type (Mucina *et al*. 2006), but does contain endemics belonging to the Griqualand West or Gariep Centres of Endemism (van Wyk & Smith 2001), namely Aizoon asbestinum, Maerua gilgii, *Ruschia muricata* and *Aloe gariepensis*. The vegetation type also contains the protected tree species, *Acacia erioloba* (camel thorn), *Acacia haematoxylon* (grey camel thorn) and *Boscia albitrunca* (shepherd's bush).

This was the most commonly occurring vegetation type found on site. Vegetation on the plains on site broadly matched the general description for this vegetation type, an example of which is shown in **Figure 23** below.

Figure 23: Typical vegetation structures within the general study area

6.6.3 Lower Gariep Broken Veld

This consists of sparse vegetation dominated by shrubs and dwarf shrubs, with annuals conspicuous, especially in spring, and perennial grasses and herbs occurring in low amounts. On the slopes of koppies groups of widely scattered low trees such as *Aloe dichotoma* occur and the sandy soils of footslopes *Acacia mellifera* occurs. Known endemics in this vegetation include the tall shrub *Caesalpinia bracteata* and the succulent shrub *Ruschia pungens* (Mucina *et al*. 2006). The vegetation contains endemics belonging to the Griqualand West or Gariep Centres of Endemism (van Wyk & Smith 2001), namely *Digitaria polyphylla* and *Crassula corallina* subsp. *macrorrhiza*. At a national scale this vegetation type has been transformed only a small amount and is also conserved in Augrabies Falls National Park. It is not considered to be a threatened vegetation type (Mucina *et al*. 2006).

The vegetation of the low hills on site matches the description of this vegetation type most closely, an example of which is shown in **Figure 24** below. Note the band of *Acacia mellifera* shrubs around the base of the hill (on the footslopes).

Figure 24: Typical vegetation of the hills within the study area

6.6.4 Bushmanland Basin Shrubland

This vegetation type occurs in the Northern Cape Province in the Large Bushmanland Basin centred on Brandvlei and Vanwyksvlei, from Granaatboskolk in the west to Copperton in the east and Kenhardt in the north to Williston in the south (Mucina *et al*. 2006). It is found on slightly irregular plains. The vegetation is a dwarf shrubland dominated by a mixture of low sturdy, spiny and sometimes succulent shrubs (*Rhigozum*, *Salsola*, *Pentzia* and *Eriocephalus*), white grasses and, in years of high rainfall, abundant annuals, such as *Gazania* and *Leysera*. In comparison to the bordering Bushmanland Arid Grasslad, the vegetation of this unit shows increased presence of shrubs and plant indicators of high salt status of soils.

6.6.5 Bushmanland Vloere

This is the vegetation of the salt pans and broad riverbeds of the central Bushmanland basin (Mucina *et al.* 2006). It occurs in areas of flat and very even surfaces of pans and broad bottoms of intermittent dry rivers. Typically, the central parts are devoid of vegetation. Around this is loosely patterned scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, with a mixture of karroid dwarf shrubs. In places loose thickets of *Parkinsonia africana*, *Lebeckia linearifolia* and *Acacia karroo* may be found.

Local vegetation matching this description was found in a number of small pans located on site. An example is shown in **Figure 25** below, which shows pan vegetation surrounded by plains vegetation.

Figure 25: Typical vegetation within pans in the study area

6.6.6 *Northern Upper Karoo*

This vegetation type occurs in the Northern Cape and Free State in the northern regions of the Upper Karoo Plateau from near Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. It is found on flat to gently sloping landscapes. The vegetation is a shrubland dominated by dwarf karoo shrubs, grasses and *Acacia mellifera* and some other low trees. This vegetation type did not occur on site.

6.6.7 *Upper karoo Hardeveld*

This vegetation type is found in the Northern, Western and Eastern Cape Provinces in the region from Middelpos in the west to Strydenburg, Richmond and Nieu-Bethesda in the east. Most of the crest areas and steep slopes of the Great Escarpment facing south between Teekloofpas and Graaff-Reinet are covered in this vegetation. The vegetation occurs on steep slopes of koppies, butts, mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation is a sparse dwarf Karoo scrub with drought-tolerant grasses. The vegetation unit contains a number of endemics, especially within the Great Escarpment part. This vegetation type did not occur on site.

6.7 Avifauna

The Avifauna Assessment, including 12 months of preconstruction monitoring, was conducted by Chris van Rooyen (**Appendix 6B**). The environmental baseline from an avifaunal perspective is presented below.

The habitat in the broader development area is highly homogenous and consists of extensive sandy and gravel plains with low shrub. Although Mucina & Rutherford (2006) classify the vegetation as Bushmanland Arid Grassland, the dominant vegetation type leans more towards Bushmanland Basin Shrubland. Bushmanland Basin Shrubland consists of dwarf shrubland dominated by a mixture of low, sturdy and spiny (and sometimes also succulent) shrubs (*Rhigozum*, *Salsola*, *Pentzia*, *Eriocephalus*), 'white' grasses (*Stipagrostis*) and in years of high rainfall also abundant annual flowering plants such as species of *Gazania* and *Leysera* (Mucina & Rutherford 2006).

SABAP1 recognises six primary vegetation divisions within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al*. 1997). 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. Using this classification system, the natural vegetation in the study area is classified as Nama Karoo. Nama Karoo is dominated by low shrubs and grasses; peak rainfall occurs in summer from December to May. Average daily temperatures range between 35°C in January and 18°C in July. Trees, e.g. *Vachellia karroo* are mainly restricted to ephemeral watercourses, but in the proposed development area, due to the extreme aridity (average annual precipitation 147mm in the 12 years from 2000 – 2012) the ephemeral watercourses contain only small stunted trees and dense shrubs. In comparison with the Succulent Karoo, the Nama Karoo has higher proportions of grass and tree cover.

6.7.1 Habitat classes and avifauna potentially occurring in the study area

Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of the biomes and vegetation types above, it is as important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types, and are determined by a host of factors such as topography, land use and man-made infrastructure.

The following bird habitat classes were identified in the study area:

- **Nama Karoo**

This habitat class is described above under **section 6.7**.

- **Waterbodies**

Surface water is of specific importance to avifauna in this arid study area. The study area contains at least nine boreholes and a small pan. Boreholes with open water troughs are important sources of surface water. Pans are endorheic wetlands having closed drainage systems; water usually flows in from small catchments but with no outflow from the pan basins themselves. They are characteristic of poorly drained, relatively flat and dry regions. Water loss is mainly through evaporation, sometimes resulting in saline conditions, especially in the most arid regions. Water depth is shallow (<3m), and flooding characteristically ephemeral (Harrison *et al.* 1997). In this instance the pan is very small and unlikely to hold water regularly.

- **Trees**

The study area is generally devoid of trees, except for isolated clumps of trees at two of the water points, where a mixture of alien and indigenous trees are growing. The trees could attract a variety of species for purposes of nesting.

- **High voltage lines and telephone lines**

High voltage lines are an important potential roosting and breeding substrate for large raptors in the greater study area. There are no existing high voltage lines crossing the actual study area, but there are sub-transmission lines on 5-pole wooden structures running north and south of the site.

High voltage lines hold a special importance for large raptors (Jenkins *et al.* 2006). A Martial Eagle nest site on the Hydra-Kronos 400kV line at the Kronos MTS was initially recorded in the early 2000s in surveys of large raptors nesting on Eskom's transmission network in the Karoo (Jenkins *et al.* 2013). The presence of the nest was re-confirmed in 2013, with a pair of adults in attendance at a nest on tower 519 (30º 01.579 S, 22º 20.675 E) in May 2013, and feeding a small chick in August of the same year. This chick was successfully fledged by November, and at least one adult was present in the area, with the nest showing signs of preparation for the upcoming breeding season, in March 2014 (Jenkins & Du Plessis 2014). The nest was inspected during the site visit in June 2015, but the birds were not observed, which is an indication that the nest may not have been active during 2015. At the time of the site visit, there was extensive activity at the Kronos MTS with continuous movements of trucks and pedestrians, which may account for the absence of the eagles at this specific nest site. The nest was again inspected in August 2015 and January 2016, but there was no sign of the birds. Although the nest is too far away to be directly impacted by the construction activity at the site, the proposed grid connection could potentially impact on the eagle nest through displacement due to disturbance associated with the construction of the power line, if the grid connection terminates in Kronos MTS. However, indications are that the birds have abandoned the nest, most likely due to disturbance.

There is also a telephone line next to the R357 tar road running through the north of the site. The poles are used extensively by Sociable Weavers *Philetairus socius* for nesting. A Verreaux's Eagle pair is breeding on a Sociable Weaver nest on one of the poles approximately 1.65km east of the western border of the site. The nest was active in June 2015.

See **APPENDIX 1** of the Avifauna report for a photographic record of the bird habitat in the study area

6.8 Bats

The Bat Assessment, including 12 months of preconstruction monitoring, was conducted by Werner Marais of Animalia (**Appendix 6C**). The environmental findings from a bat perspective are presented below.

Three factors need to be present for most South African bats to be prevalent in an area: availability of roosting space, food (insects/arthropods or fruit), and accessible open water sources. However, the dependence of a bat on each of these factors depends on the species, its behaviour and ecology. Nevertheless, bat activity, abundance and diversity are likely to be higher in areas supporting all three above mentioned factors.

The site is evaluated by comparing the amount of surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces and foraging sites), climate (can influence insect numbers and availability of fruit), and presence of surface water (influences insects and acts as a source of drinking water) to identify bat species that may be impacted by wind turbines. These comparisons are done chiefly by studying the geographic literature of each site, available satellite imagery and observations during site visits. Species probability of occurrence based on the above mentioned factors are estimated for the site and the surrounding larger area (see **Section 4.2** of the Bat Assessment Report).

6.8.1 Land Use, Vegetation, Climate and Topography

Vegetation units and geology are of great importance as these may serve as suitable sites for the roosting of bats and support of their foraging habits (Monadjem *et al*. 2010). Houses and buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem *et al*. 2010). The importance of the vegetation units and associated geomorphology serving as potential roosting and foraging sites have been described in **Table 12Table 12** below.

Table 12: Potential of the vegetation to serve as suitable roosting and foraging spaces for bats

Vegetation Unit	Roosting Potential	Foraging Potential	Comments
Bushmanland Arid Grassland	Low	Low-Moderate	Very little natural roosting space is available and may be limited to the few buildings/man-made structures on site. Foraging will mostly be by open space foraging bats species with strong seasonality.
Lower Gariep Broken Veld	Low	Moderate	The vegetation unit does not present a lot of roosting potential apart from low trees and man-made structures. The unit can provide adequate foraging opportunities, especially for open air foraging bat species.

6.8.2 Literature Based Species Probablity of Occurrence

"Probability of Occurrence" is assigned based on consideration of the presence of roosting sites and foraging habitats on the site, compared to literature described preferences. The probability of occurrence is indicative of the likelihood of encountering the bat species on site.

The column of "Likely risk of impact" describes the likelihood of risk of fatality from direct collision or barotrauma with wind turbine blades for each bat species. The risk was assigned by Sowler and Stoffberg (2014) based on species distributions, altitudes at which they fly and distances they traverse; and assumes a 100% probability of occurrence. The ecology of most applicable bat species recorded in the vicinity of the site is discussed in **Table 13** below.

Table 13: Table of species that may be roosting or foraging in the study area and the possible site specific roosts (Mondajem *et al*. 2010).

Species	Common name	Probability of occurrence (%)	Conservation status	Possible roosting habitat on site	Possible foraging habitat utilised on site	Likelihood of risk of fatality (Sowler & Stoffberg, 2014)
Rhinolophus clivosus	Geoffroy's horseshoe bat	10 - 20	Least Concern	Roosts in caves, mine adits and hollows (man-made and natural).	It is associated with a variety of habitats including arid savanna, woodland and riparian forest. Clutter forager that may only possibly be found in denser drainage systems. Relatively small foraging range	Low
Nycteris thebaica	Egyptian slit-faced bat	10 - 20	Least Concern	Roosts in caves, aardvark burrows, culverts under roads and the trunks of large trees and hollows (man-made or natural). Roosting space unlikely on site.	It appears to occur throughout the savanna and karoo biomes, but avoids open grasslands. May be found in denser drainage systems. Relatively small foraging range and an open space forager	Low
Sauromys petrophilus	Roberts's flat-headed bat	60 - 70	Least Concern	Roosts in narrow cracks and under slabs of exfoliating rock. Closely associated with rocky habitats in dry woodland, mountain fynbos or arid scrub.	Open space forager with relatively large foraging range.	High
Tadarida aegyptiaca	Egyptian free-tailed bat	Confirmed	Least Concern	Roost during the day, rock crevices, under exfoliating rocks, in hollow trees, and behind the bark of dead trees. The species	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It	High

				has also taken to roosting in buildings, in particular roofs of houses. The farm buildings are the most likely roosting space.	seems to forage in all types of natural and urbanised habitats with a relatively large foraging range. Open space forager	
Miniopterus natalensis	Natal long-fingered bat	Confirmed (in very low numbers)	Near Threatened	It is cave/mine dependent and hence the availability of suitable roosting sites is a critical factor in determining its presence. It may be found in the Copperton copper mines. Have been found roosting singly or in small groups inside culverts and manmade hollows.	Forages around the edge of clutters of vegetation, and may therefore avoid most of the site and may only be found at the denser drainage systems. It is also dependant on open surface water sources.	Medium - High
Cistugo seabrae	Angolan wing-gland bat	40 - 50	Near Threatened	It is restricted to the arid western parts of southern Africa, typically in desert and semi-desert conditions. Not a common bat.	Not well known, once netted at a dry stream bed in 2006 close to Vredesvallei.	Not known
Eptesicus hottentotus	Long-tailed serotine	30 - 40	Least Concern	It is a crevice dweller roosting in rock crevices, expansion joints in bridges and road culverts	It seems to prefer woodland habitats, but has been caught in granitic hills and near rocky outcrops. Clutter edge forager	Medium
Myotis tricolor	Temmink's myotis	20 - 30	Least Concern	Roosts gregariously in caves, but have been found roosting singly or in small groups inside culverts and manmade hollows.	It is restricted to areas with suitable caves or hollows, which may explain its absence from flat and featureless terrain; its close association with mountainous areas may therefore be due to its roosting requirements.	Medium - High

Neoromicia capensis	Cape serotine	Confirmed	Least Concern	Roosts under the bark of trees, at the base of aloe leaves, and inside the roofs of houses. The farm buildings are the most likely roosting space.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannas. Highly adaptable species, but a clutter edge forager limiting its utilisation of the site.	Medium - High

6.9 Surface Water

The Surface Water Assessment was conducted by Shaun Taylor of SiVEST (**Appendix 6D**) and the environmental findings from a Surface Water perspective are presented below.

6.9.1 Surface Water Desktop Baseline Information

In terms of the National ENPAT (2000) database, the proposed application site can be found within the Lower Orange Water Management Area. Moreover, the proposed development is within the Orange Primary Catchment. At a finer level of detail, the Aletta Wind Farm site traverses two (2) quaternary catchments including D54D and D62H. The north east boundary of the proposed development site can be found along the boundary of quaternary catchment D72A.

No new database information was identified that could be of relevance to the proposed development and the previous findings were therefore unchanged and used for the in-field assessment.

6.10 Soils and Agricultural Potential

The Soils and Agricultural Potential Assessment was conducted by Garry Patterson (**Appendix 6E**) and the environmental baseline from an Agricultural Potential perspective is presented below.

For the scoping report, existing soil information was obtained from the map sheets 2922 Prieska and 3022 Britstown (Bruce & Geers, 2005) from the national Land Type Survey, published at 1:250 000 scale.

For this study, a field visit was made, on 9th to 11th November 2016, to carry out a ground truthing exercise and to confirm the soils occurring.

A reconnaissance field investigation was carried out and randomly placed soil observations were made throughout the study area, using a hand soil auger to verify the dominant soil forms and soil depths. The soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991) and a very broad soil map was compiled.

6.10.1 Terrain

The area lies at a height of approximately 1 100 to 1 150 metres above sea level, with very gentle (<2%) slopes), although several small rocky kopjes occur in places, especially in the north.

Only a few non-perennial drainageways are present in the vicinity but some small pans also occur.

6.10.2 Climate

The climate of the study area (Monnik & Malherbe, 2005) can be regarded as warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 198 mm, of which 138 mm, or 69%, falls from November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is over 2 100 mm per year, peaking at over 8.5 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 31.6ºC and 11.8ºC for January to 15.9ºC and 1.0oC for July respectively. The extreme high temperature that has been recorded is over 42oC and the extreme low –10.0ºC. Frost occurs most years on 30-40 days on average between early May and mid-September.

6.10.3 Parent Material

The geology of the area comprises quartzite of the Uitdraai Formation, Olifantshoek sequence (Geological Survey, 1977).

The distribution of the geological units in the area is shown in **Figure 26**.

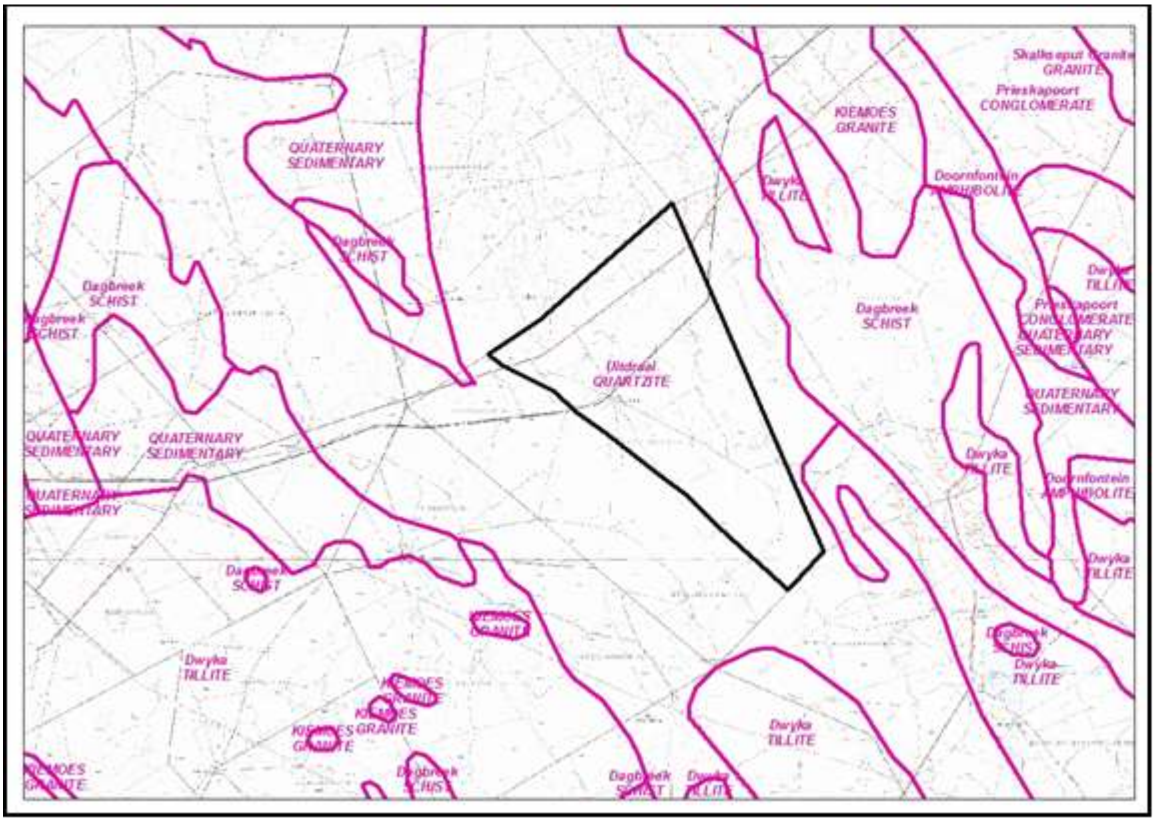


Figure 26: Geology

6.11 Noise

The Noise Assessment was conducted by Adrian Jongens of Jongens Keet Associates. The full report is included in **Appendix 6F**. The environmental baseline from a noise perspective is presented below.

The proposed Aletta WEF site is located approximately 28 km South West of Prieska and 14 km South East of the town Copperton that is reached via the R357. The R357 passes through the Northern part of the site.

Figure 27 displays an aerial view of the Aletta site and surrounding land. The site boundaries are outlined in dark blue. The small purple circles depict the proposed turbine locations. The area is rural with sparse habitation. Several noise sensitive receptors, namely, residential dwellings were identified that could potentially be affected by noise emitted by the wind energy turbines. These are numbered and located within the light blue circles.

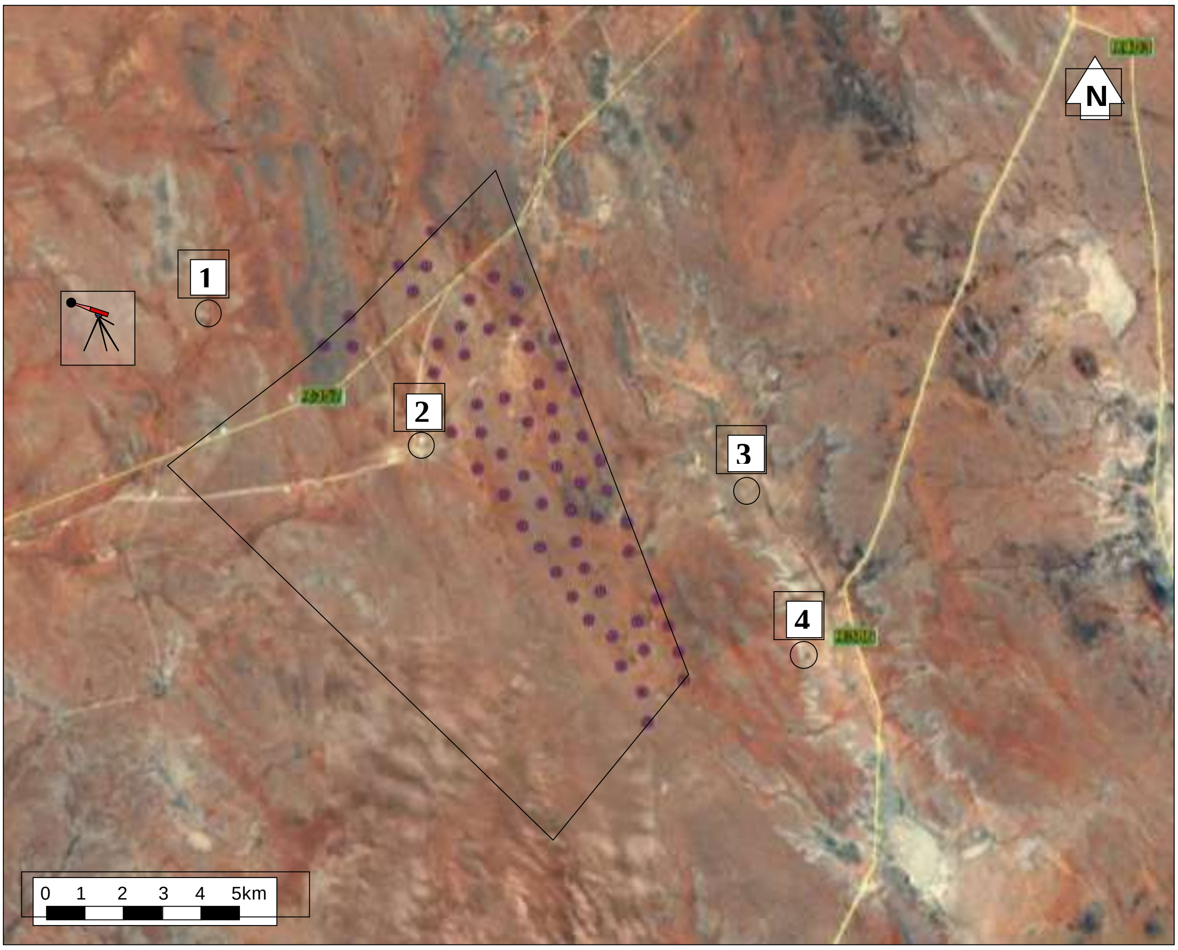


Figure 27: Aletta Wind Energy Facility study area

Residual equivalent continuous A-weighted sound pressure levels, LAeq simultaneously with equivalent octave frequency band levels (spectrum levels) were measured on 4 August 2016 along a farm road 3 km north of the R357. The location is depicted in **Figure 27** by means of a sound level meter on tripod symbol. Within a few minutes after commencing the measurements the readout of the sound level meter varied by less than 0,5 dB. Measurement duration of ten minutes was therefore considered to be representative of the time of day and weather conditions.

Figure 28 displays the equivalent continuous A-weighted octave frequency band levels commencing at 11h48 and commencing at 21h57. The respective overall, single-figure LAeq levels are displayed in the legend.

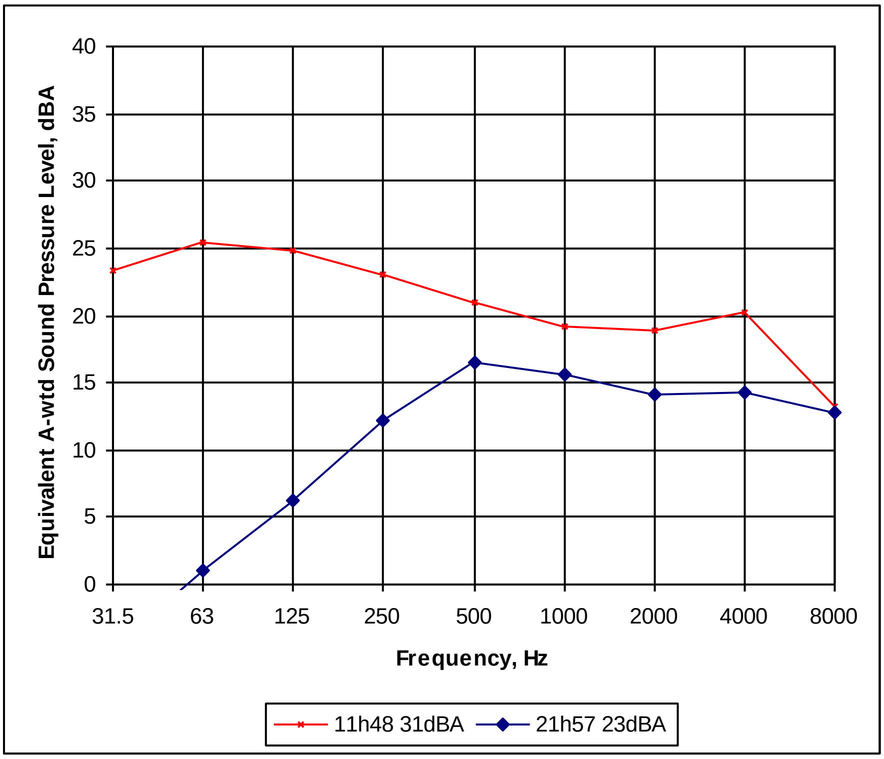


Figure 28: Measured octave band spectrum levels of residual noise

The daytime measurement was considered to be influenced by wind turbulence around the microphone due to a northerly wind of 5 m/s which resulted in increased levels below 1 000 Hz. Wind still conditions prevailed during the night-time measurement. The maximum levels centred on 500 Hz were due to faintly audible road traffic.

The daytime LAeq of 31 dBA and night-time LAeq of 23 dBA were similar to numerous previous measurements confirming the very low levels prevailing in the Karoo and that are significantly lower than the "typical" levels for rural districts contained in Table 2 of SANS 10103:2008.

6.12 Visual

The Visual Assessment was conducted by Andrea Gibb and Stephan Jacobs of SiVEST and is included in **Appendix 6G**. The findings are presented below.

6.12.1 Visual baseline

The largely flat terrain that occurs within the immediate vicinity of the application site results in generally wide-ranging vistas throughout the surrounding area (**Figure 29**). There are however exceptions to this generally flat topography which include the Dorinberge mountain range located to the north-east of the site, as well as the open hills or ridges located to the north. The Doringberge are situated approximately 24km from the application site and enclose the visual envelope. However, these mountains are located beyond the visual assessment zone and would offer very little topographical shielding/screening to lessen the impact of the wind energy facility from locally-occurring receptor locations. As these hills lie between Prieska and the site, they are a contributing factor in potentially shielding Prieska from the proposed development, although Prieska is situated at a distance from where the impact of the development is likely to be negligible. The hills and ridges to the north of the application site, will partially screen views of the wind energy facility from areas to the north-west, north and north-east of the application site.

Figure 29: Generally wide-ranging vistas found throughout the surrounding area as a result of the largely flat terrain that occurs within the immediate vicinity of the application site.

The natural short scrub-like vegetation cover, which dominates within most of the application site and visual assessment zone is not expected to offer any significant visual screening. Sections of the visual assessment zone are however characterised by relatively large tree species such as the Black thorn (*Acacia mellifera* subsp. *detinens),* as well as some other low trees (**Figure 30**). These trees occur naturally in certain areas of the visual assessment zone and are expected to contribute to the overall natural character of the study area as well as provide some form of screening from the proposed development. In addition, tall exotic trees may also effectively screen the proposed development from farmhouses, where these trees occur in close proximity to the farmhouse and are located directly in the way of views toward the development (**Figure 31**).

The influence of the level of human transformation on the visual character of the area is described in more detail below.

Figure 30: Example of the relatively large tree species (such as the Black thorn), as well as some other low trees which can be found in sections of the visual assessment zone

Figure 31: Example of tall trees that have been established around a farmhouse in the area

6.12.2 Visual Character

The above physical and land use-related characteristics of the study area contribute to its visual character. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation of the landscape. 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 at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as electrical infrastructure.

Most of the study area is considered to have a rural or pastoral character as a result of the limited human habitation and associated human infrastructural footprint present within the wider study area. The nature of the predominant land use (livestock farming) has retained the natural vegetation and natural appearance of the landscape. Built infrastructure within the study area is limited to isolated farmhouses, gravel access roads, several existing high voltage power lines (Figure 32), boundary fences, a slimes dam and a railway line which traverses a section of the application site. As previously mentioned, the old railway line appears to be no longer operational (Figure 33). In addition, the infrastructure associated with the Copper Mine is unlikely to change the visual character of the study area as the relic mine is situated outside of the visual assessment zone, has been non-functional for a number of years, and the transformation of the area around the mine is extremely localised. The town of Copperton is also situated outside the visual assessment zone and is therefore not expected to alter the visual character of the study area.

Figure 32: View of the existing high voltage power lines found within the study area which are expected to alter the overall natural / scenic character of the study area slightly and lower the visual contrast associated with the proposed wind energy facility.

Figure 33: View of the non-operational railway line which traverses the northern section of the application site. Note that no railway tracks are present.

The relatively low density of human transformation throughout majority of the study area is an important component contributing to the largely natural visual character of the study area. This is important in the context of potential visual impacts associated with the proposed development of a wind energy facility as introducing this type of development could be considered to be a degrading factor in this context. In addition, the hilly / mountainous terrain which occur within parts of the study area are considered to be important features that would increase the scenic appeal and visual interest in the area (**Figure 34**).

Figure 34: View of some of the hilly / mountainous areas located within parts of the study area which are expected to increase the scenic appeal and visual interest in the study area.

It should however be noted that several wind and solar energy facilities are proposed within relatively close proximity to the proposed development. These facilities, and their associated infrastructure, typically consist of very large structures which are highly visible. As such, these facilities will significantly alter the visual character and baseline in the study area once constructed resulting in a more industrial-type visual character. As previously mentioned, the ABB Solar Facility can be found with close proximity to the Prieska Copper Mine and is currently operational (**Figure 35**). This facility is however located outside of the visual assessment zone and is therefore not expected to alter the visual character of the study area.

Although the presence of other renewable energy developments will lessen the degree to which the proposed Aletta Wind Energy Facility farm would contrast with the elements and form in the surrounding environment, the cumulative impact on each potentially sensitive visual receptor location would increase. This is discussed in more detail in **section 4.5** of the Visual Assessment Report.

Figure 35: View of the ABB Solar Facility which is found within close proximity to the Priska Copper Mine. This facility is however located outside of the visual assessment zone**.**

6.12.3 Cultural, historical and Scenic Value

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 a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). The cultural landscape concept is relatively new in the heritage conservation movement across the world. In 1992 the World Heritage Committee adopted the following 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.

According to the Committee's Operational Guidelines Cultural Landscapes can fall into three categories

i) *"a landscape designed and created intentionally by man";*
ii) *an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";*

iii) *an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"*

The greater area surrounding the proposed development site is also an important component when assessing visual character. The area can be considered to be typical of a Karoo or “platteland” landscape that would characteristically 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 on route between the major inland centres and the Cape coast, or between the Cape and Namibia. 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 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). 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. Many potential objectors stress the need to preserve the environment of the Karoo, as well as preserve 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/).

The typical Karoo landscape can also be considered a valuable ‘cultural landscape’ in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small Karoo towns, such as Prieska and Copperton, 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 the 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.

The study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the proposed development of a wind energy facility as introducing this type of development could be considered to be a degrading factor in the context of the natural Karoo character of the study area, as discussed further below.

6.13 Heritage and Palaeontology

The Heritage Assessment was conducted by Wouter Fourie from PGS, with Palaeontological input from Gideon Groenewald, and is included in **Appendix 6H**. The environmental baseline from a heritage perspective is presented below.

The proposed site is generally flat on some of the western and northern parts. Quartzite and gneiss ridges and outcrops dominate the eastern and some of the southern parts of the property. Some of these outcrops, although smaller, as well as some drainage lines occur sporadically across the rest of the property. A few pans do occur across the central and western parts of the proposed development area. The site also has red Kalahari Aeolian sands of various thicknesses on top of a general calcrete layer across most of the western half of the proposed site. These Aeolian red sands are also found in between the ridges on the eastern side of the property.

The vegetation of the general area and the proposed site is typical of the Upper Karoo and consists mainly of Karoo scrub and grass and the occasional Karoo Acacia and forms part of the Bushmanland Arid Grassland vegetation in the Nama-Karoo biome (Mucina & Rutherford 2006).

The southern side of the property was previously largely undisturbed and were and are presently mainly used for grazing of sheep and cattle. Some game was observed on the property during the survey. Existing farm infrastructure such as windmills, boreholes, fencing and livestock pens are sparsely dotted across this part of the property.

The northern part of the property has the R357 tar road crossing from east to west. The decommissioned railway line situated just to the south of the tar road also crosses the property from east to west parallel to the tar road. An extended farmstead and its associated buildings and features form part of the built environment of the study area. The farmstead and its associated structures and features, although old, are still being occupied and in use at present.

Figure 36: General view of rocky outcrops

Figure 37: View of agricultural practice on the farm

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore, an Internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. Previous studies listed for the area in the APM Report Mapping Project included a number of surveys within the area.

6.13.1 Findings from studies

- **Palaeontology**

The following section has been compiled by Gideon Groenewald for PGS Heritage. The full report can be viewed in **Appendix D** of the Heritage Assessment Report.

Olifantshoek Supergroup

- **Bulpan Group**

Uitdraai Formation

The Mokolian aged Uitdraai Formation have not been studied for fossils up to date and due to the age it was not expected to yield any fossils. Recent research however indicate that earlier, very primitive life forms could have existed during Mogolian times and albeit very difficult to see and normally only described during detailed academic work, the recording of any mico-fossis and trace fossils, including possible algal mat structures from the study are will contribute significantly to the National Heritage Estate of the Northern Province and South Africa.

Karoo Supergroup

- **Dwyka Group**

  Trace fossils have been recorded from the fine-grained shales of the Dwyka Group in KwaZulu-Natal (Linstrom, 1987; MacRae, 1999). All of the following could potentially be found in KwaZulu-Natal. Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Group. Other trace fossils include coprolites (fossilized faeces) of chondrichthyians (sharks, skates and rays).

  Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living *Nautilus*), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaia haibensis*, *Eurydesma mytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthys schroederi* and *Watsonichthys lotzi*.

  Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (such as moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005).

Kalahari Group

- **Gordonia Formation**

  Palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (eg termitaria), rare vertebrate remains (mammals, fish, ostrich egg shell etc), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods, charophytes are all described from these deposits.

  Fossils are mainly associated with ancient pans, lakes and river systems Palaeontology poorly studied. Basal Late Cretaceous gravels and lacustrine clays probably fossiliferous (bones, teeth, petrified wood, palynomorphs) but very rarely exposed. Wide range of fossils can be present in these surface deposits, including mammalian bones and teeth, tortoise remains and ostrich egg shells.

Palaeontological Sensitivity

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged (**Figure 38**). The different sensitivity classes used are explained in the full paleontological report in **Appendix D** of the Heritage Assessment Report**.**

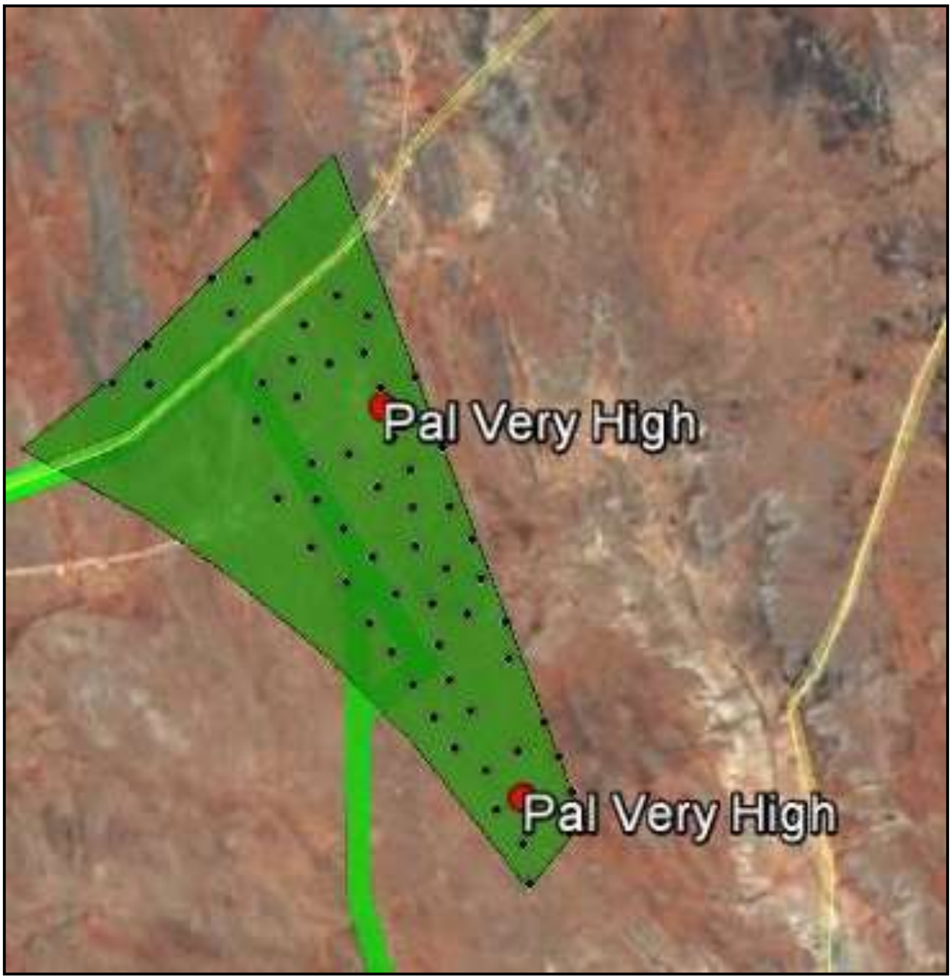


Figure 38: Palaeontological Sensitivity of the entire Study Area is presented. A Moderate sensitivity is allocated to all the geological formations except the two spring sites (Groenewald, 2016)

The Mokolian aged Uitdraai Formation, Carboniferous to Permian aged Dwyka Group and Quaternary aged Gordonia Formation underlying the alternative layouts for the Aletta as WEF areas and the power line corridors are similarly rated for Palaeontological Impact.

Exceptions are the two historic spring sites that are rated Very Highly sensitive for Palaeontological Heritage.

Archaeology

Most archaeological material in the Northern Cape is found near water sources such as rivers, pans and springs, as well as on hills and in rock shelters. Sites usually comprise of open sites where the majority of evidence of human occupation is scatters of stone tools (Parsons 2003). Evaluation of the alignment has identified possible sensitive areas.

The areas marked in brown (**Figure 41**) shows drainage lines and pans in the proposed development areas.

Since September 2011 a large number of Heritage and Archaeological Impact Assessments were completed in the vicinity of the proposed development area. Most notably the work of Orton (2011, 2012 and 2013), Kaplan (2010) and Kaplan and Wiltshire (2011) and Van der Walt (2012), has confirmed the statement by Parsons (2003), as noted earlier.

Figure 39: Early Stone Age stone toold found close to Kronos substation, just west of the study area

Orton (2012) notes that literature has shown that the Bushmanland area is littered by low density lithic scatters, with well weathered Early (ESA) and Middle Stone Age (MSA) artefacts dominating the assemblages. Orton's (2012 and 2013) and Fourie's (2012, 2013, 2015) work on the Klipgats Pan and Hoekplaas, has produced numerous find spots as well as clusters of site located on elevated terraces overlooking pan-like areas (identified as the drainage area as indicated in **Figure 41,** noted by Orton as being of LSA origin.

Fourie (2015) notes that findspots were mostly characterised by three types of setting, deflated red sands, and pebble concentrations associated with a calcrete exposure and non-deflated red sand exposures in between low-density vegetation.

The findspots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.

Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.

Figure 40: Close-up view of quartzite flakes and debitage at Kr_Cu/2012/003 (Debitage and lithics indicate by dots) a site situated some 500 meters to the east of the study area (Fourie, 2013)

Kaplan and Wiltshire's (2011) work to the north of the study area has confirmed the presence of Stone Age Sites with a high local significance rating with the sites at Modderpan and Saaipan covering ESA, MSA and LSA finds. A number of knapping occurrences and find spots were also made during the fieldwork.

Van der Walt (2012) indicates that the fieldwork done for the HIA on Bosjesmansberg, adjacent to the study area has shown a high incidence of low-density scatters all over the study area. Wiltshire (2011) indicates the presence of round stone built kraals, close or on low rises that could possibly be associated with herder activity.

6.13.2 Heritage sensitivities

The evaluation of the possible heritage resource finds and their heritage significance linked to mitigation requirements was linked to types of landscape. The heritage sensitivity rating does not indicate no-go areas but the possibility of finding heritage significant site that could require mitigation work.

6.13.3 Possible finds

Evaluation of aerial photography has indicated that certain areas may be sensitive from an archaeological perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 14**.

Table 14: Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

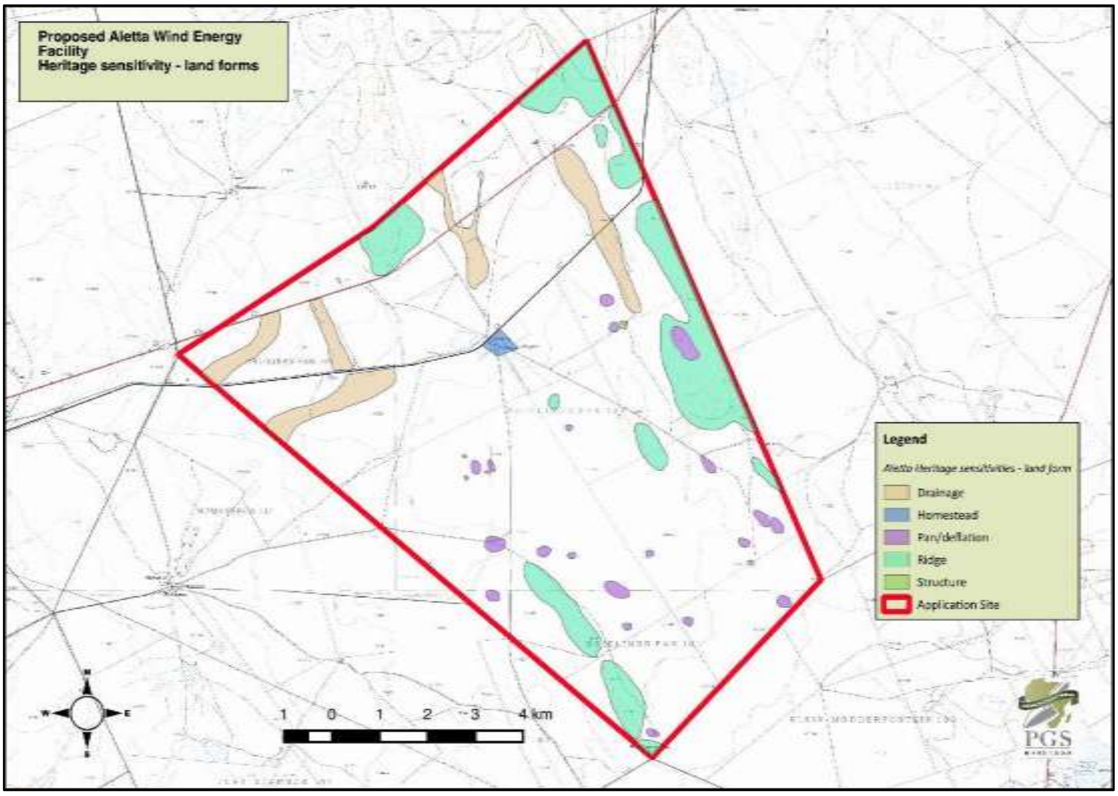


Figure 41: Possible heritage sensitive areas

6.14 Socio-economic Environment

The Socio-Economic Assessment was conducted by Elena Broughton and Memory Madondo from Urban Econ Development Economists. The full report is included in **Appendix 6I**. The environmental baseline from a socio-economic perspective is presented below.

6.14.1 Study area's composition and locational factors

- **Spatial context and regional linkages**

The Northern Cape Province is geographically the largest province in South Africa, covering an area of 372 889 km2, which constitutes approximately 30% of the country's total area. Despite having the largest surface area, the Northern Cape Province is the least populated of all nine provinces. According to Census 2011, the Province's population was 1 145 859, or 2.2%, of the national population. The Province is bordered by Namibia and Botswana in the north, while domestically, the North West Province borders it in the north-east, the Free State Province in the east, the Eastern Cape Province in the south-east, and the Western Cape Province to the south and south-west. The Northern Cape consists of five districts, namely Frances Baard, Pixley ka Seme, Namakwa, ZF Mgcawu (previously known as Siyanda) and John Taolo Gaetsewe.

The Pixley ka Seme DM, which lies in the south-east of the Northern Cape Province, is geographically the second largest of the five district municipalities in the Province and covers a surface area of 103 410 km^2. It is bordered by the Free State in the east, the ZF Mgcawu District in the north, the Eastern Cape Province to the south, and the Namakwa District in the west. The total population of the district according to the 2011 Census, was approximately 186 349, making it the municipality with the second lowest population in the Northern Cape.

The Siyathemba LM is located within the central eastern parts of the Northern Cape Province and is traversed from the east to west by the Orange River, South Africa's largest river. The municipality covers a geographic area of 14 725 km2. Prieska functions as the administrative seat of the local municipality. Other settlements include Marydale, Nierkerkshoop, and Copperton.

Spatially, Siyathemba is very distant from South Africa's largest consumer markets. The nearest major town to the site is Prieska, which has easy access to the main railway line running to Namibia and good tarred road connections to Upington, Kimberly, and De Aar.

- **Towns and settlements**

Copperton is the town located closest to the proposed project site. It was once a very populated area that housed nearly 3 000 miners and their families. As a result of the closure of the Copperton Mine, the population of the town dropped to 55 individuals (33 households) by 2011 (Stats SA, 2015). A few of the unoccupied houses are currently used by Denel SOC Ltd, which operates a missile testing centre in the area (Wikipedia, 2014).

The closest major town to Copperton is **Prieska**, which is situated approximately 50 km away. Prieska was originally named Prieskap, a Khoisan word meaning, "lace of the lost she-goat". Prieska is the administrative seat of the Siyathemba LM. It is located on the southern bank of the Orange River and is home to 14 248 people (Stats SA, 2015). While relatively isolated, Prieska has good access to the main railway line leading to Namibia, good tarred road connections to Upington, Kimberley and De Aar, and two landing strips for light aircrafts.

Marydale, situated 60km north-west of Copperton, is a rural service centre. **Nierkerkshoop**, another rural service centre, is located approximately 80km north-east of Copperton. Both of these settlements are largely underdeveloped and sparsely populated.

Figure 42: Settlements and towns near the project site (Siyathemna LM, 2015)

- **Locational factors and major tourism attractions**

Copperton can be accessed through the R357 from Prieska, which is a tarred road, as well as various dirt roads that stem from a north-westerly direction near the project site itself. These dirt roads lead to Marydale, but are not suitable for large traffic volumes; most motorists choose the tarred roads leading from Marydale to Prieska and then to Copperton. There are also tarred roads that lead to the military testing facility known as Alkantpan. From the aforementioned, it can be seen that access to the proposed location is limited to very few quality tarred roads and may need to be addressed when considering any further developments in the said area.

Generally, the area does not have any significant mineral deposits. To the south of Prieska, on the farm Doornfontein, a medium-sized mineral deposit of Phosphate can be found. Various small mineral deposits can be found near Niekerkshoop. These include Tiger's-eye and Crocidolite (i.e. asbestos). Small deposits of Alluvial Diamonds can be found in the Orange River. Other small mineral deposits within the municipal boundary include Salt, Gypsum, Iron and Uranium (Siyathemba LM, 2015).

The Orange River runs through the municipality and provides ideal conditions for irrigation farming and cultivation of grains and vegetables.

The following are the main tourism attractions in the region (Siyathemba LM, 2015):

- Die Bos Nature Reserve
- British Fort
- Green Valley Nuts
- The Oranjezicht and Keikamspoort Hiking Trails
- Khoisan Rock Art

- Memorial Garden
- Prieska Museum
- Ria Huysamen Aloe Garden Schumann Rock Collection
- Wonderdraai Island

6.14.2 Sense of place, history and cultural aspects

Copperton was once a populated town, providing accommodation for the mine workers and their families during the period from 1970 to the end of the 20th century. It was then sold to a private owner after the closure of the Copperton Mine and is currently on a long-term lease by the Request Trust. Some of the houses were initially demolished, but after the lease agreement was signed with the Request Trust, an agreement was reached that the rest of the houses could be retained and used for accommodation of occasional visitors that may visit the Alkantpan testing facility (Siyathemba LM, 2014).

The preferred language in the Copperton area is Afrikaans, followed by English. The immediate surroundings can be described as a sparsely populated, semi-desert natural region with little to no noise or visual pollution.

Prieska is a far more densely populated area than Copperton, and has its origins in the early 1800s when farmers used it as a place to stay when the nearby dry riverbeds were full. It was administered by a village management board from 1882 and attained municipal status in 1892 (Siyathemba LM, 2016).

The preferred language in the Prieska area is Afrikaans (Stats SA, 2015). The sense of place is again defined as a semi-desert, natural region but more densely populated with small levels of visual and noise pollution. Prieska also has rich heritage and memorial sites that include the Khoisan rock art, the British Fort and the Boss Nature Reserve that are all near the town.

Marydale was established by the Dutch Reformed Church in 1903, and named after the wife of Mr. GP Snyman who owned the farm on which the town was built (Siyathemba LM, 2016). The preferred language in the area is Afrikaans, with 96% of the population stating that it is their first language (Stats SA, 2015). The sense of place of the Marydale area and its immediate surroundings can again be defined as a sparsely populated, semi-desert natural region with little to no noise or visual pollution.

Niekerkshoop was laid out on the farm Modderfontein in 1902 as an Asbestos mining centre. The village management board has administered it since 1904 (Siyathemba LM, 2016). The preferred language in the area is Afrikaans, with 95.8% of the population stating that it is their first language (Stats SA, 2015). The sense of place of the Niekerkshoop area and its immediate surroundings can again be defined as a sparsely populated, semi-desert natural region with little to no noise or visual pollution.

6.14.3 Demographic Profile

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential in gaining an accurate perspective of those who are likely to be affected by any prospective development or project.

- **Population demographics**

The Siyathemba LM is home to approximately 21 593 people, with a total of 5 830 households (Stats SA). The population has increased by 14.9% from 18 376 in 2001. A large portion (87.2%) of the population in the LM resides in urban areas, while the rest (12.8%) lives on farms. Both urban to urban migration and rural to urban migration are relevant in the Pixley ka Seme region, including the Siyathemba LM. Rural to urban migration is perceived as the dominant migration type at present (Pixley ka Seme District Municipality, 2014/15). The large proportion of people living in the urban area can be explained by the ease of access to opportunities and services within the larger urban centres, in this case Prieska. The majority (72.2%) of the people in the municipality are Coloured with 18.5% of the population being Black, followed by White 8.4%), and Indians/Asians (0.5%). Afrikaans is the language most spoken in the LM. The municipality's sex ratios are just slightly skewed, the female population (50.1%) accounts for slightly more of the LM's population compared to the male population (49.9%).

The youth (age 15-34) make up the majority of the people living in the Siyathemba LM with 31.7%, followed by the group between the ages of 35 and 64 with 31.4%. Considering the working age group that is between the ages of 15 and 64, the municipality has a slightly bigger percentage of working age males than females (**Figure 43**). The population in the area is characterised by a high dependency ratio (58.5%) with a total of 36.8% of the population within the ages of 0 to 14 (30.6%) and over 65 years old (6.2%). According to the district municipality's IDP, the implications of this population structure are a higher demand on the provision of social and physical facilities, like schools, primary health care centres, etc.

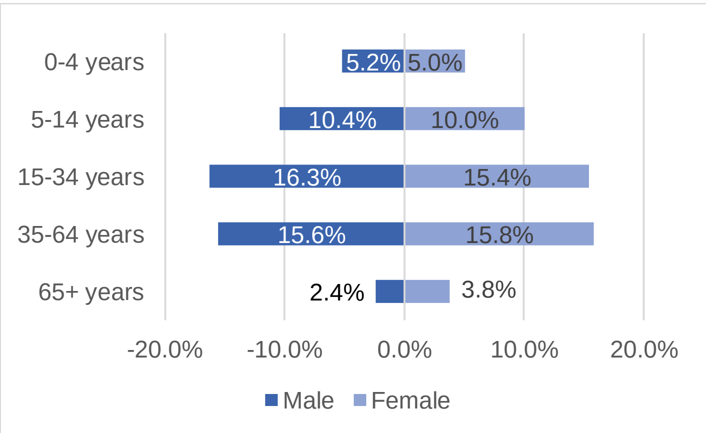


Figure 43: Age and gender profile

At community level, Prieska has a population of 14 248 people with 3 462 households. As mentioned previously, Afrikaans is the preferred language, with 92.6% of the population using it as their First Language. Additionally, 4.4% of the population speaks Xhosa while only 1% speaks English. As is the case at municipal level, the majority (67.7%) of the people in Prieska are Coloured with 23.4% of the population being Black and 8% being White. There are slightly more females (51.2%), than males (48.8%) in the Prieska community. The community's dependency ratio (59%) is on par with that of the LM.

- **Health demographics**

The effect that the HIV virus has had on the DM and LM is less profound than in the rest of South Africa and the Northern Cape Province, but the number of HIV cases and AIDS-related deaths have increased more rapidly in the last 15 years when compared to national and provincial averages.

Table 15: Population, HIV positives, AIDS and other deaths (2015)

Indicator	South Africa	Northern Cape	Pixley ka Seme DM	Siyathemba LM
Population	54 956 509	1 175 780	192 549	22 448
HIV positive	6 248 908	86 146	11 517	1 204
AIDS deaths	206 761	2 360	227	26
Other deaths	444 866	9 729	1 581	186

(Quantec, 2016)

The Siyathemba LM had a reported 1 204 individuals that were HIV positive in 2015, which equates to 5.3% of the total LM population. The percentage is far less than the National and Provincial levels at 11.3% and 7.3% for both provincial and national population, respectively. Total AIDS-related deaths equated to 26 individuals in the LM, or 0.1% of the LM population, which is again below the National and Provincial averages of 0.3% and 0.2% respectively. The AIDS-related LM deaths also equate to 12.2% of total deaths in the LM, which is lower than the national and provincial figures of 31.7% and 19.5%, respectively.

Since the year 2000, the number of people living with HIV has increased from 350 individuals in 2000 to just over 1 200 people in 2015. This indicates a near 250% increase in ten years, which is far more when compared to national and provincial averages (Siyathemba LM, 2015).

- **Crime demographics**

Table 16: Crimes reported by crime type (2015)

Crime types	South Africa	Northern Cape	Pixley ka Seme DM	Siyathemba LM
Serious crimes	2 209 068	57 817	9 720	1 146
✓ **Community reported crimes**	2 068 261	54 724	8 952	1 052
✓ **Crimes dependent on police action for detection**	140 807	3 093	768	94

The Siyathemba LM recorded 1 146 cases of serious crimes in 2015, of which 1 052 were reported by the community and 94 identified by police. Assault with the intent to inflict grievous bodily harm was the most common reported crime with 253 cases, followed by common assault with 112 cases and finally burglary at residential premises with 54 cases reported. Furthermore, 53 cases of stock theft were recorded in the LM, which can be attributed to the large number of stock farming occurring in the area. Drug-related cases were less prevalent in the LM, with only 4% of reported cases being drug-related. This figure is 5% less than the District figure and 3% less than the provincial figure.

6.14.4 Economy

The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors.

- Size and Contribution of local Economy

The local economy is analysed at the municipal level as this is the lowest level to which economic data is available. In 2013, the Siyathemba LM economy was valued at R 796 million in current prices. The LM contributed 10.9% to the economy of the Pixley ka Seme District and made a contribution of 1.2% to the province's economy.

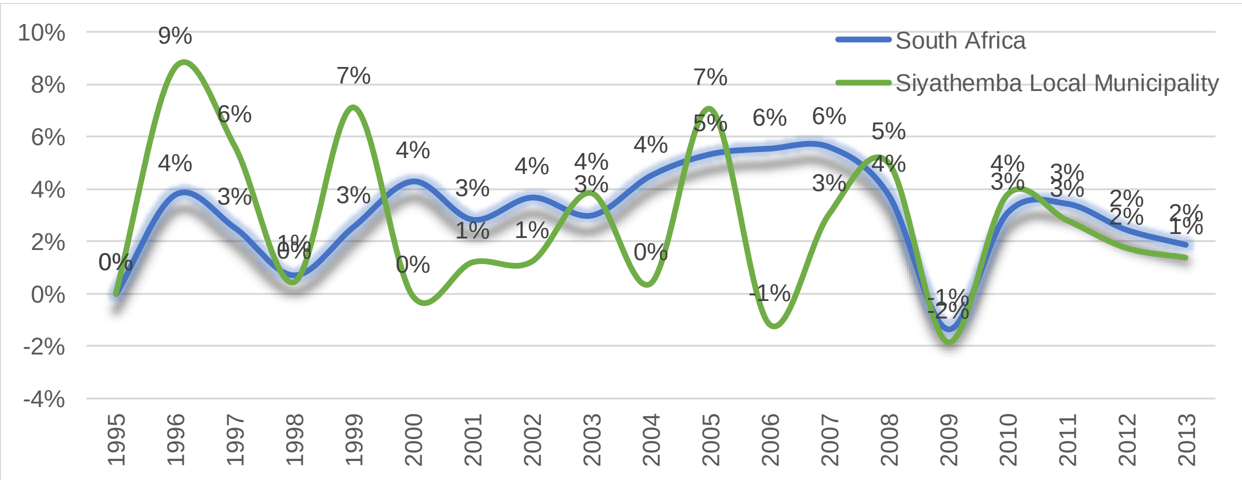


Figure 44: Growth rates for SA and Siyathemba LM (1995 – 2013) (Quantec, 2016)

High dependence of the LM on mining activities in the late 1990s and early 2000s, whilst targeting international commodity markets, resulted in the local economy being highly susceptible to economic dynamics globally. **Figure 44** illustrates that the Siyathemba economy is significantly more volatile than that of South Africa. This is largely due to the dependency of the local economy on the global demand for commodities as well as the stability of the industry internally (i.e. from a labour issue perspective).

The mining sector historically played a major role in the local economy, with asbestos and copper mining the key activities. Currently, mining activities are mainly related to alluvial diamond mining activities along the Orange River. The closure of the asbestos mines as well as the Copperton mine has had a major lasting negative impact on the Siyathemba LM economy, reducing the size of the mining industry from R47 million in 2003 to R9 million in 2013.

In 2009, as a result of the financial crisis globally, the economy contracted by 2%, but was able to recover somewhat in the following year. Sectors most heavily affected but the crisis included the wholesale and retail trade as well as the mining sectors.

- **Structure of the economy and dynamics**

The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector is also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors.

Table 17: The Northern Cape and Siyathemba LM structure of economies (2013)

Economic Sector	Northern Cape (GDP in 2013 prices)			Siyathemba LM (GDP in 2013 prices)		
	GDP (R'ml)	% of GDP	CAGR (2004 - 2013)	GDP (R'ml)	% of GDP	CAGR (2004 - 2013)
Agriculture	3 674	5,4%	2,5%	132	16.7%	6.3%
Mining and quarrying	21 399	31,2%	-1,2%	25	3.1%	-15.3%
Manufacturing	1 676	2,4%	3,7%	29	3.6%	8.0%
Electricity, gas and water	1 708	2,5%	1,0%	18	2.3%	-2.8%
Construction	1 183	1,7%	5,9%	34	4.3%	6.7%
Trade	8 600	12,5%	2,7%	119	14.9%	-0.7%
Transport and communication	5 393	7,9%	3,0%	27	3.4%	-1.8%
Finance and business services	8 406	12,2%	4,4%	178	22.4%	5.2%
Personal services	6 195	9,0%	3,3%	113	14.2%	3.7%
General government	1 0423	15,2%	3,4%	63	15%	2.8%
TOTAL	**68 656**	**100,0%**	**2,1%**	**119**	**100,0%**	**12%**

(Quantec, 2016)

In terms of economic activities, the economy of the Northern Cape Province depends heavily on the primary sectors of the economy (agriculture and mining), which made up 31.2% of GDP-R in 2013. The largest sector is mining, which has been fluctuating between periods of growth and decline in contribution to the GDP-R. Agriculture, on the other hand, has declined in contribution from 8.7% in 2002 to 5.4% in 2013. Over a period of ten years (2003-2013), the LM's economy grew at a Compounded Average Growth Rate (CAGR) of 2.4% per year. This was slightly higher than the district and provincial average growth rates of 1.8% and 2.3%, respectively.

Contrary to the Province's economy, mining and quarrying continues to be a small contributor to the economy of the LM, making a meagre 3.1% contribution compared to the Province's 31.2%. This is a result of the decline in the mining industry mentioned above, and is further illustrated by a negative CAGR of 15%

in the last ten years (see Table 3-3). On the other hand, the agricultural sector makes a significant contribution of 16.7%; making it the second largest single contributor after finance and business services (22.4%).

The agricultural sector has also shown steady growth in the last ten years with a CAGR of 6.3%, while finance and business services showed a 5.2% CAGR for the same period. The most extensively cultivated crops in the municipality are maize, wheat, peanuts, lucerne and table grapes. Stock farming activities are mainly based on sheep and goats. Another sector that has shown noteworthy growth is manufacturing with a CAGR of 8% over the last ten years, which is the highest of all the sectors. It also contributes 4.8% to the LM's GDP. Overall, the economy of the Siyathemba LM is a service economy with the tertiary sector contributing 70% to the municipality's GDP-R.

6.14.5 Labour Force and Employment Structure

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being.

- **Labour Force Composition**

The labour force consists of employed and unemployed persons. The Not Economically Active (NEA) portion of the population includes people that are not working as a result of choice, age or other circumstances. The unemployment rate indicates the percentage of unemployed individuals that form part of the labour force. It does not include discouraged job seekers, though this group of people will also be mentioned later in this section.

The Census 2011 data indicates that the Siyathemba LM had about 13 656 people in the working-age population. This amounts to 63% of the total population. Of these, 7 113 people were economically active, while roughly 48% of the working age population were not economically active (NEA); that is, persons aged 15–64 years who are neither employed nor unemployed at the time of the survey, including discouraged job seekers. The employed labour in the LM was estimated at 5 356, while the unemployed population was estimated at 1 757, reflecting an unemployment rate of 24.7%. This was lower than the country's unemployment rate of 29.7% and lower than the provincial unemployment rate that was recorded at 27.4%.

As indicated in the table below, the town of Prieska had 3 094 of the working age population employed, with 1 212 of them unemployed. This means that 28.1% of the labour force in Prieska was unemployed. On the other hand, 4 672 of the working age population was not economically active. In the smaller towns, the unemployment situation was worse, with unemployment rates of 41% and 33.6% in Marydale and Nierkerkshoop, respectively (Stats SA, 2014). The Copperton community is very small and isolated from employment opportunities and amenities, but shows a 0% unemployment rate that can be attributed to the extremely small labour force and working age population in the area.

Table 18: Labour profile of the Siyathemba LM (2011)

Town/settlement	Working age	Labour force			Discouraged job seekers	Unemployment rate
		Employed	Unemployed	Total		
Copperton	40	16	-	16	7	0%
Marydale	1 507	297	207	504	100	41.1%
Niekerkshoop	1 115	472	239	711	12	33.6%
Prieska	8 978	3 094	1 212	4 306	578	28.1%
Siyathemba NU	1 972	1 463	81	1 544	77	5.2%
Westerberg	44	14	18	32	0	56.3%
TOTAL	**13 656**	**5 356**	**1 757**	**7 113**	**774**	**24.7%**

(Stats SA, 2015)

- **Employment structure**

More than three quarters of the employed individuals in the Siyathemba LM were employed in the formal sector, and only 10.8% were employed in the informal sector. Private households provided for 11.8% of the employment opportunities in the municipality.

In Prieska, 76.7% of the employment opportunities were provided by the formal sector, and only 10.8% came from the informal sector (see **Figure 45**). In Marydale, 71.4% of the employed population is employed in the formal sector, while only 66.2% of the Nierkerkshoop employment opportunities come from the formal sector. A significant percentage (18.9%) of Nierkerkshoop's employment opportunities come from the informal sector, while the same sector contributes only 15.3% towards employment in Marydale (Stats SA, 2015). In Copperton, 73.7% of the employment opportunities were provided by the formal sector, with 12.4% coming from the informal sector and 11.5% being private households.

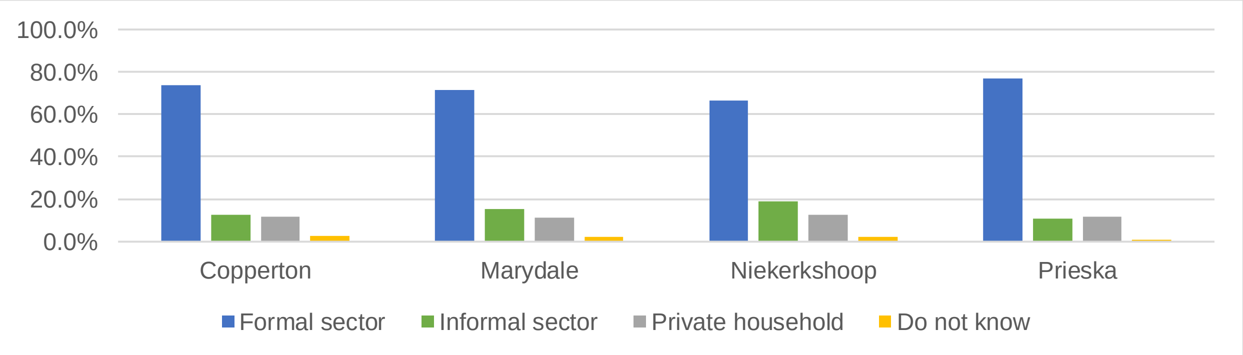


Figure 45: Regional employment by sectors (Stats SA, 2015)

The tertiary sector is the largest contributor to formal and informal sector employment with 57.4% of opportunities offered by said sector. This is followed by the Primary sector with 28.3% and the secondary sector with 14.2%. The high tertiary sector figure is somewhat inflated by the community, social and personal services; and the general government industries that make up half of the tertiary sector. Considering the aforementioned, the main contributor to employment becomes the primary sector.

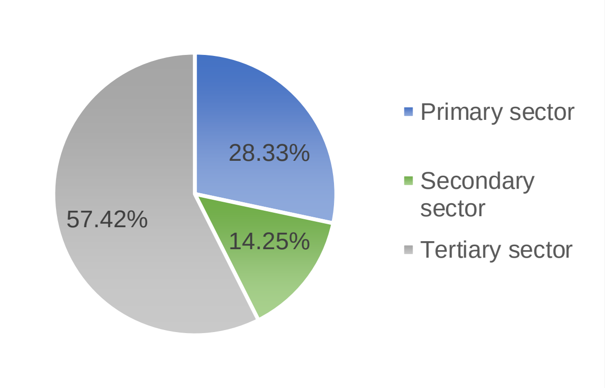


Figure 46: Siyathemba LM sectoral employment (Quantec, 2016)

In terms of the structure of employment, the agricultural sector was the most important economic sector not only in the LM but in the district as well. In the Siyathemba LM, the sector contributed 27.8% of the total employment opportunities, while creating 27.1% of employment opportunities in the Pixley ka Seme District. This was followed by personal services and general government. These figures are almost similar to those of the province but general government is the largest contributor to employment in the Northern Cape Province. **Table 19** below indicates the contribution of economic sectors to employment in the district and the LM.

Table 19: Employment by economic sectors in Pixley ka Seme DM and Siyathemba LM

Economic Sector	Pixley ka Seme DM Employment		Siyathemba LM Employment	
	Employment	%	Employment	%
Agriculture	12 587	27.1%	1 637	27.8%
Mining and quarrying	342	0.7%	32	0.6%
Manufacturing	1 354	2.9%	219	3.7%
Electricity, gas and water	358	0.8%	24	0.4%
Construction	2 813	6.1%	596	10.1%
Trade	6 491	14.0%	774	13.1%
Transport and communication	839	1.8%	50	0.8%
Finance and business services	5 357	11.6%	751	12.8%
Personal services	8 489	18.3%	921	15.6%
General government	7 756	16.7%	888	15.1%
TOTAL	**46 387**	**100%**	**5 892**	**100%**

(Quantec, 2016)

Formal sector employment for the LM consists of mainly semi- and unskilled workers, with 82.9%, followed by skilled workers with 17.1%. This is in alignment with the district averages that show almost the same figures for each skill level (see **Table 20**).

Table 20: Employment by skill level and occupation inPixley ka Seme and Siyathemba

Skills	Pixley ka Seme DM Employment		Siyathemba LM Employment	
	Employment	%	Employmen t	%
Skilled	**7 950**	**18.2%**	**923**	**17.1%**

Skills	Pixley ka Seme DM Employment		Siyathemba LM Employment	
	Employment	%	Employmen t	%
• Legislators, senior officers and managers	2 782	6.3%	338	6.3%
• Professionals	1 733	4%	241	4.5%
• Technicians and associate professionals	3 435	7.9%	344	6.4%
Semi-skilled	**19 734**	**45.1%**	**2 371**	**43.92%**
• Clerks	4 557	10.4%	395	7.3%
• Service workers and shop and market sales workers	6 103	14%	775	14.4%
• Skilled agricultural and fishery workers	2 459	5.6%	309	5.7%
• Craft and related trades workers	4 258	9.7%	498	9.2%
• Plant and machine operators and assemblers	2 354	5.4%	394	7.3%
Unskilled	**16 086**	**36.8%**	**2 105**	**39%**
• Elementary occupations	16 086	36.8%	2 105	39%
TOTAL	**43 770**	**100%**	**5 398**	**100%**

(Stats SA, 2015)

Table 20 illustrates that elementary occupations represent the biggest single group of skills observed in the municipality, which is in line with the formal employment and economic profile of the area requiring labourers in the agriculture, mining and other industries. Services workers and shop sales workers, as well as craft and related trade workers represent the second and the third largest group of formal occupation in the area. This again fits the profile of the local economy, where the former is largely engaged in the trade and personal services sector, while the latter is involved in the agricultural and mining industries.

6.14.6 Income

The average monthly household income in the Siyathemba LM was R6 858 in 2014 prices. This was less than the national, provincial and district levels, which had average household incomes of R9 743, R8 116 and R7 030, respectively. Overall, approximately two thirds of the population in the Siyathemba LM earns up to R3 200 a month; this is larger than the same group at district and provincial level. According to the Pixley ka Seme IDP, the cut-off monthly household income for indigence in the Siyathemba LM is R1 500. This refers to those households who, due to a number of socio-economic factors, are unable to afford basic services such as water, basic sanitation, basic energy, health care, housing, food and clothing. From income data obtained in the 2011 Census, approximately 39.4% of the households would qualify as indigent in the local municipality.

Table 21: Household per monthly income groups (2011)

Indicator	Siyathemba LM	Towns/main places in the Siyathemba LM					
		Copperton	Marydale	Niekerkshoop	Prieska	Siyathemba NU	Westerberg
No income	7.1%	25%	9.1%	10.6%	8%	3.8%	0%
R1 – R3 200	62.9%	25%	49.5%	76.1%	55.56%	77%	100%
R3 201 – R6 400	10.9%	0%	18.5%	3.8%	14.6%	4.3%	0%
R6 401– R12 800	9.1%	25%	12.1%	3.3%	12.3%	3.7%	0%

R12 801– R25 600	5.9%	25%	4.7%	3.8%	6.4%	5.8%	0%
R25 601– R51 200	1.3%	0%	0%	0%	1.7%	1.5%	0%
>R51 200	0.3%	0%	0%	0.8%	0.2%	0.5%	0%

(Stats SA, 2015)

Table 21 shows the income spread for the various settlements/towns in the Siyathemba LM. Niekerkshoop is by far the poorest community of the delineated areas, with nearly 87% of its population earning less than R3 200 a month. This is followed by Prieska with 64% and Marydale 58.6% for the same income spread. Copperton shows that 50% of its population lives below the R3 200 income level, which is far less than other delineated areas. This can be attributed to the small population size that exists in Copperton.

In terms of education levels in the LM, 11.5% of the adult population (over 20 years of age) had no education at all, while 64% have primary or secondary education (Stats SA, 2015).Those with higher educational qualifications accounted for 5.5% of the population. These figures indicate an increase in all categories since 2001, except for the no schooling, some primary and some secondary categories. In general, there has been an improvement in the educational qualifications of the labour force in the local municipality. The "no schooling" category decreased by 10%, indicating a higher percentage of people attending school. While the share of people with no schooling at district level is 14.1%, the percentage of people with no schooling is notably lower at provincial (11.1%) and LM (11.5%) level. Additionally, the number of people who have completed matric in Siyathemba is 17.3%, which is lower than the 20% and 22.1% at district and provincial levels, respectively.

The relatively low level of education in the LM is supported by the economic profile that exists in the region. The dependence of household income on the Agricultural, and Wholesale and retail trade sectors would act as a disincentive for further higher education studies, as sectors that support such employment are not well developed in the area.

6.14.7 Access to Services and State of Local Built Environment

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure is another indicator to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities further indicates the nature of the study area, which is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against which the potential impacts of the proposed project can be assessed.

- **Settlement Profile**

The Siyathemba LM is characterised by a low population density when compared to the national level (about 42 people/km2). However, the municipal population density is half that of the Province but nearly the same as the district.

Table 22: Population density of Siyathemba LM (2011)

Indicator	Siyathemba LM	Towns/main places in the Siyathemba LM					
		Copperton	Marydale	Niekerkshoop	Prieska	Siyathemba NU	Westerberg
Population total	21 593	55	2 622	1 829	14 248	2 765	74
Area (Sq. Km)	14 725	71	63	31	196	14 355	9
Population density	1.5	0.8	41.4	59	72.9	0.2	8

(Stats SA, 2015)

Population densities for the entire LM are extremely low, showing 1.5 individuals for every square kilometre. When focusing on the towns, it can be seen that Copperton is one of the most sparsely populated towns in the entire LM, showing 0.8 individuals for each square kilometre. Prieska is by far the most densely populated town in the LM, showing nearly 73 individuals for every square kilometre. This fact, coupled with its high population, indicates that it is the commercial hub for the LM. The large agriculture sector that exists in the LM supports the low population densities in the settlements, as large portions of land are used for sheep farming.

- **Access to Housing and Basic Services**
  - Housing

Approximately 85% of the households in the Siyathemba LM reside in formal housing in the form of a house or other brick structures on a separate stand or yard. 14.3% of the households live in informal dwellings. Furthermore, 0.7% of the municipality's households live in traditional dwellings. These numbers are similar to those of Prieska, with about 85.3% households living in formal dwellings, while 14.5% live in informal structures.

The allocation of funds for the Siyathemba Municipality is relatively small. The Municipality is therefore, struggling to address the housing need in the area. With the Housing Allocation to date, the LM managed to build 223 new RDP housing units in Prieska. New applications have been submitted to COGHSTA (Co-operative Governance, Human Settlements and Traditional Affairs) for 310 RDP units in Prieska, 55 in Marydale, and 54 in Niekerkshoop (Siyathemba LM, 2015).

  - Access to water

In terms of access to piped water, 88.7% of the households in the municipality have access to piped water either inside the dwelling or in the yard. The picture improves in Prieska, where 94.9% of the households have access to piped water inside their dwellings or yard. Only 1.2% of the households in the town do not have access to piped water at all. In terms of the supply, the bulk of the water in the LM is supplied by the municipality or other service providers. In Prieska, close to 97% of the households' water is supplied by the municipality or other water service providers, while in the non-urban areas of the municipality only 1.1% of water is supplied by bulk water infrastructure connections. Two thirds of the households in non-urban areas used boreholes (Stats SA, 2014). The district's IDP notes that water provision and availability is one of the issues that will have to be addressed in order to improve the economic activity in most towns situated within the Pixley ka Seme District Municipal area (Pixley ka Seme District Municipality, 2014/15).

Bulk water supply for Prieska is sustainable, while bulk water supply for Marydale and Niekerkshoop is expected to become a problem within the next 15- 18 years. Therefore, new bulk water supply studies have been commissioned for Niekerkshoop, which is expected to experience water shortages first (Siyathemba LM, 2015). The town of Stella is not connected to the sewer network.

- Access to sanitation

If not properly managed and monitored, sewerage and sanitation are basic needs of communities that can pose serious health and hygiene risks. 71.2% of the households in the Siyathemba LM had access to a flushing toilet, while 16.8% of the households used pit latrines. Approximately 7.7% of families have no access to toilet facilities and 3.8% is still using the bucket system. According to the Siyathemba LM IDP, the municipality has a sanitation backlog of 470 households.
During the 2011/12 financial year, the Municipality received funds from DWA through the Accelerated Community Infrastructure Programme (ACIP). This grant was utilised to refurbish sanitation infrastructure and equipment. The following projects were set in motion but no information was available on which had been completed:

- Prieksa:
  - Purchase of two (2) standby sewer pumps
  - Refurbishment of sewer take intake
  - Replacement of manhole covers at main sewer pump sets

- Marydale:
  - Refurbishment of sewer tank intake
  - Refurbishment / replacement of night soil suction tanker
  - Fence oxidation pond area

- Niekerkshoop:
  - Refurbishment of sewer tank intake into oxidation ponds
  - Refurbishment / replacement of sewer tanker

- Access to electricity

The indicator “energy for lighting” was used as a proxy for measuring households’ access to electricity. The majority of households (86.3%) in the municipality have access to electricity, while 13.7% use alternative forms of energy for lighting; mainly candles (11%).

The Municipality has developed an Electricity Master Plan in the early 2000s. The Municipality works according to this plan to upgrade electricity infrastructure, as well as to develop new infrastructure (Siyathemba LM, 2015).

- **Transport Infrastructure**

Spatially, Siyathemba is very distant from South Africa's largest consumer markets. It is located some 182km from De Aar (administrative seat of the Pixley ka Seme DM) and 236km from Kimberley. The area is traversed by the R357, which links the site to Prieska. Prieska has easy access to the main railway line en route to Namibia, and good tarred road connections to Upington, Kimberly and De Aar.

Copperton can be accessed through the R357 from Prieska, which is a tarred road, as well as various unnamed dirt roads that stem from a North Westerly direction near Aletta itself. These dirt roads lead to Marydale but are not adequate for large traffic volumes and many vehicle drivers choose the tarred roads from Marydale to Prieska and then to Copperton. There are also tarred roads that lead to the Alkantpan military testing facility. From the aforementioned it can be seen that access to the proposed location is limited to very few quality tarred road and may need to be improved when considering any further developments in said area.

The rural nature of the area impacts on the modes of transport relied on by local population for travelling from and to work. The Northern Cape Province has the largest percentage of people compared to other Provinces who "walk" to and from work (Department of Transport, 2013). Those who rely on some mode of transportation for travelling to and from work mainly make use of private transport. Public transport is the mode of choice among a relatively small percentage of people living in the Province. All of the above suggests that the local area is likely to have limited access to public transport due to relatively low population densities.

- **Social and Recreational Infrastructure**

The Siyathemba LM has the following social and recreational infrastructure available:

- Where education facilities are concerned, the municipality has one crèche, 6 primary schools and 3 combined schools, and one secondary school.
- The municipality has five community halls.
- There are four libraries in the municipality.
- Recreational facilities are available in each of the three towns
- There is a police station in each of the three towns (Marydale, Prieska and Nierkerkshoop)
- There are five health facilities in the municipality, i.e. one hospital, three clinics and a mobile clinic. It is indicated that the main challenge is the lack of ambulance services in Nierkerkshoop (Siyathemba Local Municipality, 2014).

6.15 Traffic

The Traffic Assessment was conducted by Dirk van der Merwe of BVi Consulting Engineers. The full report is included in **Appendix 6J**. The environmental baseline from a traffic perspective is presented below.

The turbine components will be transported to the Drielings Pan facility over a distance of between 900km to 1200km and 770km, from Saldanha harbour or Coega harbour, respectively. A number of routes were identified for the transport of the turbines and is indicated below.

The delivery of materials such as cement, aggregate and sand will in all probability be from Upington along the National Route N10. Steel will be delivered from either Gauteng via the N12 or Cape Town via the N1 and N12.

It is assumed that labour will commute from Prieska as it is the nearest town to provide amenities.

6.15.1 Route Alternative 1 – Saldanha to Aletta WEF via Loeriesfontein (1222km)

This route may be one of the preferred options as it avoids the Van Rhyns Pass and the Piekenierskloof Pass. Some route clearing may be needed with certain portions of the route already cleared for other wind energy projects. There is a railway bridge on the N7, located approximately 42km southeast of the town of Nuwerus. This may be a possible obstruction and in order to avoid this section, an application to use the facility road adjacent to the N7 must be investigated. The route overview is shown in **Figure 47** below.

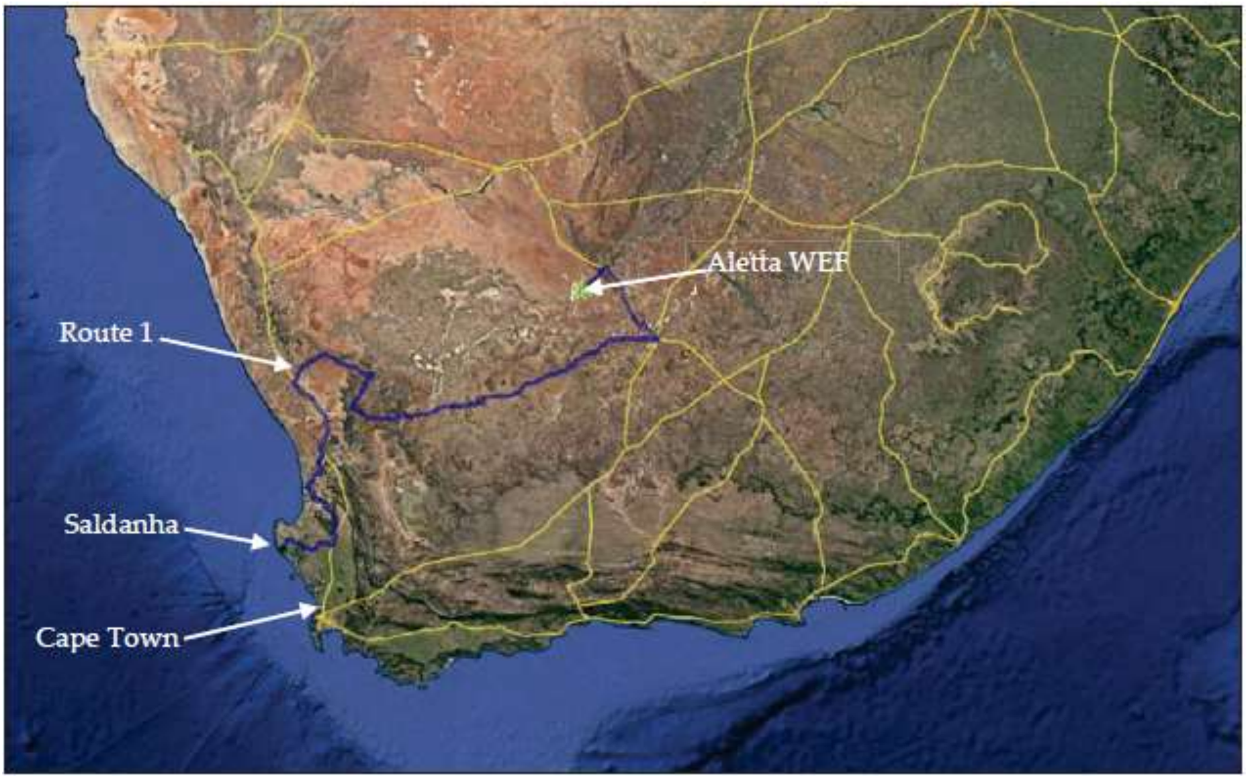


Figure 47: Transportation Route 1

6.15.2 Route Alternative 2 – Saldanha to Aletta WEF via Vanrhynsdorp (1018km)

The Vanrhyns Pass is not easily traversable by abnormal load vehicles and is therefore not a feasible nor recommended route. The route overview is shown in **Figure 48** below.

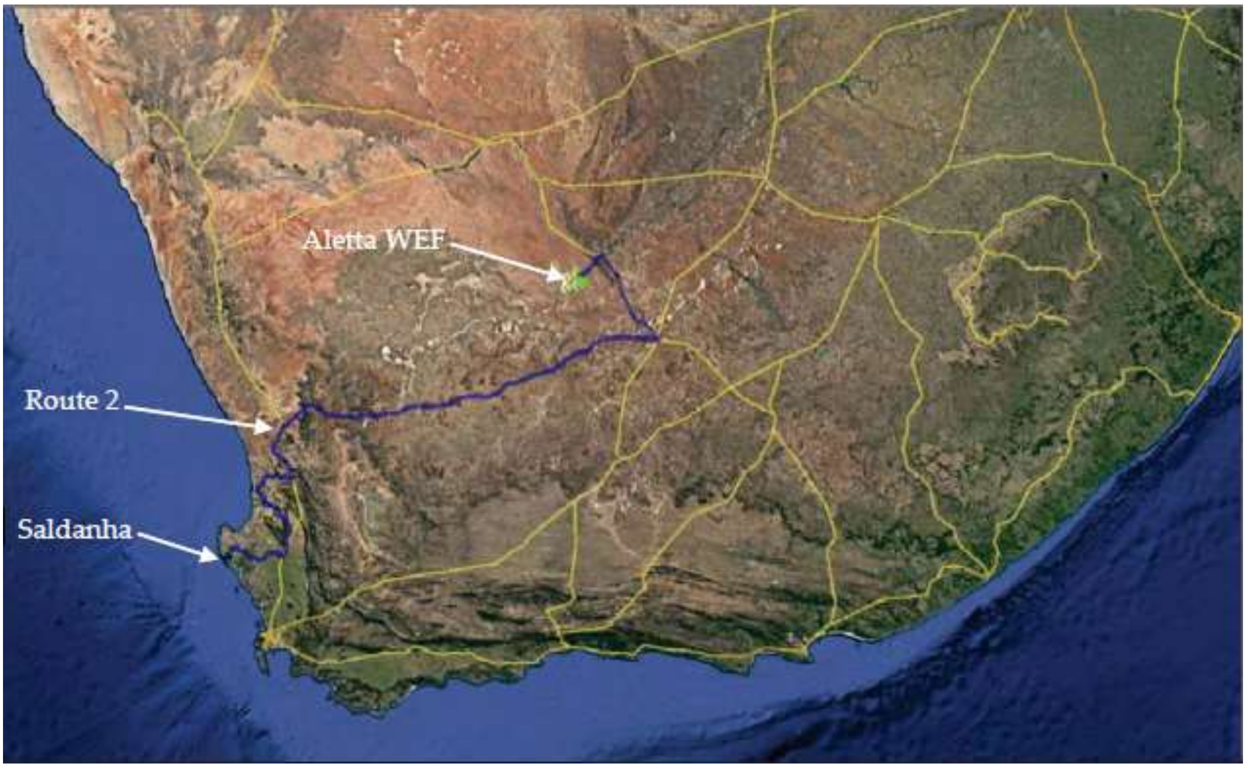


Figure 48: Transportation Route 2

6.15.3 Route Alternative 3 – Saldanha to Aletta WEF via National Route N1 (950km)

There are a number of non-traversable obstacles on this route such as interchange bridges and pedestrian bridges which will make this route not feasible. The route overview is shown in **Figure 49** below.

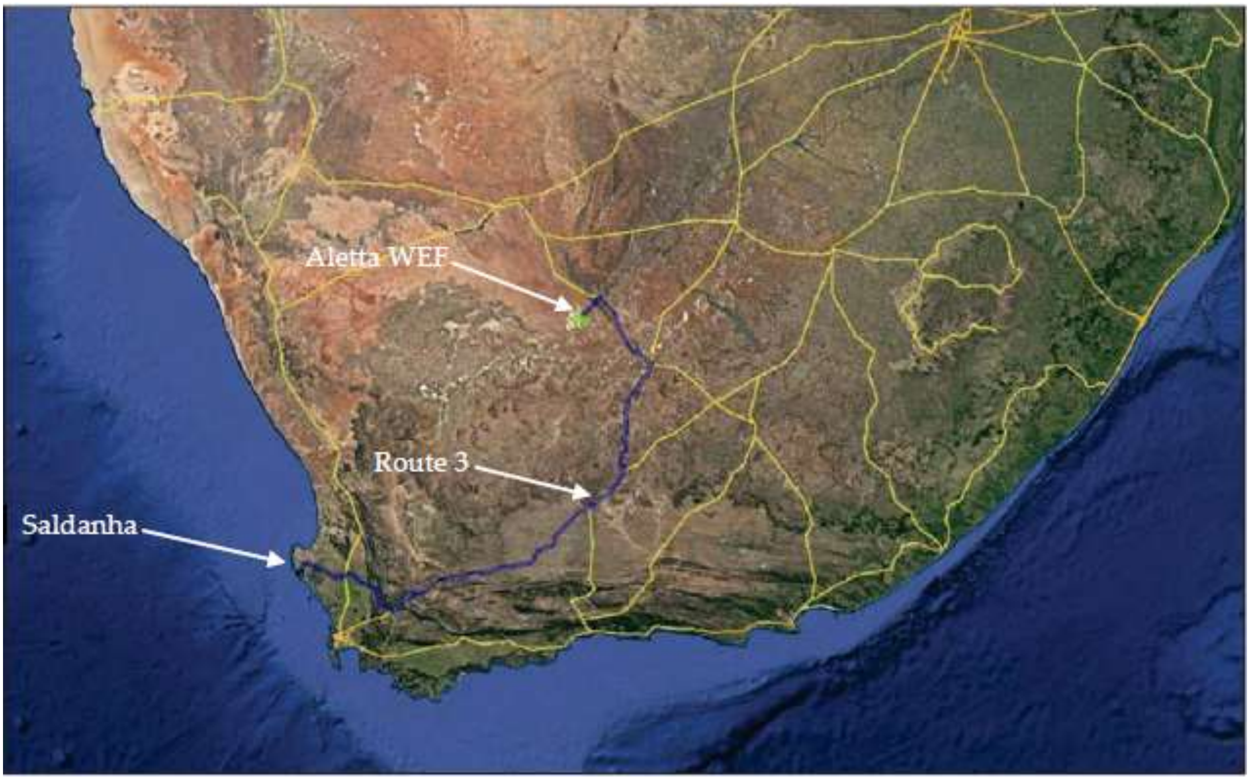


Figure 49: Transportation Route 3

6.15.4 Route Alternative 4 – Coega to Aletta WEF via National Route N10 (778km)

This route may be the preferred option as it doesn't have any gravel roads and is much shorter than the other alternatives. Some route clearing may be needed with certain portions of the route already cleared for other wind energy projects. The route overview is shown in **Figure 50** below.

Figure 50: Transportation Route 4

6.15.5 Route Clearance

The vehicles used to transport the wind turbine equipment are abnormal load or oversize vehicles. Combinations or minor alternative sections may be needed. The transport route must however be cleared and all relevant permits obtained prior to the transport activities taking place. Other alternative may also be possible which could reveal itself during the route clearance process.

6.15.6 Trip Generation

- **Current AADT on Affected Route**

It is assumed that the portion of average daily traffic that occur during the design hour (30th highest volume) is no more than 10% (K=10). TRH17: Geometric Design of Rural Roads provides service volumes for LOS B to be retained, which translates to 4900vpd as an estimated maximum average annual daily traffic (AADT7) for two lane rural highways. A number of dual carriageway sections are located on both Route 1 and Route 4, mainly near the ports of origin, being Saldanha or Coega. For equivalent levels of service to be retained on these dual carriageway sections an upper limit of 23300vpd is estimated.

It is clear that the roadways affected by the component delivery are operating well within the level of service parameters. The average heavy vehicle volume along Route Alternative 1 is 20%. It is also clear that the current daily volumes are well within its limits and that the roadways are operating with an abundance of additional capacity. The average heavy vehicle volume along Route Alternative 4 is 22%.

- **Expected Trip Generation during Construction**

From the above information it is calculated that the development will generate 6845 trips over an 18 month period. The trips generated by the construction activities are mainly due to the transport of components and materials. The assumed construction period is deemed to be quite short in terms of other contracts currently under way. This however will provide a conservative result in terms of the generated traffic per day.

It was assumed that two (2) turbines will be delivered to site each week which roughly equates three (3) deliveries per day. Fifteen normal heavy and light vehicles will also travel to and from site daily but, over a much shorter distance. The latter was therefore only added to the traffic on the N10.

- **Expected Trip Generation during Operation**

The operation and maintenance personnel will in all probability be stationed in the town of Prieska. It is envisaged that a very small number of trips would be generated to the site each day. These trips would however be of no significance to the road network.

- **Expected Trip Generation during Decommissioning**

It can be assumed that the decommissioning trip generation would be equal to that of the construction and installation with full loads running in the reverse direction. The road network would need to be assessed at that stage.

6.15.7 Site Access Route

Access to the site will be via an existing gravel track off the R357, which is currently the farmer's access road, approximately 34km from the N10 intersection. This gravel road will need upgrading and extension and will need to be suitably maintained. Re-gravelling may be necessary as a maintenance measure, from time to time, throughout the operational life of the plant.

Sight distance at the access is more than adequate and the pavement structure seems to be sound and with little to no defects. However, should damage be caused by the transport vehicles along this roadway, it should be assessed and mitigating maintenance should be initiated.

6.16 Electromagnetic Interference Path Loss and Risk Assessment

The Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan) was conducted by C Fouché of Interference Testing and Consultancy Services (ITC). The full report is included in **Appendix 6K**. The environmental baseline from an electromagnetic interference perspective is presented below.

An area, 20km east of Copperton in the Northern Cape Province, has been identified for the Aletta Windfarm Facility (Aletta) development by BioTherm Energy (Pty) Ltd (BioTherm). This is the second update of the initial site layout. The initial site layout had 125 turbines with a 20.9dB cumulative effect. As part of the mitigation strategy, it was reduced to 80 turbines ((19dB cumulative effect) and the new layout has 60 turbines (17.8dB cumulative effect). There has also been a slight change in location to obtain better total path loss values. With the initial layout the nearest turbine was located 20km from the nearest SKA Station, this has now been increased to 25km with the layout update.

The frequency band of concern for SKA mid-band is 200MHz to 20GHz.This assessment does not consider any potential telecommunication services or networks that are to be established as part of the operational plan.

This risk assessment would enable one to estimate the maximum permissible radiated emissions from the equipment installed within the Aletta and will be compared to known radiated emission data from the Acciona WTG.

This assessment and Electromagnetic Control Plan with its associated procedures addresses mitigation actions required to reduce the radiated emissions of the AW 125 TH 100A wind turbine generator (WTG) to levels acceptable for installation within the declared Karoo Central Astronomy Advantage Area. The AW 125 TH 100A is the model within the AW 3000 platform that will be evaluated for this project.

The intent of this plan is to ensure that this facility poses a low risk of detrimental impact on the SKA by describing specific mitigation measurements to be implemented in order to achieve 40 dB of attenuation, as agreed with SKA South Africa. This plan provides general Electromagnetic Compatibility guidelines as well as specific guidelines to assist and maintain electromagnetic compatibility between the windfarm and Square Kilometer Array (SKA) facility.

This plan refers to the radiated emissions of the AW3000/125 TH100 50Hz wind turbine and it concerns itself with the goal of eliminating causes of electromagnetic interference (EMI), which can adversely affect the performance of the SKA Radio telescope.

6.16.1 EMC Requirements

The current requirement is a 30dB reduction in radiated emissions to ensure the cumulative emission level of a wind farm is within the requirements of SKA. This requirement is based on measurements on the

Acciona AW 125 TH100A WTG at the Gouda facility in South Africa and Barosoain windfarm, Navarra, Spain. Very similar design will be used for the Copperton/ Garob facilities.

6.16.2 EMC Analysis

Measurements were taken at the Barasoain windfarm (Spain) and Gouda Windfarm (South Africa).

- **Site Location**

Figure 51: Area map showing Aletta locations relative to SKA

Three (3) WTG locations (WTG 1, WTG 25 and WTG 31) and four (4) SKA installations were used for the evaluation.

Figure 52: Local map showing nearest four SKA locations

Table 23: New Aletta layout distance from SKA infrastructure

	Aletta WTG 1	Aletta WTG 25	Aletta WTG 31
SKA 004 (Phase 1)	46.52km	50.22km	44.63km
SKA ID 1895 (Phase 2)	29.77km	29.39km	42.46km
SKA ID 1890 (Phase 2)	26.78km	30.65km	24.99km
SKA ID 2348 (Phase 2)	53.42km	53.38km	40.88km
MeerKAT (Core)	119.82km	121.6km	119.96km

7 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 regulation 41 of the 2014 EIA Regulations These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment, and ensuring 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 in order to achieve integration of technical assessment and public participation throughout. Secondly, 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 that their issues have been captured and 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 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 regulation 43 of the 2014 EIA Regulations

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 receipts were sent to those submitting comments.
- Comments were addressed in the Comments & Response Report.

7.1 Overview of the Public Participation Process to date

The public participation process was initiated in March 2016 with the issuing of the BID and initial landowner consultation. Site notices (as per regulations) were placed near the study area during a site visit on Thursday the 10th of March 2016. The DSR was released for review on the 30th of June 2016 and the EIA process advert was publicised on the 29th of June 2016 in the Gemsbok newspaper. The DSR comment period ran from Thursday the 30th of June 2016 to Monday the 1th of August 2016. I&APs were notified at the start of the comment period. The Final Scoping Report (FSR) was submitted to the DEA on the 12th of August 2016, and I&APs were notified on the same day. The DEA subsequently accepted the FSR on the 14th of September 2016. During the DEIAr comment period, the public and focus group meetings will be held.

On-going consultation with key stakeholders (e.g. provincial, district and local authorities, relevant government departments, local business, affected and adjacent landowners etc.) and identified I&APs will ensure that I&APs are kept informed regarding the EIA phase (the full stakeholder database list is included in **Appendix 5F**).

The stages that typically form part of the public participation process during the EIA phase are reflected in **Figure 53** below.

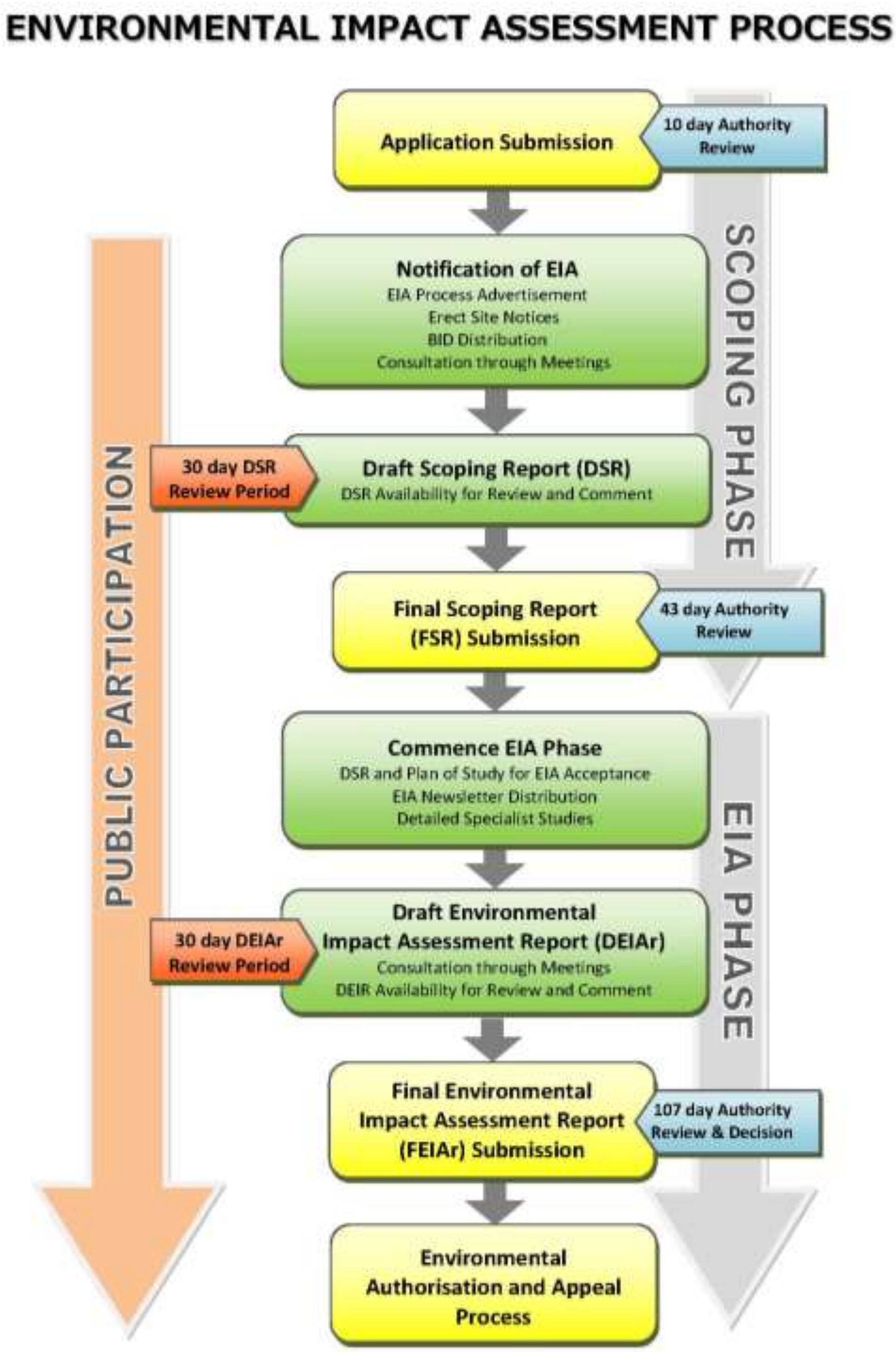


Figure 53: EIA and Public Participation Process

7.2 Consultation and Public Involvement

As in the scoping phase, consultation will continue to be held with key stakeholders and other relevant I&APs in order to identify key issues, needs and priorities for input into the proposed project. Special attention will be paid to the consultation with possibly affected landowners and communities within the study area to try address their main concerns.

Notifications will be sent via email, sms, fax and post to inform I&APs of the availability of the Draft Environmental Impact Assessment Report (DEIAr).

7.3 Comments Received during the Scoping Phase

All comments and recommendations made by stakeholders and I&APs during the scoping phase and submitted as part of the FSR have been taken into consideration when preparing the DEIAr.

All comments received during the scoping phase are addressed and included in **Appendix 5E**.

7.4 Proof of Notification

Appendix 5 includes all proof of notification to Interested and Affected Parties which includes;

- Proof of process advertisements in the newspapers (**Appendix 5C**)
- EIA Newsletter (**Appendix 5A**)
- Correspondence to registered I&APs and key stakeholders (**Appendix 5B** and **5D**)

7.5 Focus Group Meetings

Focus Group Meetings (FGMs) are smaller meetings with specific groups or organisations who have similar interests in or concerns about the project.

It must be noted that FGMs have not yet taken place. Two (2) FGMs are however scheduled to take place during the review period of the DEIAr. Affected landowners and authorities will be invited to the respective FGMs, as follows:

DATE	TIME	MEETING TYPE	VENUE
Thursday , 24 November 2016	13h30 - 15h30	Authorities FGM	Siyathemba Local Municipality Board Room Steward Street, Prieska
Friday, 25 November 201	09h00 - 11h00	Landowners FGM	Nelspoortjie Karoo Guest Farm R357 (Prieska - Copperton Road)

Minutes of the FGMs will be compiled and forwarded to all attendees for their review and comment. The primary aim of the meetings are to:

- Disseminate information regarding the proposed development to I&APs.
- Provide I&APs with an opportunity to interact with the EIA team and the BioTherm representatives present.
- Supply more information regarding the EIA process.
- Answer questions regarding the project and the EIA process.
- Receive input regarding the public participation process and the proposed development.
- Present I&APs with an overview of EIA phase specialist findings.

Draft minutes of the FGMs will be included in **Appendix 5G**.

7.6 Public Meeting

A Public Meeting will be held during the review of the DEIAr as follows:

DATE	TIME	MEETING TYPE	VENUE
Thursday , 24 November 2016	17h00 - 19h00	Public Meeting	Omega Hall, Alwyn Street, Bonteheuwel, Prieska

Invitation letters were sent out via post and e-mail to all registered I&APs on the project's database.

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

Draft minutes of the PM will be compiled and forwarded to all attendees for their review and comment. Minutes of the meetings will be included in **Appendix 5G**.

7.7 Public review of Environmental Impact Assessment Report

The DEIAr will be made available for review from **Friday 25 November to Monday 16 January 2017** at the following venue for a period of 30 calendar days, excluding public holidays and the December closure period:

Table 24: Venues where the DEIAr will be publically available

VENUE	STREET ADDRESS	HOURS	CONTACT NO

Elizabeth Vermeulen Public Library	Corner Victoria Street and Steward Street, Prieska	Mondays- Fridays 08h45 – 16h15 Saturday 08h00 – 13h00	053 353 5300/ 053 353 5305

All comments received on this report will be incorporated into the Comments and Response Report, which will be attached to the FEIAr as **Appendix 5E**.

7.8 Comments and response report

Issues, comments and concerns raised during the public participation process to date are captured in the Comments and Response Report (C&RR) – **Appendix 5E**. This C&RR provides a summary of the issues raised, as well as responses which were provided to I&APs. This information will be used to feed into the evaluation of social impacts.

8 SPECIALIST STUDIES

The following specialist studies were undertaken as per the Plan of Study for EIA:

- Biodiversity (flora and fauna)
- Avifauna
- Bat
- Surface Water
- Soils and Agricultural Potential
- Noise
- Visual Impact
- Heritage and Palaeontology
- Socio-economic Impact
- Traffic
- Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)

Each specialist assessed the impact of the proposed Aletta wind energy facility and associated infrastructure that BioTherm are proposing to develop near Copperton and the results are presented below.

8.1 Biodiversity

The full Biodiversity Assessment was conducted by David Hoare and is included in **Appendix 6A**.

8.1.1 *Conservation status of broad vegetation types*

On the basis of a recently established approach used at national level by SANBI (Driver *et al*. 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in **Table 25**, as determined by best available scientific approaches (Driver *et al*. 2005).

The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al*. 2005).

All of the vegetation types occurring in the study area (**Table 26**) are classified as Least Threatened (Driver *et al*. 2005; Mucina *et al*., 2006). None of the vegetation types are flagged therefore as being of conservation concern.

Table 25: Determining ecosystem status (from Driver *et al*. 2005)
*BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Table 26: Conservation status of different vegetation types occurring in the study area, according to Driver *et al*. 2005 and Mucina *et al*. 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al*. 2005; Mucina *et al*., 2006	**Draft Ecosystem List (NEMBA)**
Bushmanland Arid Grassland	21	1	1	Least Threatened	Not listed
Lower Gariep Broken Veld	21	4	1	Least Threatened	Not listed
Bushmanland Basin Shrubland	21	0	1	Least Threatened	Not listed
Bushmanland Vloere	24	0	2	Least Threatened	Not listed
Northern Upper Karoo	21	0	4	Least Threatened	Not listed
Upper Karoo Hardeveld	21	3	0	Least Threatened	Not listed

8.1.2 Biodiversity Conservation Plans

There are no fine-scale biodiversity conservation plans for the study area (bgis.sanbi.org). According to SANBI, *"Presently BGIS has no Systematic Biodiversity Conservation Plan for the Northern Cape other than the Namakwa District Biodiversity Sector Plan therefore the Biodiversity Summaries Map is used in it place for land use decision support in the province."* The Biodiversity Summary Map for the Pixley ka Seme District Municipality shows all natural vegetation within the municipal area, except along the Orange River, to be Least Threatened and no areas mapped as of particular biodiversity concern.

8.1.3 Proposed protected areas

According to the National Parks Area Expansion Strategy (NPAES), the central part of the site has been identified as a priority area for inclusion in future protected areas. According to the guideline description of the strategy, the *"focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for finescale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities"*. No description is provided of specific biodiversity features per proposed area.

The area on site shown as being included in the NPAES (**Figure 54**) includes a small portion of the hills as well as mostly plains areas. Based on the field assessment of this site as well as that for the nearby Eureka project, the specific areas selected for inclusion in the NPAES are not unique to that specific location and could be accommodated in adjacent areas. The hills on site were considered to all have equivalent biodiversity patterns. Some of the plains in the selected area were considered to be slightly compromised by existing activities on site (farm-house, roads and livestock impacts). The opportunity to implement a more detailed conservation plan is therefore not compromised by the proposed project.

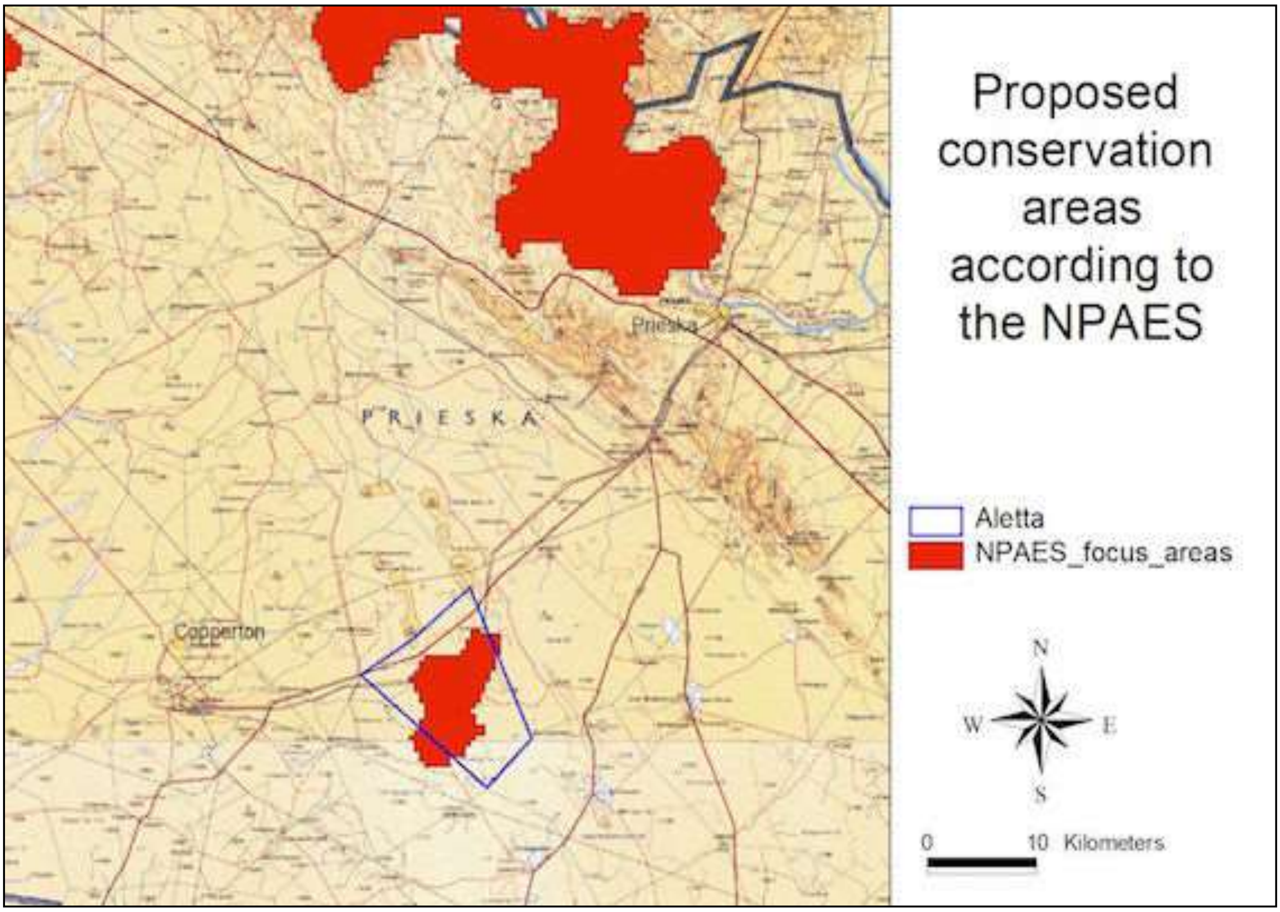


Figure 54: Prposed National Park expansion areas according to the NPAES

8.1.4 Red List plant species of the study area

Lists of plant species of conservation concern previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in **Appendix 1** of the Biodiversity Specialist Report. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

There is one species that was considered to possibly occur in the study area, the succulent, *Hoodia officinalis* subsp. *officinalis*. This species is listed as Near Threatened (see **Table 27** for explanation of categories). The species is found in Desert, Nama Karoo and Succulent Karoo and is found inside bushes in flat or gently sloping areas. The species has been recorded in two neighbouring grids and the possibility of it occurring in the study area was therefore considered to be high. A detailed search across the entire site did not locate any individuals of this species. The plants are relatively conspicuous and should have been visible if they occurred there. It is therefore considered unlikely, although not impossible, that the species occurs on site.

There is another Near Threatened plant species that could potentially occur in the study area, namely *Drimia sanguinea*. The main occurrence of this species is, however, more to the north and north-east of the current site. No individuals of this species were seen during the field survey.

Table 27: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

8.1.5 Red List animal species of the study area

All Red List vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in **Appendix 3** of the Biodiversity Specialist Report.

Excluding bats, there are two mammal species of low conservation concern that could occur in available habitats in the study area. These are the Honey Badger and Littledale's Whistling Rat. Both of these species are classified nationally as near threatened (NT), but globally as Least Concern. They are, therefore, of relatively low conservation concern in comparison to more threatened species found in other parts of the country. The Honey Badger is protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. Only the Honey Badger and Littledale's Whistling Rat were considered likely to be found on site. The Honey Badger is a mobile species and it is considered unlikely that construction and operation of the proposed Wind Energy Facility would affect it significantly. Individuals are likely to move away from the path of construction and then return during operation to undisturbed habitats. No evidence of Littledale's Whistling Rat was found on site during the field survey. There is a possibility of it occurring there, but it is considered unlikely at this stage.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on any of the sites. This species is classified as Least Concern globally and Near threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. The study area is at the limits of the distribution of this species. No evidence of it was found on site, but there is still the possibility that it occurs there.

There are no reptile species of conservation concern that have a distribution that includes the study area.

8.1.6 Protected plants (National Environmental Management: Biodiversity Act)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in **Appendix 4** of the Biodiversity Specialist Report. Two plant species that appear on this list that could potentially occur in the general region, although they have not previously been recorded in the grids of the study area, are *Hoodia gordonii* and *Harpagophytum procumbens*.

Hoodia gordonii is found in Namibia, Botswana, Angola and the dry margins of the summer rainfall region of South Africa, including parts of the Western Cape, Northern Cape and Free State Provinces. It occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds. It has not been previously recorded in this grid, but has been recorded in the grid to the north-east. Suitable habitat conditions occur on site relative to the species requirements. However, no individuals of this species were found on site. It is therefore considered unlikely that it occurs there.

Harpagophytum procumbens occurs in Angola, Botswana, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape. The species Well drained sandy habitats in open savanna and woodlands. It has not been previously recorded in this grid, but has been recorded in the grids to the north. Marginally suitable habitat conditions were found on site relative to the species requirements. However, no individuals of this species were found on site and it is considered unlikely that it occurs there.

8.1.7 Protected plants (Northern Cape Nature Conservation Act, No. 9 of 2009)

The Act provides lists of protected species for the Province, which is very lengthy and includes a number of commonly occurring species (see **Appendix 7** of the Biodiversity Specialist Report). According to Northern Cape Nature Conservation officials, a permit is required for the removal of any species on this list. Based on previous experience on projects in the Northern Cape Province, it must be assumed that a permit application will need to be undertaken and that it will include a variety of species found on site, including various common species.

The following species were found on site that are protected according to the Northern Cape Nature Conservation Act:

- *Eberlanzia ferox* (MESEMBRYANTHEMACEAE) - very common
- *Sutherlandia frutescens*
- *Boscia albitrunca*
- *Aloe claviflora*
- *Moraea* species (IRIDACEAE)
- *Babiana* species (IRIDACEAE)

It is likely that detailed site-specific searches will reveal a number of additional species that are protected according to the Northern Cape Nature Conservation Act.

8.1.8 Protected trees

Tree species protected under the National Forest Act are listed in **Appendix 3** of the Biodiversity Specialist Report. The only one that has a geographical distribution that includes the study sites is *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi). *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi) occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils.

A number of individuals of this species were found on site, especially within the low hills on the eastern side of the site. These varied from upright individuals in open areas to sprawling, decumbent plants in rocky areas (**Figure 55**). There is a high probability that proposed infrastructure will affect individuals of this species.

8.1.9 Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).According to this Act, "*a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7".* Such activities include any that are "*of a nature that may negatively impact on the survival of a listed threatened or protected species*". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in **Appendix 6** of the Biodiversity Specialist Report, marked with the letter "N". This includes the following species: White Rhinoceros, Black Wildebeest, Oribi, Cheetah, Cape Clawless Otter, Black-footed Cat, Brown Hyaena, Serval, Spotted-necked Otter, Honey Badger, Leopard, Cape Fox, Southern African Hedgehog, Southern African Python and Giant Bullfrog.

Due to habitat and forage requirements and the fact that some species are restricted to game farms and/or conservation areas, only the Black-footed Cat, Honey Badger, Leopard, Cape Fox and Giant Bullfrog have a likelihood of occurring on site. All of these species are mobile animals that are likely to move away in the event of any activities on site disturbing them. They are therefore unlikely to be affected by the proposed development of the wind energy facility and associated infrastructure.

Figure 55: Typical *Boscia albitrunca* trees on site

8.1.10 Alien invasive species observed on site

The tree, *Prosopis glandulosa*, was seen on site in localised places and is present in the general study area. There is a high risk of this species becoming invasive in the project area. The only other declared weed seen on site was *Datura ferox*, which also has the potential to become problematic. Other species seen in the general area are *Opuntia ficus-indica* and *Schinus molle*. There are a wide variety of other species that occur in the general geographical area and any of these could become established on site.

8.1.11 Habitats on site

The distribution of main habitats on site is shown in **Figure 56**. Aerial imagery and the field survey indicates that most of the site consists of natural vegetation (karroid dwarf shrubland called Bushmanland Arid Grassland). There are very shallow drainage areas running through the site and a number of small pan depressions. These lowland areas have deeper, calcareous soils and the vegetation is distinctly different to the surrounding plains. These areas of deeper soils have a higher incidence of animal burrows and, based on excavations that were examined, the water table appears to be closer to the surface. There are also some low hills along the northern and eastern boundary of the site where quartzite rocks outcrop from the surrounding plains. These hills have shallow soils and high surface rock cover. The different physiographic units harbour different vegetation structure and species composition.

8.1.12 Pans and drainage areas

The study area contains some drainage areas and pans. These are visible on aerial imagery and are shown in **Figure 56**. The drainage areas and pans, as mapped here, define habitat units and not wetlands, as defined in the National Water Act. Wetlands, riparian zones and watercourses are defined in the National Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). It is important that these areas are properly delineated according to accepted methods and that impacts on them are kept to a minimum, if possible.

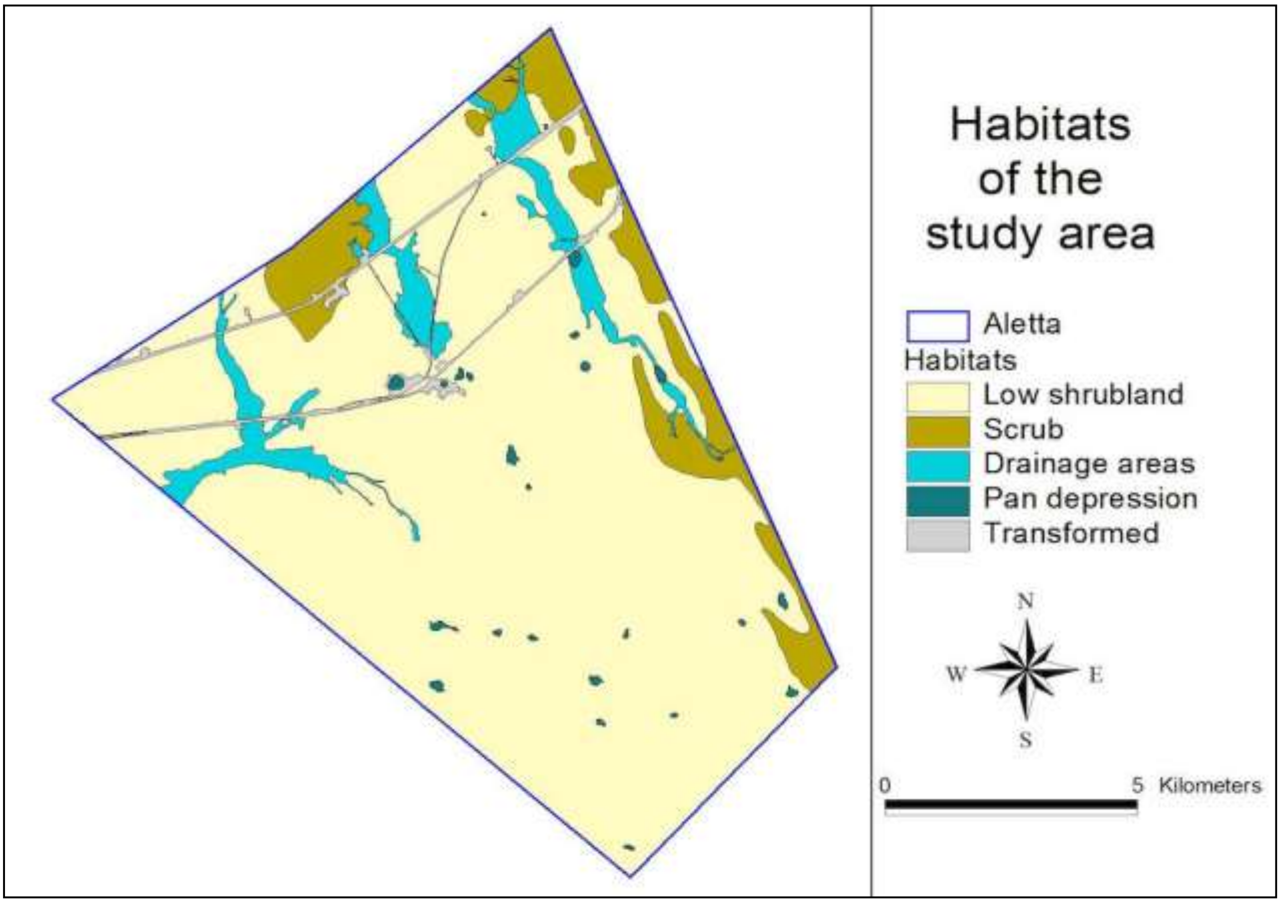


Figure 56: Main habitats of the study area

8.1.13 Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. Areas of potentially high sensitivity are shown in **Figure 57**. The information provided in the preceding sections was used to compile a map of remaining natural habitats and areas important for maintaining ecological processes in the study area. The only features of potential concern that need to be taken into account in order to evaluate sensitivity in the study area is the presence of non-perennial watercourses and pan depressions. These represent ecological processes, including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal.

These factors have been taken into account in evaluating sensitivity within the study area. Watercourses are considered to be the most sensitive features on site. The sensitivity classification is as follows:

1. MEDIUM-HIGH: All of the watercourses, pans and drainage areas on site are classified as having medium-high sensitivity (**Figure 57**). They are protected according to the National Water Act (Act 36 of 1998). Ecologically, they are areas that provide moderate value ecosystem goods and services. They have deeper soils and there is a higher probability of burrowing animals occurring within this habitat.

2. MEDIUM: The majority of the study area is classified as having medium sensitivity (**Figure 57**). These are areas of natural vegetation which harbour no particular features of conservation concern, except for habitat that is potentially suitable for five near threatened animal species and one near threatened plant species (none confirmed to occur on site). There is one protected tree species that may also occur within some of these areas.
3. LOW: Transformed areas are classified as having low sensitivity (**Figure 57**). These are areas in which no intact natural habitat still remains.

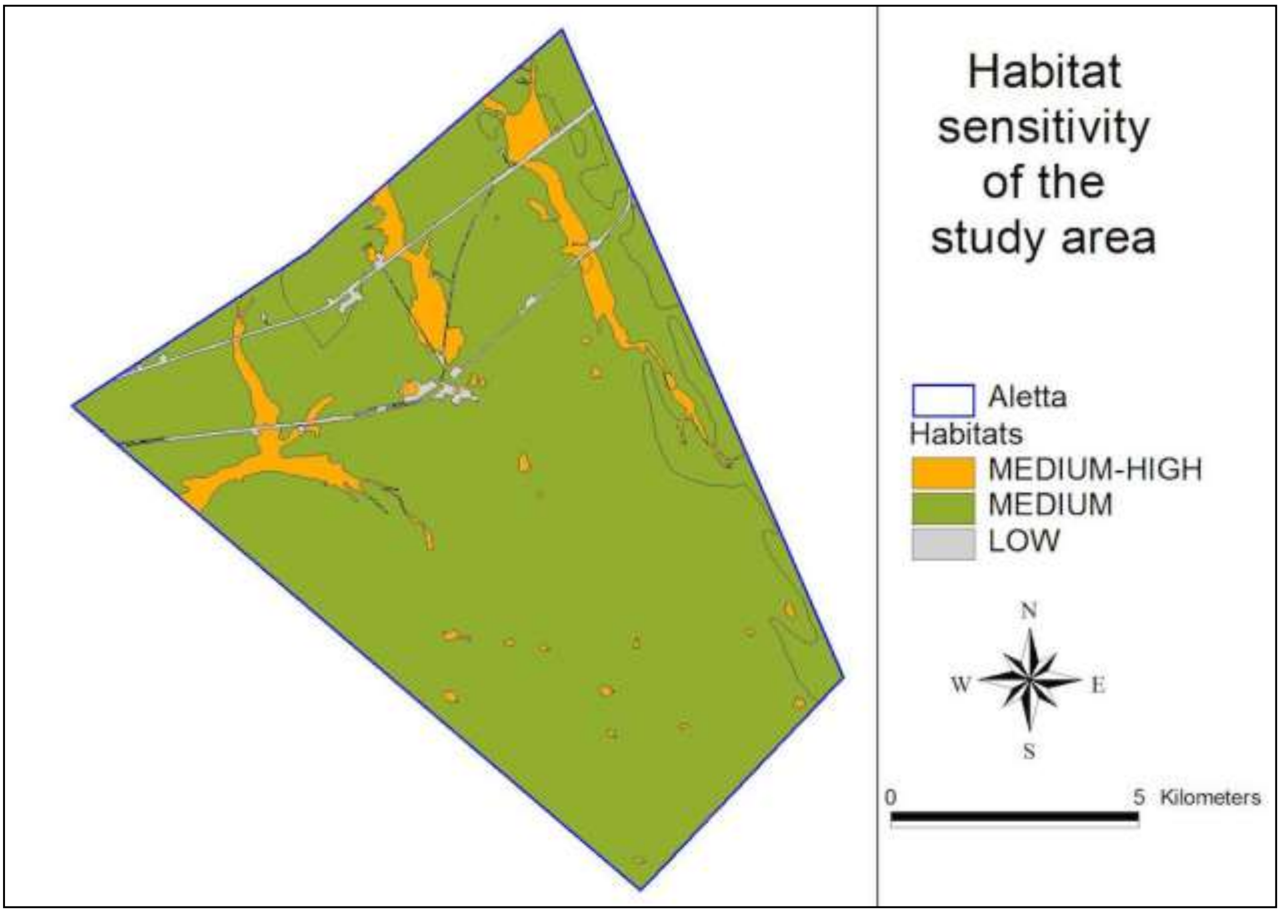


Figure 57: Potentially sensitive areas of the study area

8.1.14 Description of potential impacts

Potential issues relevant to potential impacts on the ecology of the study area include the following:

- <u>Impacts on biodiversity:</u> this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- <u>Impacts on sensitive habitats</u>: this includes impacts on any sensitive or protected habitats, including indigenous forest and/or woodland and wetland vegetation that leads to direct or indirect loss of

such habitat.

- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
    - disruption to nutrient-flow dynamics;
    - impedance of movement of material or water;
    - habitat fragmentation;
    - changes to abiotic environmental conditions;
    - changes to disturbance regimes, e.g. increased or decreased incidence of fire;
    - changes to successional processes;
    - effects on pollinators; and
    - increased invasion by alien plants.

Changes to factors such as these may lead to a reduction in the resilience of plant communities and ecosystems or loss or change in ecosystem function.

- Secondary and cumulative impacts on ecology: this includes an assessment of the impacts of the proposed project taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g. reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

A number of direct risks to ecosystems that would result from **construction** of the proposed power line are as follows:

- Clearing of land for construction.
- Construction of access roads.
- Placement of power lines.
- Establishment of borrow and spoil areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

There are also risks associated with **operation** of the proposed facility, as follows:

- Maintenance of surrounding vegetation as part of management of the power line.
- Animal collisions with infrastructure, especially flying animals.
- Invasion of habitats by alien plants as a consequence of disturbance.

8.1.15 Potential issues for the general study area

A summary of the potential ecological issues for the study area is as follows (issues assessed by other specialists, e.g. on flying animals and on wetlands, are not included here):

- Presence of natural vegetation on site, although of low conservation priority.
- Potential presence of a number of Provincially protected plant species.
- Presence of one protected tree species, Boscia albitrunca.
- Potential presence of the following partly sedentary animals of conservation concern:
    - Littledale's Whistling Rat (NT)
    - Giant Bullfrog (NT/LC).
- Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features.

Potential risks to the ecological receiving environment are therefore the following:

1. Loss of indigenous natural vegetation during construction;
2. Impacts on protected plant species;
3. Impacts protected tree species;
4. Impacts on sensitive habitats;
5. Mortality of populations of sedentary species during construction;
6. Displacement of populations of mobile species;
7. Introduction and/or spread of declared weeds and alien invasive plants in terrestrial habitats.

8.2 Avifauna

The full Avifauna Assessment was conducted by Chris van Rooyen and is included in **Appendix 6B**.

A total of 96 species were recorded in the study area from all data sources (drive transects, walk transects, VP watches, focal point counts and incidental sightings), of which 17 are priority species. See **Table 28** for a list of all priority species that were recorded in the study area, as well as those that could potentially occur at the site itself. **Table 29** lists all species recorded in the study area and

Table **30** lists the priority species recorded at the site itself, and the method by which they were recorded.

8.2.1 Transect counts

- **Drive transects**

A total of 1 931 individual birds were recorded during drive transect counts at the turbine site, of which 154 were priority species and 1 777 were non-priority species, belonging to 67 species (9 priority species and 58 non-priority species). At the control site, a total of 627 birds were recorded during transect counts, of which 84 were priority species and 543 non-priority species, belonging to 49 species (10 priority species and 39 non-priority species).

- **Walk transects**

A total of 6 807 individual birds were recorded during walk transect counts at the turbine site, of which 215 were priority species and 6 592 were non-priority species, belonging to 74 species (6 priority species and 68 non-priority species). At the control site, a total of 1 549 birds were recorded during transect counts, of which 36 were priority species and 1 513 non-priority species, belonging to 49 species (7 priority species and 42 non-priority species).

- **Index of kilometric abundance**

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each priority species, and also for all priority species combined. This was done separately for drive transects and walk transects. **Figure 58** and **Figure 59** shows the relative abundance of priority species recorded during the pre-construction monitoring through drive and walk transects.

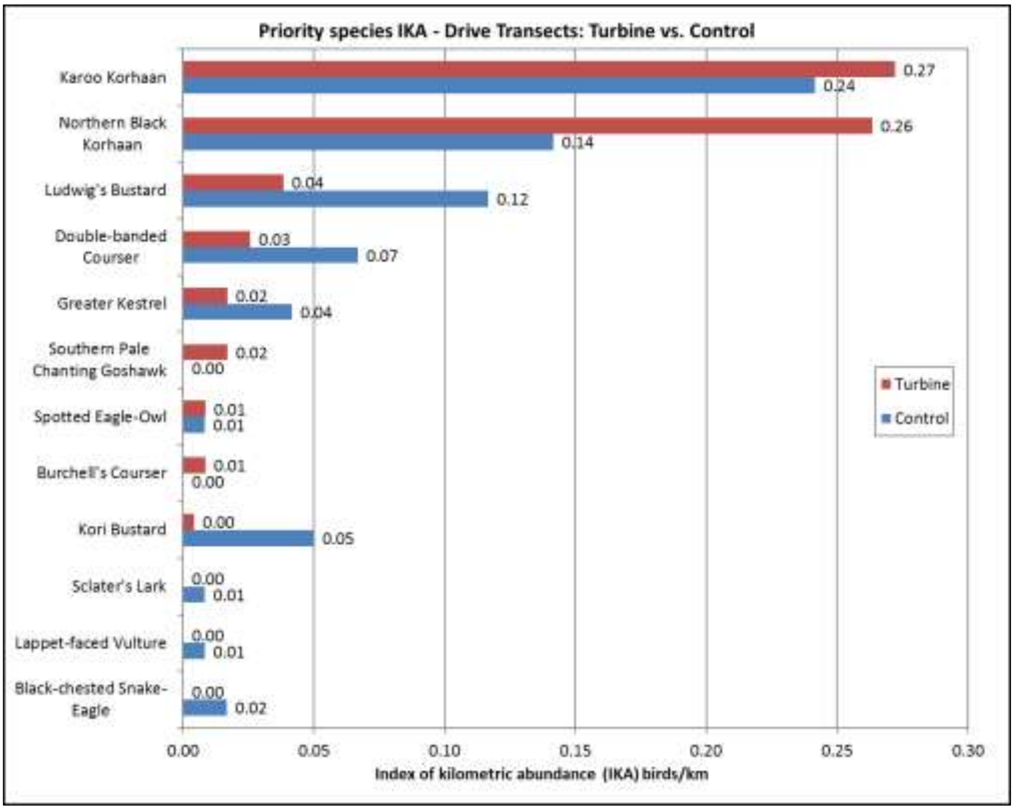


Figure 58: Priority species recorded at the turbine and control site through drive transect surveys

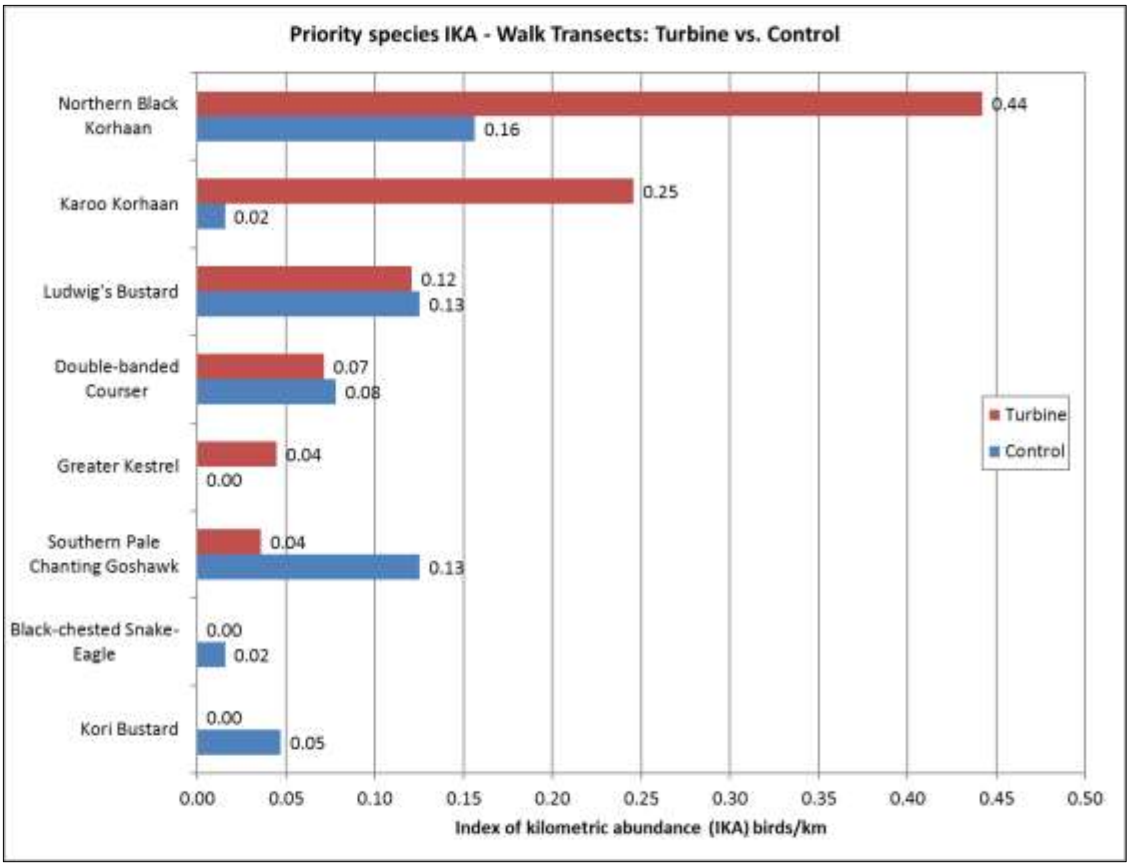


Figure 59: Priority species recorded at the turbine and control site through walk transect surveys

- **Overall species composition**

The study area supports a relatively low diversity and abundance of avifauna, which is to be expected in an arid area like Bushmanland. Based on species diversity recorded during transect surveys, the turbine and control sites are fairly similar as far as priority species are concerned. The higher counts at the turbine is most likely a result of the difference in survey effort, and does not reflect any intrinsic differences in habitat quality or species diversity.

- **Abundance**

The abundance of priority species at the turbine site is low, with 0.65 birds/km recorded on drive transects, and 0.96 birds/km recorded during walk transects. Karoo Korhaan, Northern Black Korhaan and Ludwig's Bustard consistently emerged as the three most abundant priority species at the turbine site during both walk and drive transect counts. Karoo Korhaan and Northern Black Korhaan definitely breed in the study area, and Ludwig's Bustard potentially too, although no evidence of bustard display areas or nests were recorded. Raptors were generally scarce with Greater Kestrel and Southern Pale Chanting Goshawk the only raptors recorded during transect counts, in equal numbers.

- **Spatial distribution of transect record and incidental sightings at the turbine site**

No clear distribution patterns emerged from the sightings data for Karoo Korhaan, Northern Back Korhaan and Ludwig's Bustard at the site, with sightings more or less evenly distributed along all the transects. This is to be expected given the uniformity of the habitat all over the site. As far as raptors are concerned, the sightings of Greater Kestrel similarly not linked to any specific landscape feature. In the case of Southern Pale Chanting Goshawk, the sightings are clearly linked to the telephone line running adjacent to the R357 in the north of the site. The rest of the priority species were not recorded in sufficient numbers for any clear conclusions to be drawn as far has bird/habitat associations are concerned, with random sightings scattered all over the site and immediate surroundings.

Figure 60 below indicates the spatial distribution of priority species (transect counts and incidental sightings).

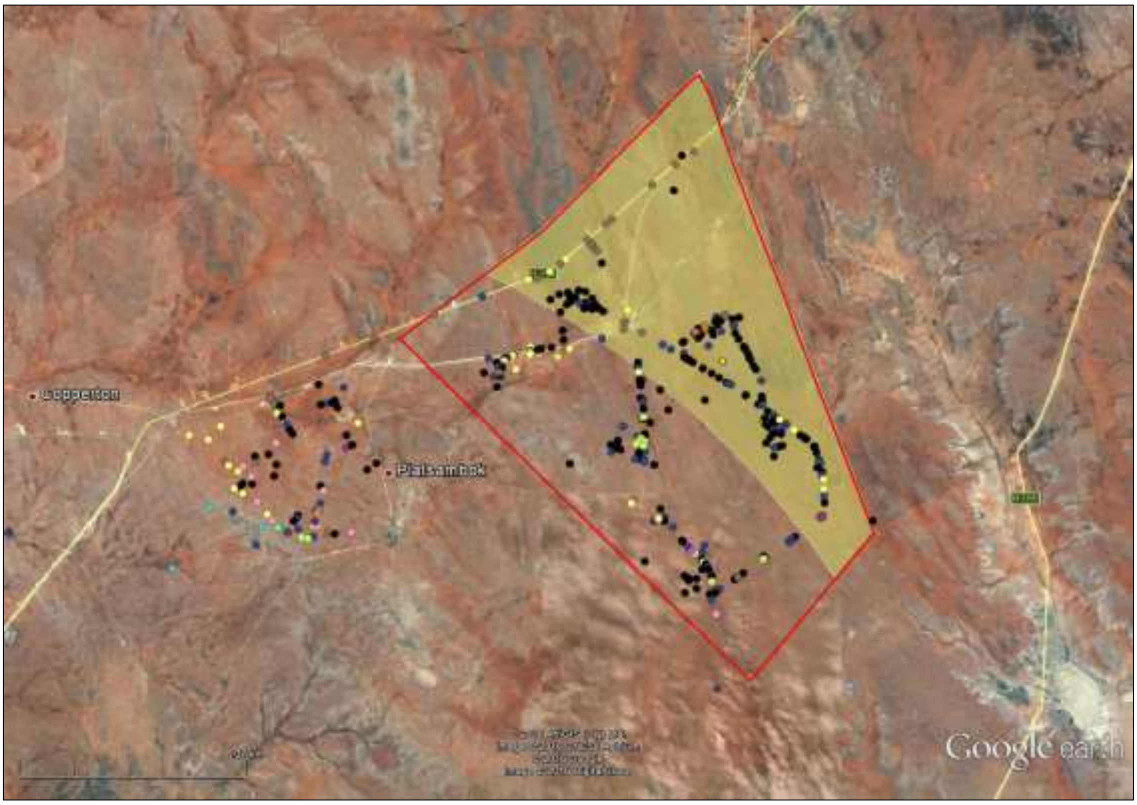


Figure 60: Spatial distribution of sightings of priority species (transects and incidental sightings)

Table 28 below lists all the priority species that could potentially occur at the turbine site and the potential impact on the respective species by the development infrastructure. Species actually recorded <u>at the site</u> during pre-construction surveys are shaded. The following abbreviations and acronyms are used:

VU Vulnerable
NT Near threatened
EN Endangered

SAE	Southern African endemic or near endemic
Ct	Collisions with turbines
Cp	Collisions with power line
Dd	Displacement through disturbance
Dh	Displacement habitat transformation

Table 28: Priority species (Retief et al. 2012) potentially occurring at the site. **Species recorded at the turbine site are shaded**.

Name	**Scientific name**	**Regional threatened status (Taylor et al. 2015)**	**Global threatened status (IUCN 2016)**	**BLSA/EWT Priority rating (on scale of 170 – 395)**	**Terrestrial**	**Soaring**	**Likelihood of occurrence**	**Potential impact**
Martial Eagle	*Polemaetus bellicosus*	EN	NT	330		x	Medium. One incidental sighting of a flying bird in the broader area. Could sporadically be attracted to water troughs.	Ct, Dd,
Ludwig's Bustard	*Neotis ludwigii*	SAE, EN	EN	320	x		Confirmed. Occurrence likely to be linked to habitat conditions. The species is nomadic and a partial migrant and may occur sporadically.	Ct, Cp, Dd,
Secretarybird	*Sagittarius serpentarius*	VU	VU	320	x	x	Confirmed. Two foraging individuals recorded at the site itself.	Ct, Cp, Dd,
Kori Bustard	*Ardeotis kori*	NT	Least concern	280	x		Confirmed. One bird flying over the site. May occur sporadically. Lack of dry watercourses with trees may be an inhibiting factor.	Ct, Cp, Dd,

Name	Scientific name	Regional threatened status (Taylor et al. 2015)	Global threatened status (IUCN 2016)	BLSA/EWT Priority rating (on scale of 170 – 395)	Terrestrial	Soaring	Likelihood of occurrence	Potential impact
Lanner Falcon	*Falco biarmicus*	VU	Least concern	280		x	High. Was recorded as an incidental in the broader study area. Could occur sporadically. Most likely to perch on telephone lines running through the site, but may also be attracted to the water points where it hunts small birds.	Ct
Sclater's Lark	*Spizocorys sclateri*	SAE, NT	NT	240	x		Medium. The species was recorded incidentally once in the broader area during monitoring, but large sections of the habitat seem suitable, i.e. stony arid to semi-arid plains with scattered shrubs, grasses and extensive bare patches. The species is nomadic and may occur sporadically.	Dd Dh

Name	Scientific name	Regional threatened status (Taylor et al. 2015)	Global threatened status (IUCN 2016)	BLSA/EWT Priority rating (on scale of 170 – 395)	Terrestrial	Soaring	Likelihood of occurrence	Potential impact
Black-chested Snake-Eagle	*Circaetus pectoralis*	Least concern	Least concern	230		x	High. Recorded at the control site. Most sightings associated with the distribution line which is used for perching. May visit water points at the turbine site.	Ct
Southern Pale Chanting Goshawk	*Melierax canorus*	SAE	Least concern	200	x	x	Confirmed. Habitat is very suitable for the species.	Ct, Dd,
Karoo Korhaan	*Eupodotis vigorsii*	SAE, NT	Least concern	190	x		Confirmed. One of the most commonly recorded terrestrial species. Occurs all over the site.	Ct, Dd, Cp
Northern Black Korhaan	*Afrotis afraoides*	SAE	Least concern	180	x		Confirmed. One of the most commonly recorded terrestrial species. Occurs all over the site.	Ct, Dd, Cp
Greater Kestrel	*Falco rupicoloides*	Least concern	Least concern	174		x	Confirmed. Encountered all over the site, but most likely to be associated with utility lines and fences which are used for perching.	Ct

Name	Scientific name	Regional threatened status (Taylor et al. 2015)	Global threatened status (IUCN 2016)	BLSA/EWT Priority rating (on scale of 170 – 395)	Terrestrial	Soaring	Likelihood of occurrence	Potential impact
Spotted Eagle-Owl	*Bubo africanus*	Least concern	Least concern	170	Nocturnal raptor but flight characteristics more like terrestrial species		Confirmed. Recorded at a stand of trees, where they may be breeding, but could not be confirmed.	Ct
Jackal Buzzard	*Buteo rufofuscus*	SAE	Least concern	125		x	Low. Most likely to be associated with utility lines and fence lines. May occur sporadically, particularly immature birds.	Ct
Lappet-faced Vulture	*Torgos tracheliotis*	EN	VU	310		x	Low. A single adult was recorded at the control site. Unlikely to occur regularly, vagrant to the region.	Ct
Burchell's Courser	*Cursorius rufus*	SAE, VU	Least concern	140	x		Confirmed. Two individuals were recorded once.	Ct
Double-banded Courser	*Rhinoptilus africanus*	NT	Least concern	154	x		Confirmed. Recorded regularly during the winter surveys.	Ct

Booted Eagle	*Aquila pennatus*		Least concern	230		x	Confirmed. Most likely to be encountered foraging on the wing over the site, and coming down to water points to bath and drink.	Ct

Table 29 lists all the species recorded during the pre-construction surveys and incidental counts, as well as the manner in which they were recorded

Table 29: Priority species recorded during pre-construction surveys and incidental counts in the broader area.

Priority Species	Scientific Name	Turbine	Control	VP	Control VP	FP	Incidental
Black-chested Snake-Eagle	*Circaetus pectoralis*		*				
Booted Eagle	*Aquila pennatus*			*			
Burchell's Courser	*Cursorius rufus*	*					
Double-banded Courser	*Rhinoptilus africanus*	*	*				*
Greater Kestrel	*Falco rupicoloides*	*	*	*			
Karoo Korhaan	*Eupodotis vigorsii*	*	*	*	*		*
Kori Bustard	*Ardeotis kori*	*	*		*		
Lanner Falcon	*Falco biarmicus*						*
Lappet-faced Vulture	*Torgos tracheliotus*		*				
Ludwig's Bustard	*Neotis ludwigii*	*	*	*	*		*
Martial Eagle	*Polemaetus bellicosus*						*
Northern Black Korhaan	*Afrotis afraoides*	*	*	*			*
Sclater's Lark	*Spizocorys sclateri*		*				
Secretarybird	*Sagittarius serpentarius*						*
Southern Pale Chanting Goshawk	*Melierax canorus*	*	*	*	*		*
Spotted Eagle-Owl	*Bubo africanus*	*	*				
Verreaux's Eagle	*Aquila verreauxii*					*	
17	**Total:**	**9**	**11**	**6**	**4**	**1**	**8**

Table 30: Priority species recorded at the site itself and the method by which they were recorded

Non-Priority Species		Turbine	Control
Acacia Pied Barbet	*Tricholaema leucomelas*	*	
African Pipit	*Anthus cinnamomeus*	*	*
Anteating Chat	*Myrmecocichla formicivora*	*	*
Ashy Tit	*Parus cinerascens*	*	
Barn Swallow	*Hirundo rustica*	*	*
Black-chested Prinia	*Prinia flavicans*	*	*
Black-Eared Sparrowlark	*Eremopterix australis*	*	*
Black-Headed Canary	*Serinus alario*	*	*
Blacksmith Lapwing	*Vanellus armatus*	*	
Black-winged Stilt	*Himantopus himantopus*	*	
Bokmakierie	*Telophorus zeylonus*	*	
Bradfield's Swift	*Apus bradfieldi*	*	
Cape Bunting	*Emberiza capensis*	*	
Cape Penduline-Tit	*Anthoscopus minutus*	*	
Cape Sparrow	*Passer melanurus*	*	*
Cape Teal	*Anas capensis*	*	
Cape Turtle-Dove	*Streptopelia capicola*	*	*
Cape Wagtail	*Motacilla capensis*	*	
Capped Wheatear	*Oenanthe pileata*	*	*
Chat Flycatcher	*Bradornis infuscatus*	*	*
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	*	
Common Fiscal	*Lanius collaris*	*	*
Common Swift	*Apus apus*	*	*
Crowned Lapwing	*Vanellus coronatus*	*	*
Dusky Sunbird	*Cinnyris fuscus*	*	
Eastern Clapper Lark	*Mirafra [apiata] fasciolata*	*	
Egyptian Goose	*Alopochen aegyptiaca*	*	*
Fairy Flycatcher	*Stenostira scita*	*	*
Familiar Chat	*Cercomela familiaris*	*	*
Fawn-coloured Lark	*Calendulauda africanoides*	*	*
Fiscal Flycatcher	*Sigelus silens*	*	*
Greater Striped Swallow	*Hirundo cucullata*	*	
Grey Tit	*Parus afer*	*	
Grey-Backed Sparrowlark	*Eremopterix verticalis*	*	*
Hadeda Ibis	*Bostrychia hagedash*	*	
Helmeted Guineafowl	*Numida meleagris*	*	
House Sparrow	*Passer domesticus*	*	
Kalahari Scrub-Robin	*Cercotrichas paena*	*	*
Karoo Chat	*Cercomela schlegelii*		*
Karoo Eremomela	*Eremomela gregalis*	*	*
Karoo Long-Billed Lark	*Certhilauda subcoronata*	*	*
Karoo Scrub-Robin	*Cercotrichas coryphoeus*	*	*
Kittlitz's Plover	*Charadrius pecuarius*	*	
Large-Billed Lark	*Galerida magnirostris*	*	*
Lark-Like Bunting	*Emberiza impetuani*	*	*
Laughing Dove	*Streptopelia senegalensis*	*	*
Little Swift	*Apus affinis*	*	*
Long-billed Crombec	*Sylvietta rufescens*	*	
Long-billed Pipit	*Anthus similis*	*	*
Namaqua Dove	*Oena capensis*	*	*
Namaqua Sandgrouse	*Pterocles namaqua*	*	*
Pied Crow	*Corvus albus*	*	*
Plain-backed Pipit	*Anthus leucophrys*	*	*
Pririt Batis	*Batis pririt*	*	
Pygmy Falcon	*Polihierax semitorquatus*	*	
Red-Billed Quelea	*Quelea quelea*	*	
Red-Capped Lark	*Calandrella cinerea*	*	*
Red-Headed Finch	*Amadina erythrocephala*	*	*
Rock Martin	*Hirundo fuligula*	*	*
Rufous-Eared Warbler	*Malcorus pectoralis*	*	*
Sabota Lark	*Calendulauda sabota*	*	*
Scaly-feathered Finch	*Sporopipes squamifrons*	*	*
Sickle-winged Chat	*Cercomela sinuata*	*	*
Sociable Weaver	*Philetairus socius*	*	*
South African Shelduck	*Tadorna cana*	*	*
Southern Masked-Weaver	*Ploceus velatus*	*	*
Speckled Pigeon	*Columba guinea*	*	*
Spike-Heeled Lark	*Chersomanes albofasciata*	*	*
Spotted Thick-knee	*Burhinus capensis*	*	
Stark's Lark	*Spizocorys starki*	*	*
Three-banded Plover	*Charadrius tricollaris*	*	
Tractrac Chat	*Cercomela tractrac*	*	*
White-Backed Mousebird	*Colius colius*	*	
White-Browed Sparrow-Weaver	*Plocepasser mahali*	*	
White-Necked Raven	*Corvus albicollis*	*	
White-Rumped Swift	*Apus caffer*	*	
White-throated Canary	*Crithagra albogularis*	*	*
Yellow Canary	*Crithagra flaviventris*	*	*
Yellow-Bellied Eremomela	*Eremomela icteropygialis*	*	*
79	Total:	78	50
Grand Total		**87**	**61**

8.2.2 Vantage point watches

Six priority species were recorded during vantage point (VP) watches. A total of 336 hours of vantage point watches (12 hours per season per vantage point) was completed at 7 VPs in order to record flight patterns of priority species at the site. In the four seasonal sampling periods, priority species were recorded flying over the VP area for a total of 3 hours, 12 minutes and 45 seconds. A total of 114 individual flights were recorded. Of these, 0 (0.0%) flights were at high altitude (above rotor height), 45 (39.5%) were at medium altitude (i.e. approximately within rotor height) and 69 (60.5%) were at a low altitude (below rotor height). The passage rate for priority species over the VP area (all flight heights) was 0.24 birds/hour. See **Figure 61** below for the duration of flights within the VP area for each species, at each height class.

For purposes of flight analyses, priority species recorded during VP watches at the site were classified in two classes:

- Terrestrial species: 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 larger species undertake longer distance flights at higher altitudes, when commuting between foraging and roosting areas. At the wind farm site, korhaans, bustards and larks were 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, the raptor species that were recorded during VP watches were included in this class.

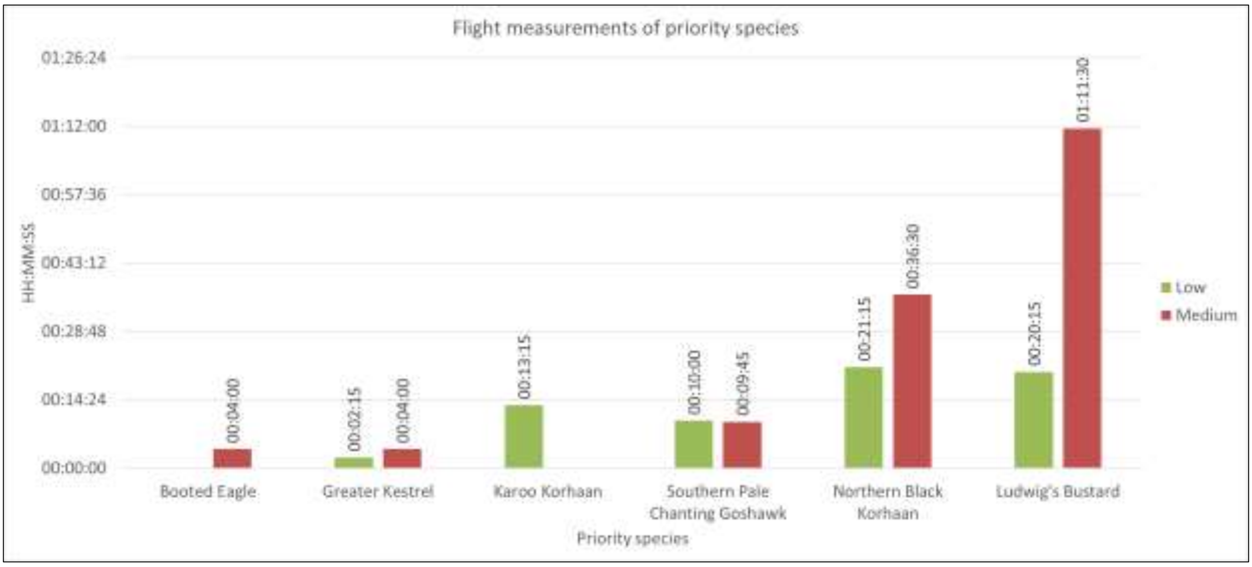


Figure 61: Flight duration and heights recorded for priority species. Low = below rotor height. Medium = within rotor height. No flights were recorded above rotor height.

- **Site specific collision risk rating**

A site specific collisions risk rating for each priority species recorded during VP watches was calculated to give an indication of the likelihood of an individual of the specific species to collide with the turbines at this site. This was calculated taking into account the following factors:

- The duration of rotor height flights;
- the susceptibility to collisions, based on morphology (size) and behaviour (soaring, predatory, ranging behaviour, flocking behaviour, night flying, aerial display and habitat preference) using the ratings for priority species in the Avian Wind Farm Sensitivity Map of South Africa (Retief et al. 2012); and
- the number of planned turbines.

This was done in order to gain some understanding of which species are likely to be most at risk of collision. The formula used is as follows:

Duration of medium height flights (decimal hours) x collision susceptibility calculated as the sum of morphology and behaviour ratings x number of planned turbines ÷100.

The results are displayed in **Table 31** and **Figure 62** below.

Table 31: Site specific collision risk rating for all priority species recorded during VP watches.

Species	Duration of flights (hr)	Collision rating	# turbines	Risk rating
Karoo Korhaan	0	60	60	0.00
Booted Eagle	0.07	80	60	3.36
Greater Kestrel	0.07	52	60	2.18
Southern Pale Chanting Goshawk	0.16	65	60	6.24
Northern Black Korhaan	0.61	55	60	20.13
Ludwig's Bustard	1.26	80	60	60.48

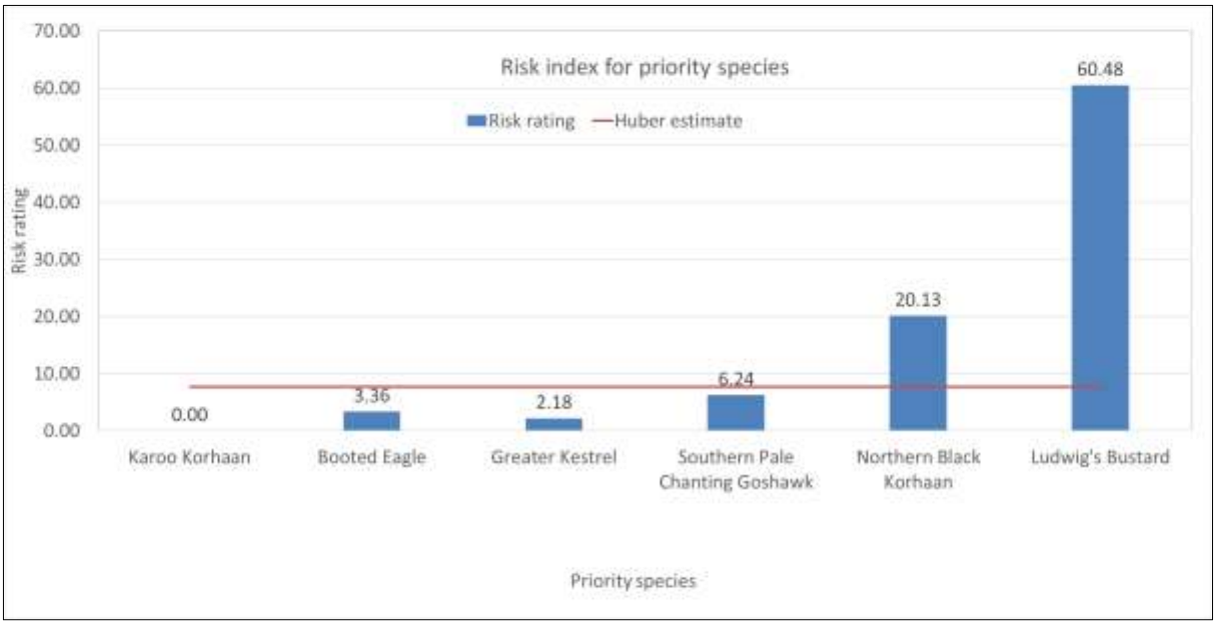


Figure 62: Site specific collision risk rating for priority species recorded during VP watches. Due to the wide range of values, the Huber estimator was used instead of average.

- **Sample size and representativeness of flight data**

Insight into the representativeness and stability of the counting process may be obtained by noting that as the data are gathered watch period by watch period an improved estimate of the average number of birds occurring in the area will be achieved for each added count. As more data are gathered the more accurate the estimate will become. The issue is to determine if the updated average count begins to stabilise towards the end of the survey (and thus the conclusion that a representative sample has been achieved).

To investigate the behaviour of this process the average number of flights per 3h watch period (as well as for individuals) are computed from all preceding data as the data become available in consecutive watch periods. These updated averages are expected to vary to some extent in the initial stages of sampling but to stabilise as more data come in. These data are plotted (by season) in **Figure 63** for soaring birds and **Figure 64** for terrestrial birds.

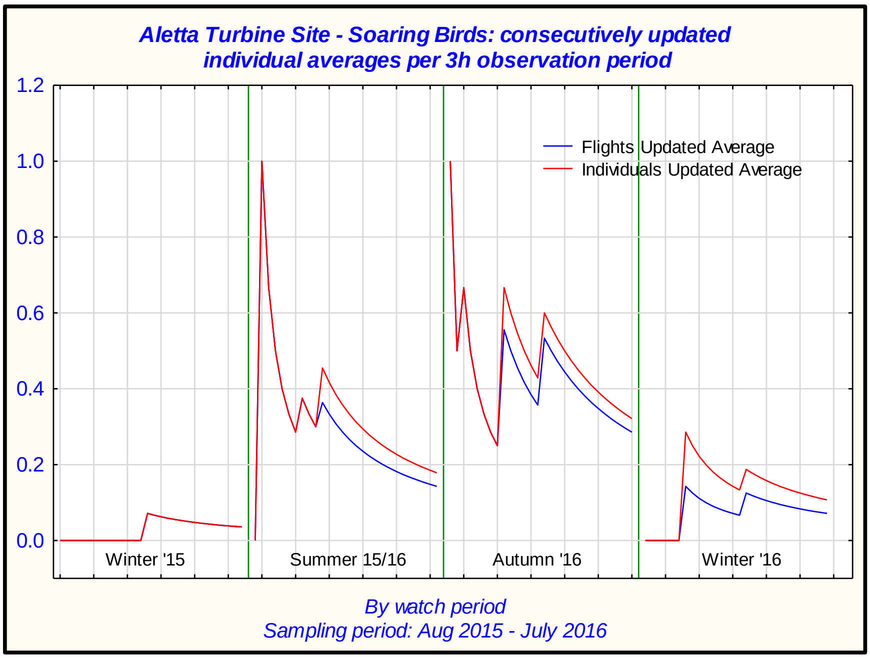


Figure 63: Soaring birds: updated average for *Flight* and *Individual* counts, separately by season.

Figure 63 shows that the updated averages for flights and individual birds are identical in Winter 2015. The other seasons show a gradual downward trend due to no sightings in the last 10 or more consecutive watch periods of each season. This implies a reasonable amount of stability of the series of counts.

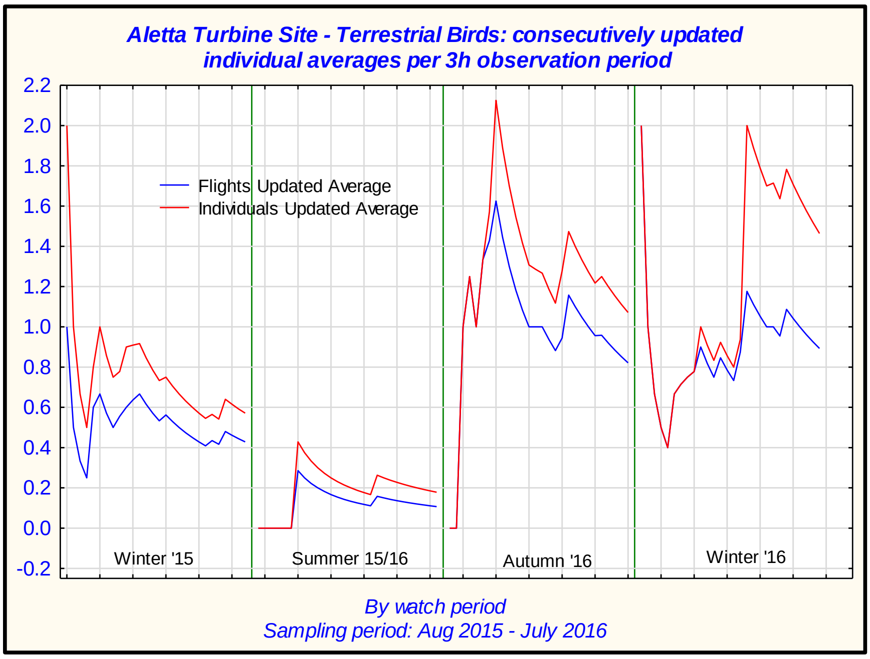


Figure 64: Terrestrial birds: updated average for *Flight* and *Individual* counts, separately by season.

In the case of terrestrial birds, **Figure 64**, the Winter of 2015 and Summer of 2015/16 updated averages for both flights and individual birds seem to stabilise reasonably well. The downward trend towards the end of the two last seasons is due to no new counts being recorded. As with the soaring birds these counts have also stabilised reasonably well.

Figure 65 is prepared for individual counts only by not recalculating the updated averages at the beginning of each season but continuing it over all seasons for the consecutive watch periods.

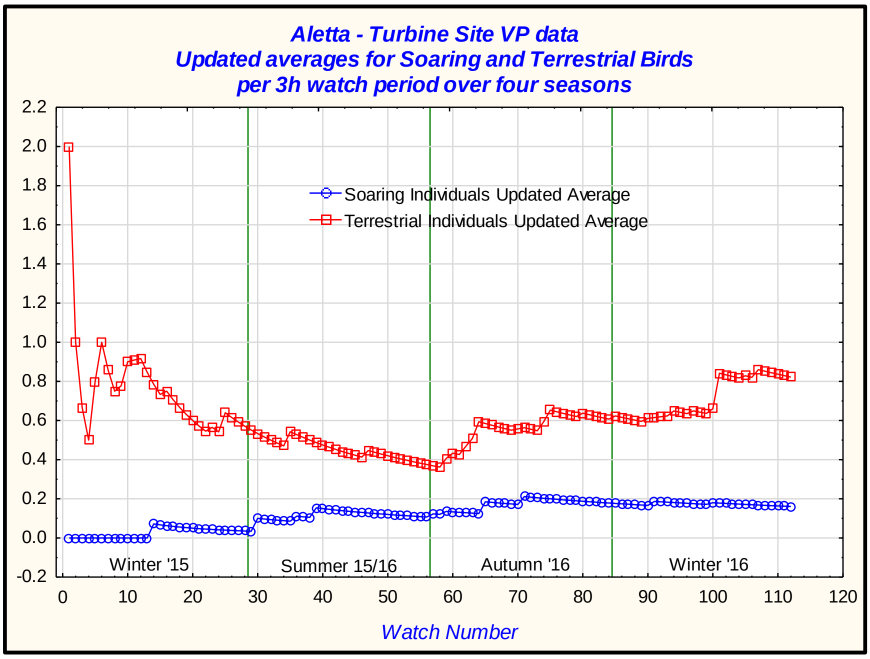


Figure 65: Soaring and Terrestrial birds: updated average for *Individual* counts.

Figure 65 shows that the average counts stabilise well towards the end of the second season. The Autumn and Winter 2016 seasons have shown an increase in the number of counts. The jump at the end for terrestrial individuals is due to the single outlying count.

The information depicted in **Figure 63**- **Figure 65** shows that it is not expected that further sampling will succeed in changing the estimated average number of flight or individual counts in a substantial way.

See **APPENDIX 3** of the Avifauna Specialist Report for a detailed explanation of the statistical methods.

- **Spatial distribution of flight activity**

Flight maps were prepared, indicating the spatial distribution of passages of those priority species which emerged with higher than average collision risk ratings i.e. Ludwig's Bustard and Northern Black Korhaan, as observed from the various vantage points (see **Figure 66**-**Figure 67** below). This was done by overlaying a 100m x 100m grid over the survey area. Each grid cell was then given a weighting score taking into account the duration and distance of individual flight lines through a grid cell and the number of individual birds associated with each flight crossing the grid cell. It is important to interpret these maps bearing in mind the amount of time that each species spent flying over the site i.e. the "High" category on the map for Ludwig's Bustard is not equivalent to the "High" category on the map for Northern Black

Korhaan, as the flight duration for Ludwig's Bustard is much higher than the flight duration for Northern Black Korhaan.

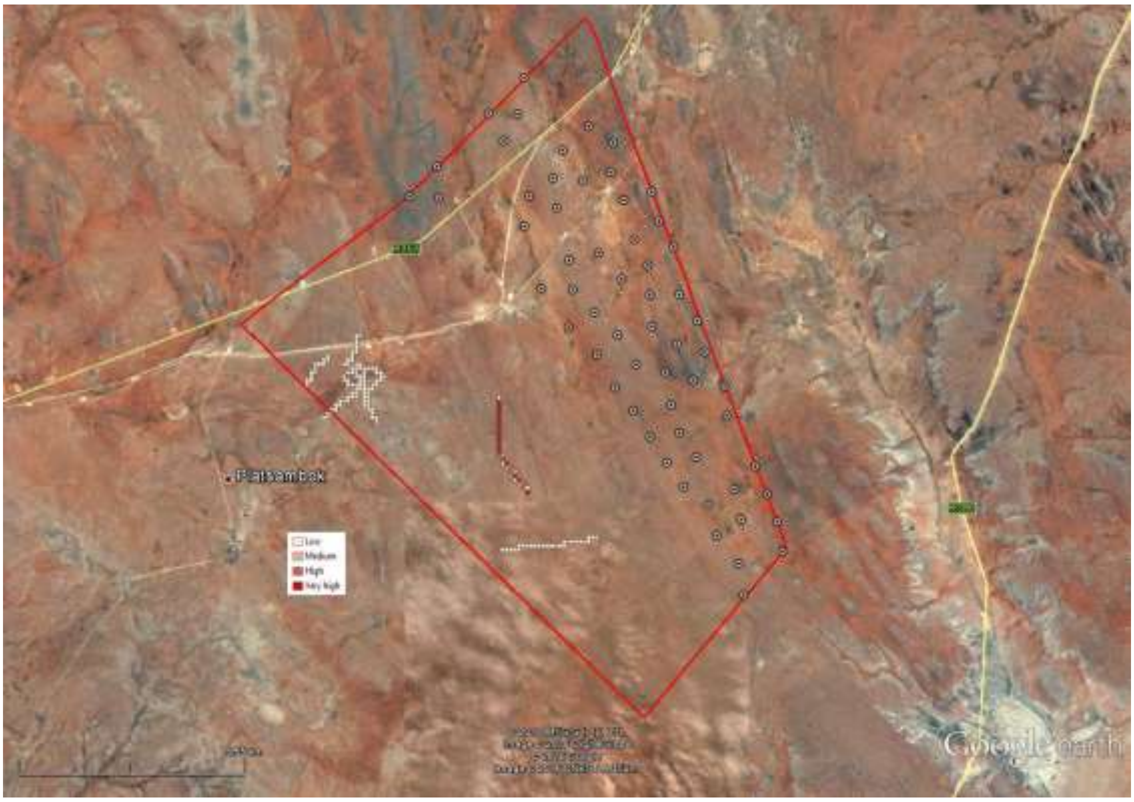


Figure 66: Spatial distribution and intensity of flights of Ludwig's Bustard

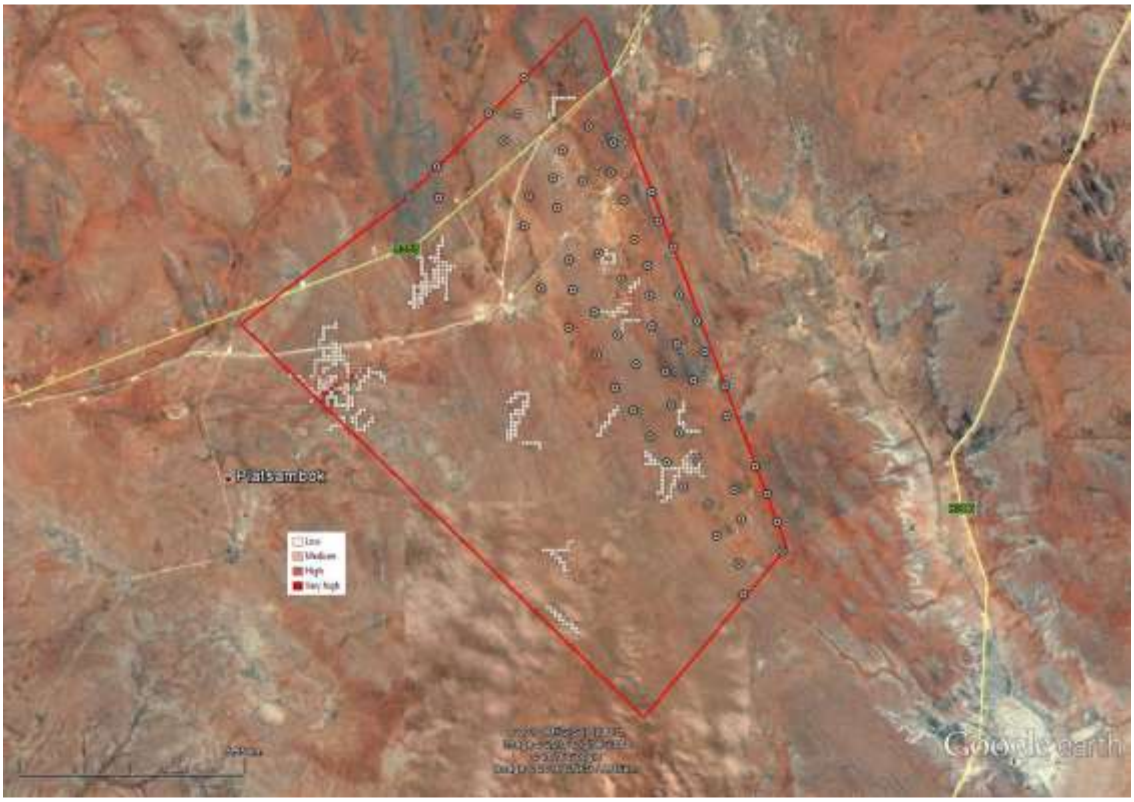


Figure 67: Spatial distribution and flight intensity for Northern Black Korhaan.

8.2.3 Focal points

A total of 5 potential focal points of bird activity were identified and monitored. The five focal points are a Martial Eagle nest on the Hydra – Kronos Tower 519 at Kronos MTS (FP1), a Verreaux's Eagle nest on a telephone pole just outside the proposed development area (FP2), a clump of trees at a borehole in the development area (FP3), a water trough at a borehole (FP4) and an ephemeral pan (FP5).

- FP1: The Martial Eagle nest was never active throughout the monitoring period. It seems the construction activity associated with multiple renewable energy facilities around Kronos MTS has led to the pair of eagles abandoning the nest due to chronic disturbance (see also **5.2.4** of the Avifuana Specialist Report).
- FP2: The Verreaux's Eagle nest was active during the pre-construction monitoring and the pair of eagles successfully raised a chick during this period (see also **5.2.4** of the Avifuana Specialist Report).
- FP3: A nest resembling that of a Southern Pale Chanting Goshawk was observed in the trees with two adult Southern Pale Chanting Goshawks in the vicinity of the nest in January 2016. This is an indication that the nest is active.
- FP4: No priority species were observed at the waterhole during any of the monitoring surveys.
- FP5: The ephemeral pan was dry during all the survey periods.

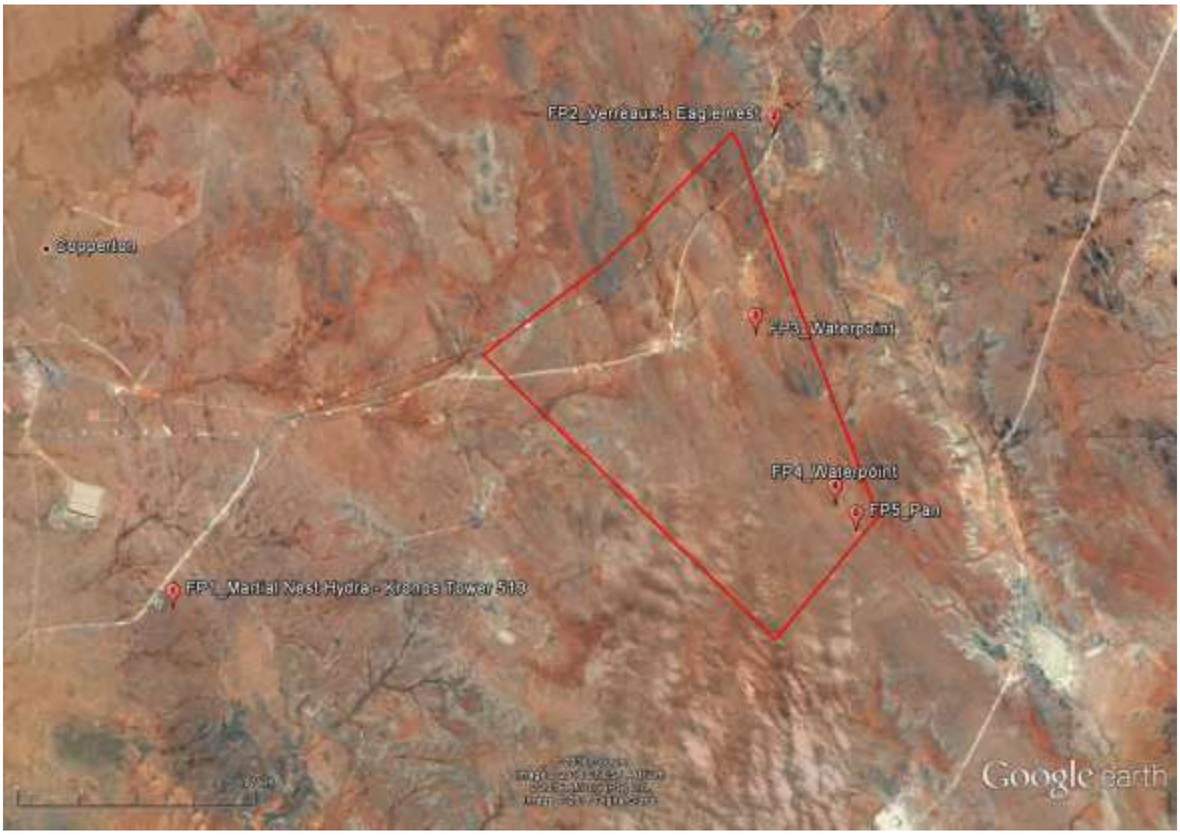


Figure 68: Focal points at the turbine site.

8.2.4 Collision Mortality on wind turbines

Wind energy generation has experienced rapid worldwide development over recent decades as its environmental impacts are considered to be relatively lower than those caused by traditional energy sources, with reduced environmental pollution and water consumption (Saidur *et al*., 2011). However, bird fatalities due to collisions with wind turbines have been consistently identified as a main ecological drawback of wind energy (Drewitt and Langston, 2006).

Collisions with wind turbines appear to kill fewer birds than collisions with other man-made infrastructures, such as power lines, buildings or even traffic (Calvert *et al*. 2013; Erickson *et a*l. 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0 to almost 40 deaths per turbine per year (Sovacool, 2009). The number of birds killed varies greatly between sites, with some sites posing a higher collision risk than others, and with some species being more vulnerable (e.g. Hull *et al*. 2013; May *et al*. 2012a). These numbers may not reflect the true magnitude of the problem, as some studies do not account for detectability biases such as those caused by scavenging, searching efficiency and search radius (Bernardino *et al*. 2013; Erickson *et al*. 2005; Huso and Dalthorp 2014). Additionally, even for low fatality rates, collisions with wind turbines may have a disproportionate effect on some species. For long-lived species with low productivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (e.g. Carrete *et al*. 2009; De Lucas *et al*. 2012a;

Drewitt and Langston, 2006). The situation is even more critical for species of conservation concern, which sometimes are most at risk (e.g. Osborn *et al*. 1998).

High bird fatality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles (*Aquila chrysaetos*), Tarifa in Southern Spain for Griffon vultures (*Gyps fulvus*), Smøla in Norway for White-tailed eagles (*Haliaatus albicilla*), and the port of Zeebrugge in Belgium for gulls (*Larus* sp.) and terns (*Sterna* sp.) (Barrios and Rodríguez, 2004; Drewitt and Langston, 2006; Everaert and Stienen, 2008; May *et al*. 2012a; Thelander *et al*. 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for a large number of fatalities that culminated in the deployment of additional measures to minimize or compensate for bird collisions. However, currently, no simple formula can be applied to all sites; in fact, mitigation measures must inevitably be defined according to the characteristics of each wind farm and the diversity of species occurring there (Hull *et a*l. 2013; May *et al.* 2012b). A deep understanding of the factors that explain bird collision risk and how they interact with one another is therefore crucial to proposing and implementing valid mitigation measures.

8.2.4.1 Species-specific factors

- **Morphological Features**

Certain morphological traits of birds, especially those related to size, are known to influence collision risk with structures such as power lines and wind turbines. The most likely reason for this is that large birds often need to use thermal and orographic updrafts to gain altitude, particularly for long distance flights. Thermal updrafts (thermals) are masses of hot, rising wind that form over heated surfaces, such as plains. Being dependent on solar radiation, they occur at certain times of the year or the day. Conversely, orographic lift (slope updraft), is formed when wind is deflected by an obstacle, such as mountains, slopes or tall buildings. Soaring birds use these two types of lift to gain altitude (Duerr *et al*. 2012). Janss (2000) identified weight, wing length, tail length and total bird length as being collision risk determinant. Wing loading (ratio of body weight to wing area) and aspect ratio (ratio of wing span squared to wing area) are particularly relevant, as they influence flight type and thus collision risk (Bevanger, 1994; De Lucas *et al.* 2008; Herrera-Alsina *et al.* 2013; Janss, 2000). Birds with high wing loading, such as the Griffon Vulture (*Gyps fulvus*), seem to collide more frequently with wind turbines at the same sites than birds with lower wing loadings, such as Common Buzzards (Buteo buteo) and Short-toed Eagles (Circaetus gallicus), and this pattern is not related with their local abundance (Barrios and Rodríguez, 2004; De Lucas *et al*. 2008). High wing-loading is associated with low flight manoeuvrability (De Lucas *et a*l. 2008), which determines whether a bird can escape an encountered object fast enough to avoid collision.

<u>Aletta wind farm</u>
Priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are Northern Black Korhaan, Karoo Korhaan, Kori Bustard and Ludwig's Bustard.

- **Sensoral perception**

Birds are assumed to have excellent visual acuity, but this assumption is contradicted by the large numbers of birds killed by collisions with man-made structures (Drewitt and Langston, 2008; Erickson *et a*l. 2005). A common explanation is that birds collide more often with these structures in conditions of low visibility, but recent studies have shown that this is not always the case (Krijgsveld *et al*. 2009). The visual acuity of birds seems to be slightly superior to that of other vertebrates (Martin, 2011; McIsaac, 2001). Unlike humans, who have a broad horizontal binocular field of 120°, some birds have two high acuity areas that overlap in a very narrow horizontal binocular field (Martin, 2011). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (*Gyps* sp.) cranes and bustards (Martin and Katzir, 1999; Martin and Shaw, 2010; Martin, 2012, 2011; O'Rourke *et al*. 2010). Furthermore, for some species, their high resolution vision areas are often found in the lateral fields of view, rather than frontally (e.g. Martin and Shaw, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Finally, some birds tend to look downwards when in flight, searching for conspecifics or food, which puts the direction of flight completely inside the blind zone of some species (Martin and Shaw, 2010; Martin, 2011). For example, the visual fields of vultures (*Gyps* sp.) include extensive blind areas above, below and behind the head and enlarged supra-orbital ridges (Martin *et al.* 2012). This, combined with their tendency to angle their head toward the ground in flight, might make it difficult for them to see wind turbines ahead, which might at least partially explain their high collision rates with wind turbines (Martin, 2012).

Currently, there is little information on whether noise from wind turbines can play a role in bird collisions with wind turbines. Nevertheless, wind turbines with whistling blades are expected to experience fewer avian collisions than silent ones, with birds hearing the blades in noisy (windy) conditions. However, the hypothesis that louder blade noises (to birds) result in fewer fatalities has not been tested so far (Dooling, 2002).

<u>Aletta wind farm</u>
Many of the priority species at the proposed wind farm probably have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the bustards, korhaans and passerines. The possible exceptions to this are the raptors which all have wider binocular fields, although as pointed out by Martin (2011, 2012), this does not necessarily result in these species being able to avoid obstacles better.

- **Phenology**

It has been suggested that resident birds would be less prone to collision, due to their familiarity with the presence of the structures (Drewitt and Langston, 2008). However, recent studies have shown that, within a wind farm, raptor collision risk and fatalities are higher for resident than for migrating birds of the same species. An explanation for this may be that resident birds generally use the wind farm area several times while a migrant bird crosses it just once (Krijgsveld *et a*l. 2009). However, other factors like bird behaviour are certainly relevant. Katzner *et al*. (2012) showed that Golden Eagles performing local movements fly at lower altitudes, putting them at a greater risk of collision than migratory eagles. Resident eagles flew more frequently over cliffs and steep slopes, using low altitude slope updrafts, while migratory eagles flew more frequently over flat areas and gentle slopes, where thermals are generated, enabling the birds to use them to gain lift and fly at higher altitudes. Also, Johnston *et al*. (2014) found that during migration when visibility is good Golden Eagles can adjust their flight altitudes and avoid the wind turbines.

At two wind farms in the Strait of Gibraltar, the majority of Griffon Vulture deaths occurred in the winter. This probably happened because thermals are scarcer in the winter, and resident vultures in that season probably relied more on slope updrafts to gain lift (Barrios and Rodríguez, 2004). The strength of these updrafts may not have been sufficient to lift the vultures above the turbine blades, thereby exposing them to a higher collision risk. Additionally, migrating vultures did not seem to follow routes that crossed these two wind farms, so the number of collisions did not increase during migratory periods. Finally, at Smøla, collision risk modelling showed that White-tailed Eagles are most prone to collide during the breeding season, when there is increased flight activity in rotor swept zones (Dahl *et al*. 2013).

The case seems to be different for passerines, with several studies documenting high collision rates for migrating passerines at certain wind farms, particularly at coastal or offshore sites. However, comparable data on collision rates for resident birds is lacking. This lack of information may result from fewer studies, lower detection rates and rapid scavenger removal (Johnson *et al*. 2002; Lekuona and Ursua, 2007). One of the few studies reporting passerine collision rates (from Navarra, northern Spain) documents higher collision rates in the autumn migration period, but it is unclear if this is due to migratory behaviour or due to an increase in the number of individuals because of recently fledged juveniles (Lekuona and Ursua, 2007).

<u>Aletta wind farm</u>
The priority species recorded at the site during the 12 months monitoring are all resident species, except Booted Eagle, which is a summer migrant.

- **Bird behaviour**

Flight type seems to play an important role in collision risk, especially when associated with hunting and foraging strategies. Kiting flight, which is used in strong winds and occurs in rotor swept zones, has been highlighted as a factor explaining the high collision rate of Red-tailed Hawks (*Buteo jamaicensis*) at APWRA (Hoover and Morrison, 2005). The hovering behaviour exhibited by Common Kestrels (*Falco tinnunculus*) when hunting may also explain the fatality levels of this species at wind farms in the Strait of Gibraltar (Barrios and Rodríguez, 2004). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover and Morrison, 2005). Additionally, while birds are hunting and focused on prey, they might lose track of wind turbine positions (Krijgsveld *et al*. 2009; Smallwood et al. 2009).

Collision risk may also be influenced by behaviour associated with a specific sex or age. In Belgium, only adult Common Terns (*Sterna hirundo*) were impacted by a wind farm (Everaert and Stienen, 2007) and the high fatality rate was sex-biased (Stienen *et al*. 2008). In this case, the wind farm is located in the foraging flight path of an important breeding colony, and the differences between fatality of males and females can be explained by the different foraging activity during egg-laying and incubation (Stienen *et al*. 2008). Another example comes from Portugal, where recent findings showed that the mortality of the Skylark (*Alauda arvensis*) is sex and age biased, and affecting mainly adult males. This was related with the characteristic breeding male song-flights that make them more vulnerable to collision with wind turbines (Morinha *et al*. 2014).

Social behaviour may also result in a greater collision risk with wind turbines due to a decreased awareness of the surroundings. Several authors have reported that flocking behaviour increases collision risk with power lines as opposed to solitary flights (e.g. Janss, 2000). However, caution must be exercised when comparing the particularities of wind farms with power lines, as some species appear to be vulnerable to collisions with power lines but not with wind turbines, e.g. indications are that bustards, which are highly vulnerable to power line collisions, are not prone to wind turbine collisions – a Spanish database of over 7000 recorded turbine collisions contains no Great Bustards Otis tarda (A. Camiña 2012a). White Storks are one of the most common large soaring migratory species recorded crossing in tens of thousands from Europe into Africa at the Straits of Gibraltar, yet the species seem to be able to successfully avoid the wind turbines at the Tarifa wind farm (e.g. see Jans 2000 and De Lucas *et al*. 2004). White Storks are not mentioned in a comprehensive review by the Birdlife International of the literature on wind turbine/avian interactions spanning 10 years between 2003 and 2013 (Gove *et al*. 2013).

Several collision risk models incorporate other variables related to bird behaviour. Flight altitude is widely considered important in determining the risk of bird collisions with offshore and onshore wind turbines, as birds that tend to fly at the height of rotor swept zones are more likely to collide (e.g. Band *et al*. 2007; Furness *et al*. 2013; Garthe and Hüppop, 2004).

<u>Aletta wind farm</u>

The priority species at the wind farm can be classified as either terrestrial species or soaring species, with some, e.g. Secretarybird exhibiting both types of flight behaviour.

Terrestrial species 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. At the wind farm site, korhaans, bustards and larks are included in this category. Some larger species undertake longer distance flights at higher altitudes (specifically Ludwig's Bustard). Soaring species 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, the raptor species are included in this class. Based on the potential time spent potentially flying at rotor height, soaring species are likely to be at greater risk of collision. However, specific behaviour of some terrestrial species might put them at risk of collision, e.g. display flights of Northern Black Korhaan and Sclater's Lark might place them within the rotor swept zone.

- **Avoidance behaviours**

Collision fatalities are also related to displacement and avoidance behaviours, as birds that do not exhibit either of these behaviours are more likely to collide with wind turbines. The lack of avoidance behaviour has been highlighted as a factor explaining the high fatality of White-tailed Eagles at Smøla wind farm, as no significant differences were found in the total amount of flight activity within and outside the wind farm area (Dahl *et a*l. 2013). However, the birds using the Smøla wind farm are mainly sub-adults, indicating that adult eagles are being displaced by the wind farm (Dahl *et al*. 2013).

Two types of avoidance have been described (Furness *et al*., 2013): 'macro-avoidance' whereby birds alter their flight path to keep clear of the entire wind farm (e.g. Desholm and Kahlert, 2005; Plonczkier and Simms, 2012; Villegas-Patraca *et al*. 2014), and 'micro-avoidance' whereby birds enter the wind farm but take evasive actions to avoid individual wind turbines (Band *et al*. 2007). This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of birds will successfully avoid the turbines (SNH 2010). It is also important to note that there is not necessarily a direct correlation between time spent at rotor height, and the likelihood of collision.

Displacement due to wind farms, which can be defined as reduced bird breeding density within a short distance of a wind turbines, has been described for some species (Pearce-Higgins *et al*. 2009). Birds exhibiting this type of displacement behaviour when defining breeding territories are less vulnerable to collisions, not because of morphological or site-specific factors, but because of altered behaviour (see also **section 6.2** of the Avifauna Specialist Report).

<u>Aletta wind farm</u>
It is anticipated that most birds at the proposed wind farm will successfully avoid the wind turbines. Possible exceptions might be raptors engaged in hunting which might serve to distract them and place them at risk of collision, or birds engaged in display behaviour, e.g. Northern Black Korhaan (see earlier point). Despite being potential collision candidates based on morphology and flight behaviour, bustards do not seem to be particularly vulnerable to wind turbine collisions, indicating a high avoidance rate. Complete macro-avoidance of the wind farm is unlikely for any of the priority species.

- **Bird abundance**

Some authors suggest that fatality rates are related to bird abundance, density or utilization rates (Carrete *et al*. 2012; Kitano and Shiraki, 2013; Smallwood and Karas, 2009), whereas others point out that, as birds use their territories in a non-random way, fatality rates do not depend on bird abundance alone (e.g. Ferrer *et al*. 2012; Hull *et al*. 2013). Instead, fatality rates depend on other factors such as differential use of specific areas within a wind farm (De Lucas *et al*. 2008). For example, at Smøla, White-tailed Eagle flight activity is correlated with collision fatalities (Dahl *et al*. 2013). In the APWRA, Golden Eagles, Red-tailed Hawks and American Kestrels (*Falco spaverius*) have higher collision fatality rates than Turkey Vultures (*Cathartes aura*) and Common Raven (*Corvus corax*), even though the latter are more abundant in the area (Smallwood *et al*. 2009), indicating that fatalities are more influenced by each species' flight behaviour and turbine perception. Also, in southern Spain, bird fatality was higher in the winter, even though bird abundance was higher during the pre-breeding season (De Lucas *et al*. 2008).

<u>Aletta wind farm</u>
The abundance of priority species at the proposed wind farm site will fluctuate depending on season of the year, and particularly in response to rainfall. This is a common phenomenon in arid ecosystems, where stochastic rainfall events can trigger irruptions of insect populations which in turn attract large numbers of birds. In general, higher populations of priority species are likely to be present when the veld conditions are good, especially in the rainy season. This could increase the risk of collisions due to heightened flight activity, especially of species such as Karoo Korhaan and Ludwig's Bustard. Conversely, some species

might be more at risk during dry conditions, e.g. Sclater's Lark which seems to increase in numbers during dry spells (Hockey *et al*. 2005).

8.2.4.2 Site-specific factors

- **Landscape features**

Susceptibility to collision can also heavily depend on landscape features at a wind farm site, particularly for soaring birds that predominantly rely on wind updrafts to fly (see previous section). Some landforms such as ridges, steep slopes and valleys may be more frequently used by some birds, for example for hunting or during migration (Barrios and Rodríguez, 2004; Drewitt and Langston, 2008; Katzner *et al*. 2012; Thelander *et al*. 2003). In APWRA, Red-tailed Hawk fatalities occur more frequently than expected by chance at wind turbines located on ridge tops and swales, whereas Golden Eagle fatalities are higher at wind turbines located on slopes (Thelander *et al*. 2003). Other birds may follow other landscape features, such as peninsulas and shorelines, during dispersal and migration periods. Kitano and Shiraki (2013) found that the collision rate of White-tailed Eagles along a coastal cliff was extremely high, suggesting an effect of these landscape features on fatality rates.

<u>Aletta wind farm</u>
The proposed site does not contain many landscape features as the majority of the development area is situated on a vast open plain. There is a slight ridge to the north of the site which may be used by soaring species for declivity soaring, but this was not recorded during pre-construction monitoring. There is small pan in the south of the study area, and many boreholes with water troughs. Boreholes with open water troughs are important sources of surface water and are used extensively by various species, including large raptors, to drink and bath. Apart from raptors, smaller species congregate in large numbers around water troughs which in turn attracts raptors such as Lanner Falcon and Southern Pale Chanting Goshawk exposing them to collisions when they are distracted and hunting. If the small pan regularly holds water, it could attract all of the above as well as a variety of waterbirds. However, it seems as if the pan seldom contains water, it never contained water during the 12-months monitoring.

- **Flight paths**

Although the abundance of a species per se may not contribute to a higher collision rate with wind turbines, as previous discussed, areas with a high concentration of birds seem to be particularly at risk of collisions (Drewitt and Langston, 2006), and therefore several guidelines on wind farm construction advise special attention to areas located in migratory paths (e.g. Atienza *et al*. 2012; CEC, 2007; USFWS, 2012). As an example, Johnson *et al*. (2002) noted that over two-thirds of the carcasses found at a wind farm in Minnesota were of migrating birds. At certain times of the year, nocturnally migrating passerines are the most abundant species at wind farm, particularly during spring and fall migrations, and are also the most common fatalities (Strickland *et al*. 2011).

For territorial raptors like Golden Eagles, foraging areas are preferably located near to the nest, when compared to the rest of their home range. For example, in Scotland 98% of movements were registered at ranges less than 6 km from the nest, and the core areas were located within a 2–3 km radius (McGrady *et* *al*. 2002). These results, combined with the terrain features selected by Golden Eagles to forage such as areas closed to ridges, can be used to predict the areas used by the species to forage (McLeod *et al*. 2002), and therefore provide a sensitivity map and guidance to the development of new wind farms (Bright *et al*. 2006). In Spain, on the other hand, a study spanning 7 provinces with an estimated Golden Eagle population of 384 individuals, with a combined total of 46 years of post-construction monitoring, involving 5858 turbines, collisions did not occur at the nearest wind farm to the nest site but occurred in hunting areas with high prey availability far from the breeding territories, or randomly. A subset of data was used to investigate, inter alia, the relationship between collision mortality and proximity to wind turbines. Data was gathered for over a 12-year period. Analysis revealed that collisions are not related with the distance from the nest to the nearest turbine (Camiña 2014).

Wind farms located within flight paths can increase collision rates, as seen for the wind farm located close to a seabird breeding colony in Belgium (Everaert and Stienen, 2008). In this case, wind turbines were placed along feeding routes, and several species of gulls and terns were found to fly between wind turbines on their way to marine feeding grounds. Additionally, breeding adults flew closer to the structures when making frequent flights to feed chicks, which potentially increased the collision risk.

Aletta Wind Farm

The proposed windfarm site is not located on any known or obvious flight path. It is also not located on any known migration route. The pair of Verreaux's Eagles which breeds just outside the north-eastern corner of the site may at times forage over the site, especially in the area close to the nest, but they were never recorded flying at the site during the 12-months monitoring. Monitoring at other wind farm sites in the Karoo have indicated that the majority of flight activity is within a 2-3km radius around the nest (Ralston 2016; pers. obs). Another area of potential dense flight activity is around water points, which could regularly attract several priority species, especially large raptors (see **5.2.2** of the Avifauna Specialist Report). However, no such activity was recorded during the 12-months monitoring.

- **Food availability**

Factors that increase the use of a certain area or that attract birds, like food availability, also play a role in collision risk. For example, the high density of raptors at the APWRA and the high collision fatality due to collision with turbines is thought to result, at least in part, from high prey availability in certain areas (Hoover and Morrison, 2005; Smallwood *et al*. 2001). This may be particularly relevant for birds that are less aware of obstructions such as wind turbines while foraging (Krijgsveld *et al*. 2009; Smallwood *et al*. 2009). It is speculated that the mortality of three Verreaux's Eagles in 2015 at a wind farm site in South Africa may have been linked to the availability of food (Smallie 2015).

Aletta Wind Farm

In arid zones such as where this proposed wind farm is located, food availability is often linked to rainfall. It is a well-known fact that insect outbreaks may occur after rainfall events, which could draw in various priority species such as Ludwig's Bustard, Kori Bustard and various raptors. This in turn could heighten the risk of collisions.

- **Weather**

Certain weather conditions, such as strong winds that affect the ability to control flight manoeuvrability or reduce visibility, seem to increase the occurrence of bird collisions with artificial structures (Longcore *et al.* 2013). Some high bird fatality events at wind farms have been reported during instances of poor weather. For example, at an offshore research platform in Helgoland, Germany, over half of the bird strikes occurred on just two nights that were characterized by very poor visibility (Hüppop *et al*. 2006). Elsewhere, 14 bird carcasses were found at two adjacent wind turbines after a severe thunderstorm at a North American wind farm (Erickson *et al*. 2001). However, in these cases, there may be a cumulative effect of bad weather and increased attraction to artificial light. Besides impairing visibility, low altitude clouds can in turn lower bird flight height, and therefore increasing their collision risk with tall obstacles (Langston and Pullan, 2003). For wind farms located along migratory routes, the collision risk may not be the same throughout a 24-h period, as the flight altitudes of birds seem to vary. The migration altitudes of soaring birds have been shown to follow a typically diurnal pattern, increasing during the morning hours, peaking toward noon, and decreasing again in the afternoon, in accordance with general patterns of daily temperature and thermal convection (Kerlinger, 2010; Shamoun-Baranes *et al*. 2003).

Collision risk of raptors is particularly affected by wind. For example, Golden Eagles migrating over a wind farm in Rocky Mountain showed variable collision risk according to wind conditions, which decreased when the wind speed raised and increased under head- and tailwinds when compared to western crosswinds (Johnston *et al*. 2014).

<u>Aletta Wind Farm</u>
Weather conditions at the proposed wind farm are likely to influence flight behaviour in much the same manner as has been recorded elsewhere at wind farms. The dominant wind directions at Copperton is West/West-southwest and East - northeast. However, the majority of soaring flight activity was recorded during north-westerly wind conditions (see **APPENDIX 3** of the Avifauna Specialist Report).

8.2.4.3 Wind farm-specific factors

- **Turbine features**

Turbine features may play a role in collision risk. Older lattice-type towers have been associated with high collision risk, as some species exhibiting high fatality rates used the turbine poles as roosts or perches when hunting (Osborn *et al*. 1998; Thelander and Rugge, 2000). However, in more recent studies, tower structure did not influence the number of bird collisions, as it was not higher than expected according to their availability when compared to collisions with tubular turbines (Barrios and Rodríguez, 2004).

Turbine size has also been highlighted as an important feature, as higher towers have a larger rotor swept zone and, consequently, a larger collision risk area. While this makes intuitive sense, the majority of published scientific studies indicate that an increase in rotor swept area do not automatically translate into a larger collision risk. Turbine dimensions seem to play an insignificant role in the magnitude of the collision risk in general, relative to other factors such as topography, turbine location, morphology and a species' inherent ability to avoid the turbines, and may only be relevant in combination with other factors, particularly wind strength and topography (see Howell 1997, Barrios & Rodriguez 2004; Barclay *et al*. 2007, Krijgsveld *et al*. 2009, Smallwood 2013; Everaert 2014). Only two studies so far found a correlation between turbine hub height and mortality (De Lucas *et al.* 2008; Loss *et al*. 2013).

Rotor speed (revolutions per minute) also seems to be relevant, as faster rotors are responsible for higher fatality rates (Thelander *et al*. 2003). However, caution is needed when analysing rotor speed alone, as it is usually correlated with other features that may influence collision risk as turbine size, tower height and rotor diameter (Thelander *et al*. 2003), and because rotor speed is not proportional to the blade speed. In fact, fast spinning rotors have fast moving blades, but rotors with lower resolutions per minute may drive higher blade tip speeds.

<u>Aletta Wind Farm</u>
Due to the fact that the turbine dimensions are constantly changing as newer models are introduced, it is best to take a pre-cautionary approach in order to anticipate any future potential changes in the turbine dimensions. The pre-construction monitoring programme worked on a potential rotor swept area of 30m – 220m to incorporate a wide range of models, which accommodates the current proposed turbines.

- **Blade visibility**

When turbine blades spin at high speeds, a motion smear (or motion blur) effect occurs, making wind turbines less conspicuous. This effect occurs both in the old small turbines that have high rotor speed and in the newer high turbines that despite having slower rotor speeds, achieve high blade tip speeds. Motion smear effect happens when an object is moving too fast for the brain to process the images and, as a consequence, the moving object appears blurred or even transparent to the observer. The effect is dependent on the velocity of the moving object and the distance between the object and the observer. The retinal-image velocity of spinning blades increases as birds get closer to them, until it eventually surpasses the physiological limit of the avian retina to process temporally changing stimuli. As a consequence, the blades may appear transparent and perhaps the rotor swept zone appears to be a safe place to fly (Hodos, 2003). For example, McIsaac (2001) showed that American Kestrels were not always able to distinguish moving turbine blades within a range of light conditions.

<u>Aletta Wind Farm</u>
Motion smear is inherent to all wind turbines and will therefore also be a potential risk factor at the proposed wind farm.

- **Wind farm configuration**

Wind farm layout can also have a critical influence on bird collision risk. For example, it has been demonstrated that wind farms arranged perpendicularly to the main flight path may be responsible for a higher collision risk (Everaert *et al*. 2002 & Isselbacher and Isselbacher, 2001 in Hötker *et a*l. 2006). At APWRA, wind farms located at the ends of rows, next to gaps in rows, and at the edge of local clusters were found to kill disproportionately more birds (Smallwood and Thellander, 2004). In this wind farm, serially arranged wind turbines that form wind walls are safer for birds (suggesting that birds recognize wind turbines and towers as obstacles and attempt to avoid them while flying), and fatalities mostly occur at single wind turbines or wind turbines situated at the edges of clusters (Smallwood and Thellander, 2004). However, this may be a specificity of APWRA. For instance, De Lucas *et al*. (2012a) found that the positions of the wind turbines within a row did not influence the turbine fatality rate of Griffon Vultures at Tarifa. Additionally, engineering features of the newest wind turbines require a larger minimum distance between adjacent wind turbines and in new wind farms it is less likely that birds perceive rows of turbines as impenetrable walls. In fact, in Greece it was found that the longer the distance between wind turbines, the higher is the probability that raptors will attempt to cross the space between them (Cárcamo *et al*. 2011).

<u>Aletta Wind Farm</u>
The recorded flight behaviour of priority species at the proposed wind farm provided few clues with regard to potential areas of greater risk, largely due to the low frequency and random nature of flights. A pre-cautionary no-turbine buffer zone of 3km is recommended around the Verreaux's Eagle nest site, based on the species' known vulnerability to turbine collisions.

8.2.5 Displacement due to disturbance

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

Unfortunately, few studies of displacement due to disturbance are conclusive, often because of the lack of before-and-after and control-impact (BACI) assessments. Onshore, disturbance distances (in other words the distance from wind farms up to which birds are absent or less abundant than expected) up to 800 m (including zero) have been recorded for wintering waterfowl (Pedersen & Poulsen 1991 as cited by Drewitt & Langston 2006), though 600 m is widely accepted as the maximum reliably recorded distance (Drewitt & Langston 2006). The variability of displacement distances is illustrated by one study which found lower post-construction densities of feeding European White-fronted Geese Anser albifrons within 600 m of the turbines at a wind farm in Rheiderland, Germany (Kruckenberg & Jaene 1999 as cited by Drewitt & Langston 2006), while another showed displacement of Pink-footed Geese Anser brachyrhynchus up to only 100–200 m from turbines at a wind farm in Denmark (Larsen & Madsen 2000 as cited by Drewitt & Langston 2006). Indications are that Great Bustard Otis tarda could be displaced by wind farms up to one kilometre from the facility (Langgemach 2008). An Austrian study found displacement for Great Bustards up to 600m (Wurm & Kollar as quoted by Raab *et al*. 2009). However, there is also evidence to the contrary; information on Great Bustard received from Spain points to the possibility of continued use of leks at operational wind farms (Camiña 2012b). Research on small grassland species in North America indicates that permanent displacement is uncommon and very species specific (e.g. see Stevens *et al.* 2013, Hale *et al*. 2014). There also seem to be little evidence for a persistent decline in passerine populations at wind farm sites in the UK (despite some evidence of turbine avoidance), with some species, including Skylark, showing increased populations after wind farm construction (see Pierce-Higgins *et al*. 2012). Populations of Thekla Lark Galerida theklae were found to be unaffected by wind farm developments in Southern Spain (see Farfan *et al*. 2009).

The consequences of displacement for breeding productivity and survival are crucial to whether or not there is likely to be a significant impact on population size. However, studies of the impact of wind farms on breeding birds are also largely inconclusive or suggest lower disturbance distances, though this apparent lack of effect may be due to the high site fidelity and long life-span of the breeding species studied. This might mean that the true impacts of disturbance on breeding birds will only be evident in the longer term, when new recruits replace existing breeding birds. Few studies have considered the possibility of displacement for short-lived passerines (such as larks), although Leddy *et al*. (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80m of the turbines. A review of minimum avoidance distances of 11 breeding passerines were found to be generally <100m from a wind turbine ranging from 14 – 93m (Hötker *et al*. 2006). A comparative study of nine wind farms in Scotland (Pearce-Higgens *et al*. 2009) found unequivocal evidence of displacement: Seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with equivocal evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Levels of turbine avoidance suggest breeding bird densities may be reduced within a 500m buffer of the turbines by 15–53%, with Common Buzzard Buteo buteo, Hen Harrier Circus cyaneus, Golden Plover Pluvialis apricaria, Snipe Gallinago gallinago, Curlew Numenius arquata and Wheatear Oenanthe oenanthe most affected. In a follow-up study, monitoring data from wind farms located on unenclosed upland habitats in the United Kingdom were collated to test whether breeding densities of upland birds were reduced as a result of wind farm construction or during wind farm operation. Red Grouse Lagopus lagopus scoticus, Snipe Gallinago gallinago and Curlew Numenius arquata breeding densities all declined on wind farms during construction. Red Grouse breeding densities recovered after construction, but Snipe and Curlew densities did not. Post-construction Curlew breeding densities on wind farms were also significantly lower than reference sites. Conversely, breeding densities of Skylark Alauda arvensis and Stonechat Saxicola torquata increased on wind farms during construction. Overall, there was little evidence for consistent post-construction population declines in any species, suggesting that wind farm construction can have greater impacts upon birds than wind farm operation (Pierce-Higgens *et al*. 2012).

The effect of birds altering their migration flyways or local flight paths to avoid a wind farm is also a form of displacement. This effect is of concern because of the possibility of increased energy expenditure when birds have to fly further, as a result of avoiding a large array of turbines, and the potential disruption of linkages between distant feeding, roosting, moulting and breeding areas otherwise unaffected by the wind farm. The effect depends on species, type of bird movement, flight height, distance to turbines, the layout and operational status of turbines, time of day and wind force and direction, and can be highly variable, ranging from a slight 'check' in flight direction, height or speed, through to significant diversions which may reduce the numbers of birds using areas beyond the wind farm (Drewitt & Langston 2006). A review of the literature suggests that none of the barrier effects identified so far have significant impacts on populations (Drewitt & Langston 2006). However, there are circumstances where the barrier effect might lead indirectly to population level impacts; for example, where a wind farm effectively blocks a regularly used flight line between nesting and foraging areas, or where several wind farms interact cumulatively to create an extensive barrier which could lead to diversions of many tens of kilometres, thereby incurring increased energy costs.

Aletta Wind Farm

None of the priority species are likely to be permanently displaced due to disturbance, although displacement in the short term during the construction phase is very likely. The risk of permanent replacement is larger for large species such as Kori Bustard and Ludwig's Bustard, although displacement of the closely related Denham's Bustard (Neotis denhami) is evidently not happening at existing wind farms in the Eastern Cape (M. Langlands pers. comm). If the wind farm follows the modern trend of fewer, larger turbines, the risk of displacement is also lower. However, this will only be established through a post-construction monitoring programme.

It is recommended that a 3km buffer no development zone is implemented around the Verreaux's Eagle nest at FP2 as per the draft Verreaux's Eagle guidelines for wind farms produced by Birdlife SA in September 2015 (Ralston 2016). A 300m no development buffer zone is recommended for the suspected Southern Pale Chanting Goshawk nest at FP3.

8.2.6 Displacement due to habitat loss

The scale of permanent habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, in general it, is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development area (Fox *et al*. 2006 as cited by Drewitt & Langston 2006), though effects could be more widespread where developments interfere with hydrological patterns or flows on wetland or peatland sites (unpublished data). Some changes could also be beneficial. For example, habitat changes following the development of the Altamont Pass wind farm in California led to increased mammal prey availability for some species of raptor (for example through greater availability of burrows for Pocket Gophers Thomomys bottae around turbine bases), though this may also have increased collision risk (Thelander *et al*. 2003 as cited by Drewitt & Langston 2006).

However, the results of habitat transformation may be subtler, whereas the actual footprint of the wind farm may be small in absolute terms, the effects of the habitat fragmentation brought about by the associated infrastructure (e.g. power lines and roads) may be more significant. Sometimes Great Bustard can be seen close to or under power lines, but a study done in Spain (Lane *et al*. 2001 as cited by Raab *et al*. 2009) indicates that the total observation of Great Bustard flocks were significantly higher further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard generally avoid the immediate proximity of roads within a 500m buffer. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al*. 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Alan *et al*. 1997).

Aletta Wind Farm

The direct habitat transformation at the proposed wind farm is likely to be fairly minimal. The indirect habitat transformation is likely to have a bigger impact on priority species. It is expected that the densities of some terrestrial priority species may decrease due to this impact, e.g. Ludwig's Bustard, but complete displacement is unlikely. The degree of displacement will only become apparent through post-construction monitoring.

8.3 Bats

The full Bat Assessment was conducted by Werner Marais of Animalia and is included in **Appendix 6C**. The results below have been taken from the final progress report for a 12 month bat monitoring study.

8.3.1 Ecology of bat species that may be largely impacted by the Aletta 1 WEF

There are several bat species in the vicinity of the site that occur commonly in the area. These species are of importance based on their likelihood of being impacted by the proposed WEF, due to high abundances and certain behavioural traits. The relevant species are discussed below.

- ***Tadarida aegyptiaca***

The Egyptian Free-tailed Bat, *Tadarida aegyptiaca*, is a Least Concern species as it has a wide distribution and high abundance throughout South Africa, and is part of the Free-tailed bat family (Molossidae). It occurs from the Western Cape of South Africa, north through to Namibia and southern Angola; and through Zimbabwe to central and northern Mozambique (Monadjem *et al*. 2010). This species is protected by national legislation in South Africa (ACR 2010).

They roost communally in small (dozens) to medium-sized (hundreds) groups in caves, rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. Tadarida aegyptiaca has also adapted to roosting in buildings, in particular roofs of houses (Monadjem *et a*l. 2010). Thus man-made structures and large trees on the site would be important roosts for this species.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert, semi-arid scrub, savanna, grassland and agricultural lands. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey (Monadjem *et al*. 2010).

The Egyptian Free-tailed bat is considered to have a High likelihood of risk of fatality due to wind turbines (Sowler and Stoffberg 2014). Due to the high abundance and widespread distribution of this species, high mortality rates due to wind turbines would be a cause of concern as these species have more significant ecological roles than the rarer bat species.

After a gestation of four months, a single young is born, usually in November or December, when females give birth once a year. In males, spermatogenesis occurs from February to July and mating occurs in August. Maternity colonies are apparently established by females in November.

- ***Neoromicia capensis***

Neoromicia capensis is commonly called the Cape serotine and has a conservation status of Least Concern as it is found in high numbers and is widespread over much of Sub-Saharan Africa.

High mortality rates of this species due to wind turbines would be a cause of concern as *N. capensis* is abundant and widespread and as such has a more significant role to play within the local ecosystem than the rarer bat species. They do not undertake migrations and thus are considered residents of the site.

It roosts individually or in small groups of two to three bats in a variety of shelters, such as under the bark of trees, at the base of aloe leaves, and under the roofs of houses. They will use most man-made structures as day roosts which can be found throughout the site and surrounding areas (Monadjem *et al*. 2010).

They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; indicating that they may occupy several habitat types across the site, and are amenable towards habitat changes. They are however clutter-edge foragers, meaning they prefer to hunt on the edge of vegetation clutter mostly, but can occasionally forage in open spaces. They are thought to have a Medium-High likelihood of risk of fatality due to wind turbines (Sowler and Stoffberg 2014).

Mating takes place from the end of March until the beginning of April. Spermatozoa are stored in the uterine horns of the female from April until August, when ovulation and fertilisation occurs. They give birth to twins during late October and November but single pups, triplets and quadruplets have also been recorded (van der Merwe 1994 and Lynch 1989).

- ***Miniopterus natalensis***

Miniopterus natalensis, also commonly referred to as the Natal long-fingered bat, occurs widely across the country but mostly within the southern and eastern regions and is listed as Near Threatened (Monadjem *et al*., 2010). This bat is a cave-dependent species and identification of suitable roosting sites may be more important in determining its presence in an area than the presence of surrounding vegetation. It occurs in large numbers when roosting in caves with approximately 260 000 bats observed making seasonal use of the De Hoop Guano Cave in the Western Cape, South Africa. Culverts and mines have also been observed as roosting sites for either single bats or small colonies. Separate roosting sites are used for winter hibernation activities and summer maternity behaviour, with the winter hibernacula generally occurring at higher altitudes in more temperate areas and the summer hibernacula occurring at lower altitudes in warmer areas of the country (Monadjem *et al*., 2010).

Mating and fertilisation usually occur during March and April and is followed by a period of delayed implantation until July/August. Birth of a single pup usually occurs between October and December as the females congregate at maternity roosts (Monadjem *et al*., 2010 & Van Der Merwe, 1979).

The Natal long-fingered bat undertakes short migratory journeys between hibernaculum and maternity roosts. Due to this migratory behaviour, they are considered to be at high risk of fatality from wind turbines if a wind farm is placed within a migratory path (Sowler and Stoffberg, 2013). The mass movement of bats during migratory periods could result in mass casualties if wind turbines are positioned over a mass migratory route and such turbines are not effectively mitigated. Very little is known about the migratory behaviour and paths of *M. natalensis* in South Africa with migration distances exceeding 150 kilometres. If the site is located within a migratory path the bat detection systems should detect high numbers and activity of the Natal long-fingered bat. This will be examined over the course of the 12-month monitoring survey.

A study by Vincent *et al*. (2011) on the activity and foraging habitats of Miniopteridae found that the individual home ranges of lactating females were significantly larger than that of pregnant females. It was also found that the bats predominately made use of urban areas (54%) followed by open areas (19.8%), woodlands (15.5%) orchards and parks (9.1%) and water bodies (1.5%) when selecting habitats. Foraging areas were also investigated with the majority again occurring in urban areas (46%), however a lot of foraging also occurred in woodland areas (22%), crop and vineyard areas (8%), pastures, meadows and scrubland (4%) and water bodies (4%).

Sowler and Stoffberg (2014) advise that *M. natalensis* faces a medium to high risk of fatality due to wind turbines. This evaluation was based on broad ecological features and excluded migratory information.

8.3.2 Transects

Transect data was used to analyse the accuracy of the bat sensitivity map.

- **First Site Visit**

Figure 69 below indicates the transect routes during the first site visit. Transect routes were not calculated and were carried out randomly based on available access to the farms and condition of the farm roads. The SM2BAT+ Real time expansion type detector was used. **Table 32** displays the sampling effort and weather conditions prevalent during transect surveys.

Table 32: Transect distance, duration and average weather conditions experienced during the second transect

Date	Distance (km)	Duration (hours and minutes)	Temperature (˚C)	Rain (mm)	Wind speed (km/h)
22 July 2015	45.1	3hr 14min	15	0.6	21.6
23 July 2015	55	3hr 50 min	12	0.0	18

Transect tracks

Figure 69: Transect routes across the site over the first site visit

Figure 69 above displays that zero bat passes were detected over the course of the transect sampling period for the first site visit. This was most likely due to the cold and windy weather conditions influencing the bat activity. Bats are generally less active in adverse weather conditions.

- **Second Site Visit**

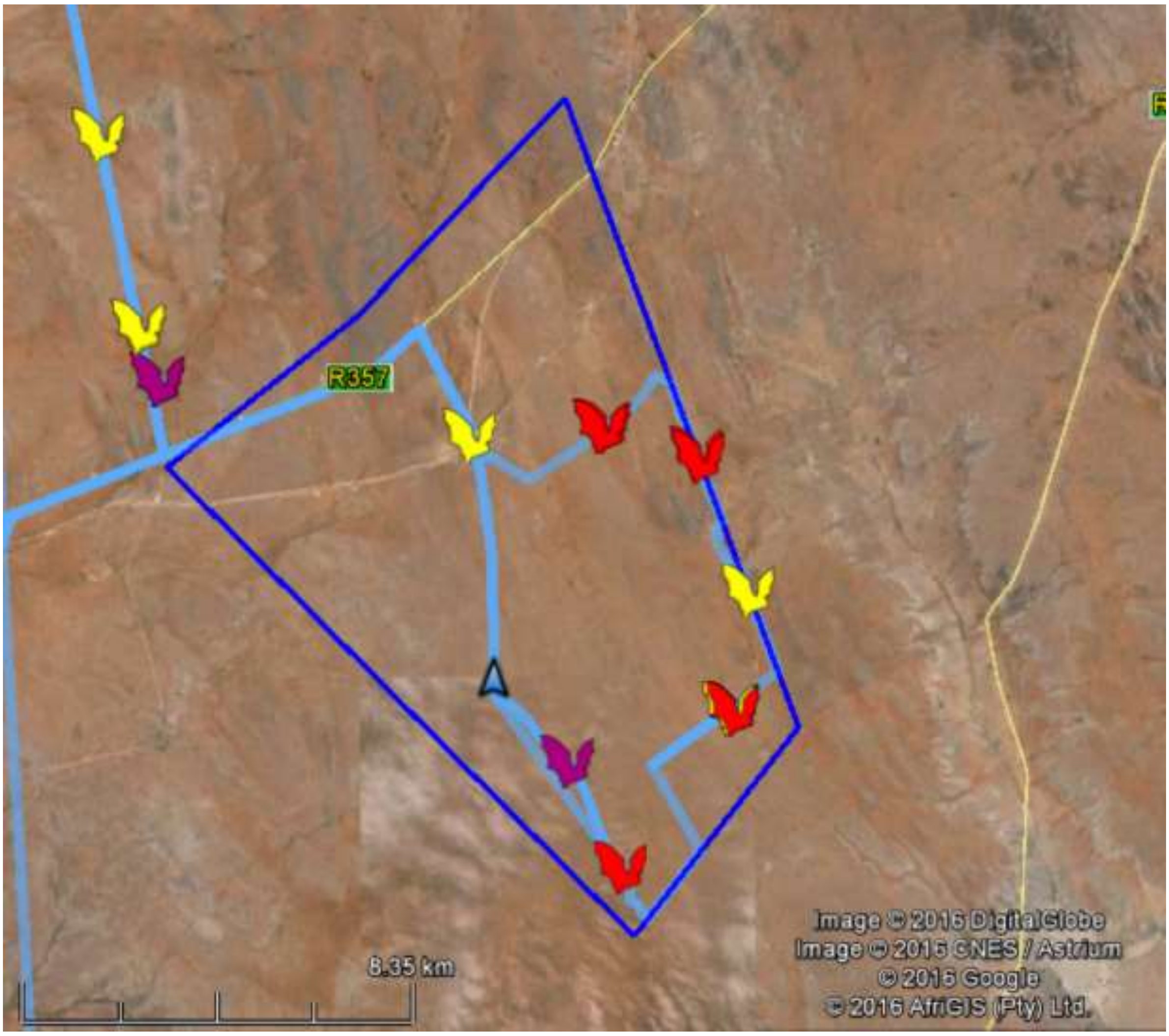
Figure 70 below indicates the transect routes during the second site visit. Transect routes were not calculated and were carried out randomly based on available access to the farms and condition of the farm roads. The SM2BAT+ Real time expansion type detector was used. **Table 33** displays the sampling effort and weather conditions prevalent during transect surveys.

Table 33: Transect distance, duration and average weather conditions experienced during the second transect

Date	Distance (km)	Duration (hours and minutes)	Temperature (˚C)	Rain (mm)	Wind speed (km/h)

20 October 2015	62.2	3hr 28min	28	0.0	18
21 October 2015	51.9	3hr 24 min	30	0.0	18
22 October 2015	75.4	5hr 29 min	25	0.0	18

Figure 70 below displays a few bat passes of three different species that were detected across the site during transects. The species detected are *Miniopterus natalensis*, *Neoromicia capensis* and *Tadarida aegyptiaca*. Their spatial distribution was relatively spread across the study area with detection in the vicinity of buildings and houses.



Miniopterus natalensis *Neoromicia capensis* *Tadarida aegyptiaca*

Transect tracks

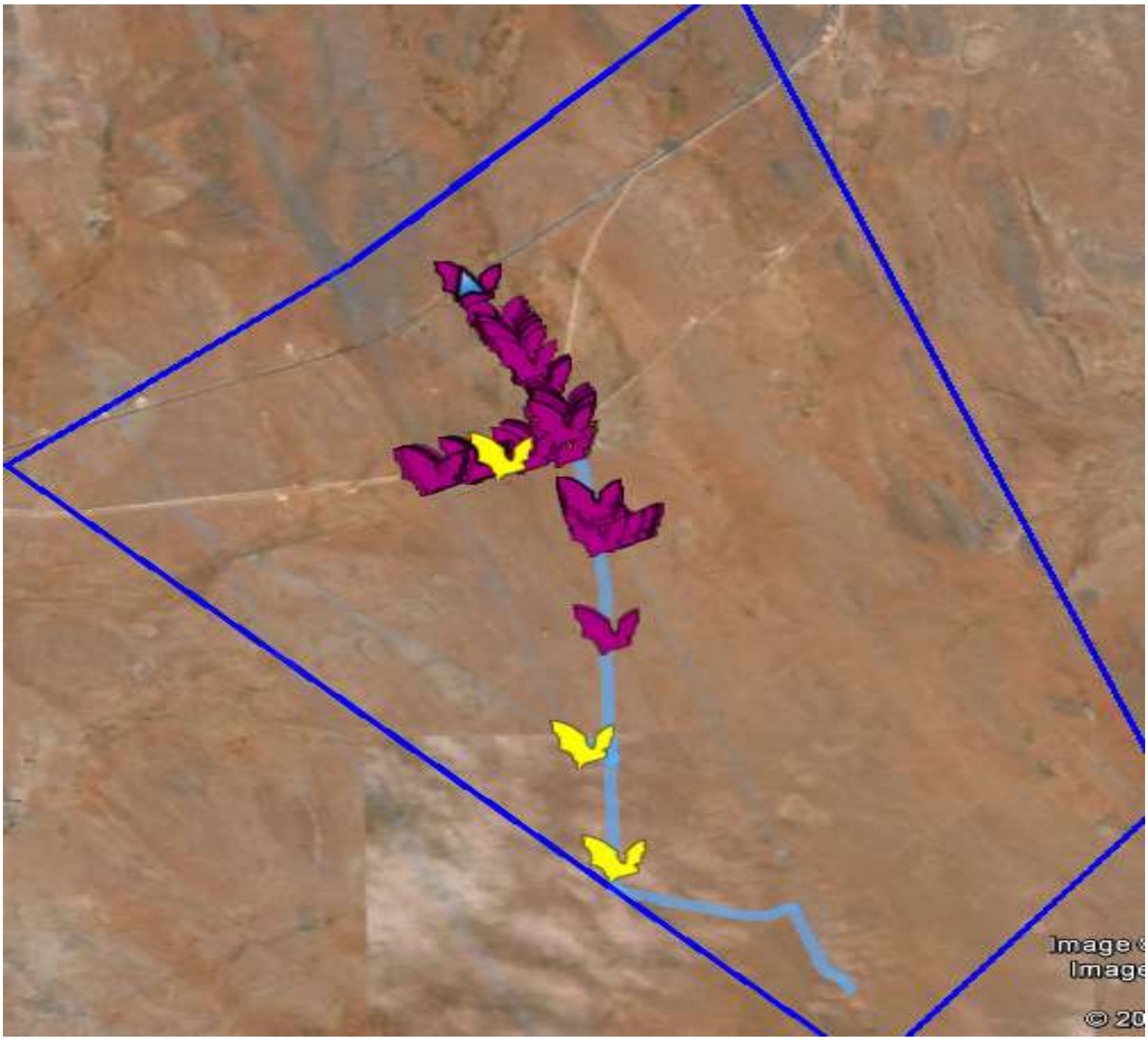
Figure 70: Transect routes across the site over the second site visit

- **Third Site Visit**

Figure 71 below indicates the transect routes during the third site visit. **Table 34** displays the sampling effort and weather conditions prevalent during transect surveys.

Table 34: Transect distance, duration and average weather conditions experienced during the second transect

Date	Distance (km)	Duration (hours and minutes)	Temperature (˚C)	Rain (mm)	Wind speed (km/h)
10 February 2016	18.7	1hr 51min	33	0.0	9.6



Miniopterus natalensis *Neoromicia capensis* *Tadarida aegyptiaca*

Transect tracks

Figure 71: Transect routes across over the third site visit

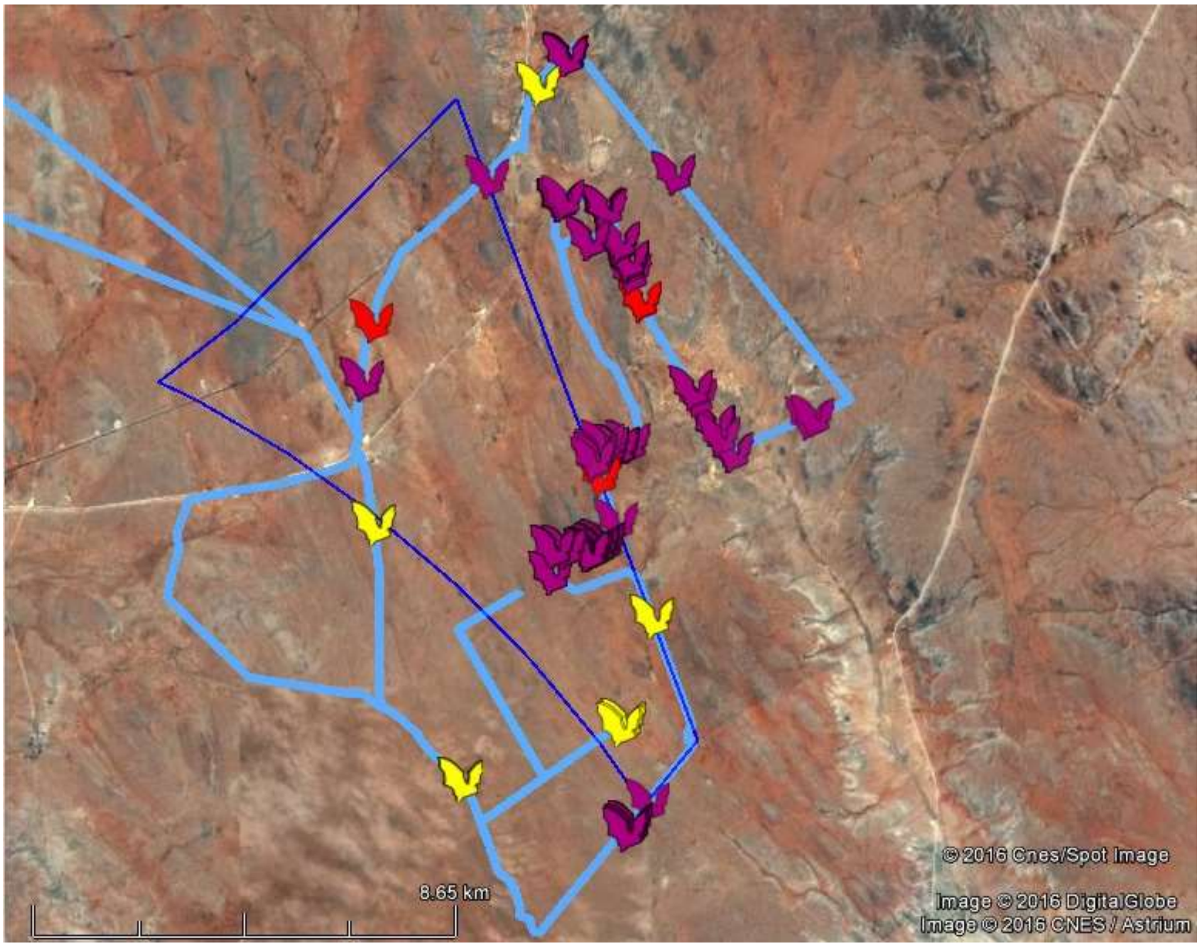
Figure 71 above displays a high concentration of *Tadarida aegyptiaca* passes near the centre of the study area, near buildings and houses. These manmade structures provide a suitable roosting place and protection from weather and predators. This bat species seems to be opportunistically utilising those features. Thus, they will be buffered in the bat sensitivity map.

- **Fourth Site Visit**

Figure 72 below indicates the transect routes during the fourth site visit. **Table 35** displays the sampling effort and weather conditions prevalent during transect surveys.

Table 35: Transect distance, duration and average weather conditions experienced during the second transect

Date	Distance (km)	Duration (hours and minutes)	Temperature (˚C)	Rain (mm)	Wind speed (km/h)
11 April 2016	56.4	3hr 24min	25.67	0.0	9.3
12 April 2016	65.8	4hr 08min	26.67	0.0	10.3
13 April 2016	52.6	3hr 30min	27.67	0.0	8
14 April 2016	48.4	2hr 21min	28.67	0.0	8



Miniopterus natalensis *Neoromicia capensis* *Tadarida aegyptiaca*
Transect tracks

Figure 72: Transect routes across the site over the fourth site visit.

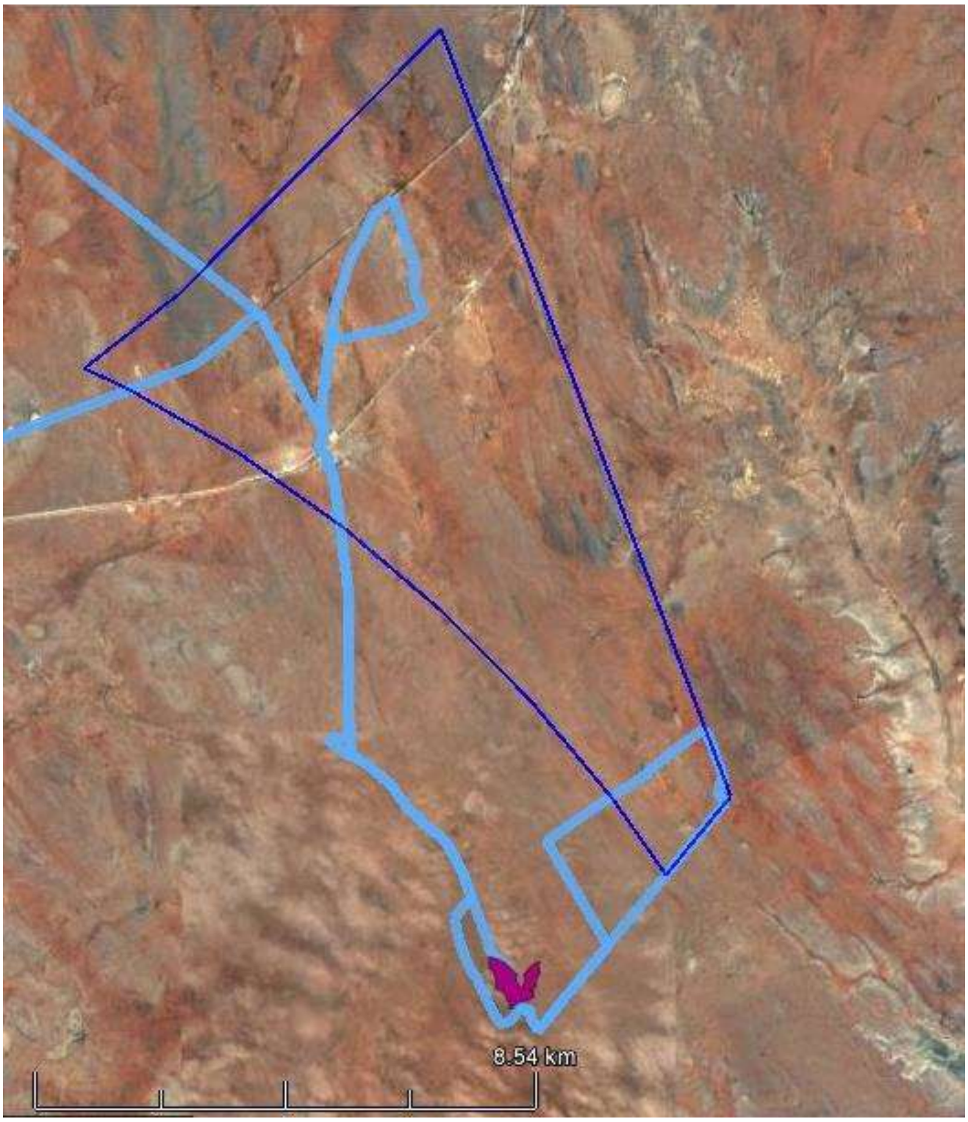
Generally increased bat activity was detected over the fourth site visit across most of the study area. The weather conditions hosted higher bat activity than the previous sampling seasons. *Tadarida aegyptiaca* was the most abundant bat species detected over the study area.

- **Fifth Site Visit**

Figure 73 below indicates the transect routes during the fifth site visit. **Table 36** displays the sampling effort and weather conditions prevalent during transect surveys. Decreased bat activity was detected over the fifth site visit across the study area. The low bat activity can be due to the transect being conducted during a winter month. Tadarida aegyptiaca was the only bat specie detected over the study area.

Table 36: Transect distane, duration and average weather conditions experienced during the second transect

Date	Distance (km)	Duration (hours and minutes)	Temperature (˚C)	Rain (mm)	Wind speed (km/h)
9 July 2016	57.8	3hr 10min	17	0.0	7.3



Tadarida aegyptiaca — Transect tracks

Figure 73: Transect routes across the site over the fifth site visit

8.3.3 Sensitivity Map

Figure 74 depicts the sensitive areas of the site, based on features identified to be important for foraging and roosting of the species that are most probable to occur on site. Thus the sensitivity map is based on species ecology and habitat preferences. This map can be used as a pre-construction mitigation in terms of improving turbine placement with regards to bat preferred habitats on site.

Table 37: Description of parameters in the construction of a sensitivity map

Last iteration	June 2015
High sensitivity buffer	250m radial buffer

Moderate sensitivity buffer	100m radial buffer
Features used to develop the sensitivity map	Manmade structures, such as houses, barns, sheds and road culverts, these structures provide easily accessible roosting sites.
	The presence of probable hollows/overhangs, rock faces and clumps of larger woody plants. These features provide natural roosting spaces and tend to attract insect prey.
	The different vegetation types and presence of riparian/water drainage habitat is used as indicators of probable foraging areas.
	Open water sources, be it man-made farm dams or natural streams and wetlands, are important sources of drinking water and provide habitat that host insect prey.
	Areas frequented often by cattle and livestock (e.g. congregation areas and kraal areas) were assigned a moderate sensitivity since large groups of animals tend to attract insects.

The areas designated as having a High Bat Sensitivity implicates that no turbines should be placed in these areas and their respective buffer zones, due to the elevated impacts it can have on bat mortalities. If turbines are located within the Moderate Bat Sensitivity zone or buffer zone, they must receive special attention and preference for post-construction monitoring and implementation of mitigations during the operational phase (if mitigation is found to be required).

Table 38: Description of sensitivity categories utilised in the sensitivity map

Sensitivity	**Description**
Moderate Sensitivity	Areas of foraging habitat or roosting sites considered to have significant roles for bat ecology. Turbines within or close to these areas must acquire priority (not excluding all other turbines) during pre/post-construction studies and mitigation measures will need to be applied immediately from the start of operation.
High Sensitivity	Areas that are deemed critical for resident bat populations, capable of elevated levels of bat activity and support greater bat diversity than the rest of the site. These areas are 'no-go' areas and turbines must not be placed in these areas and their buffers.

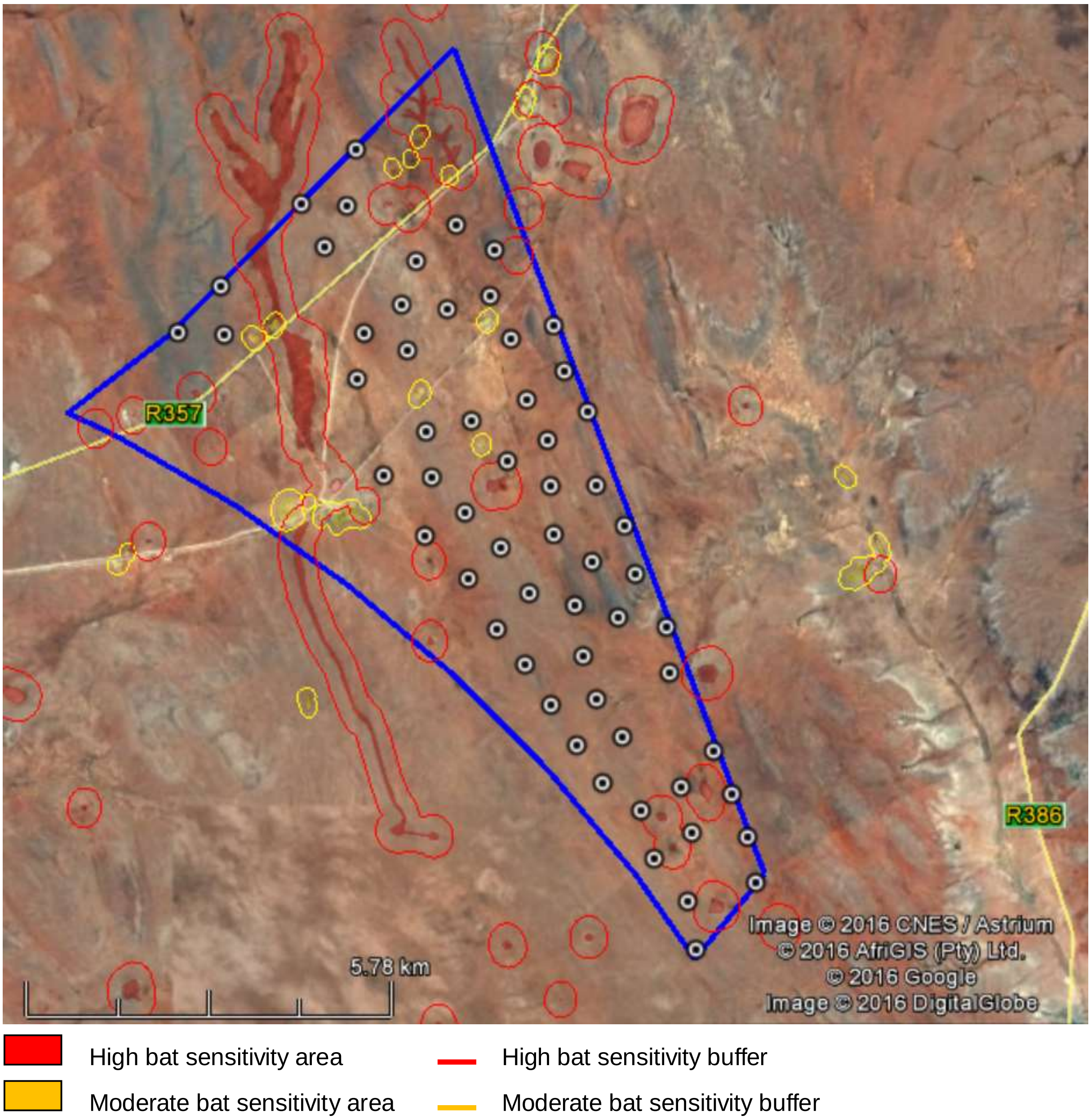


Figure 74: Bat sensitivity map of the Aletta WEF site and proposed turbine layout

The turbine layout is respective of the bat sensitve areas and their buffer zones. It does not encroach on the sensitive areas and thus is deemed acceptable relative to the bat monitoring study.

8.3.4 Passive Data

8.3.4.1 Abundances and Composition of Bat Assemblages

Average bat passes detected per bat detector night (nights on which detectors recorded correctly) and total number of bat passes detected over the monitoring period by all systems are displayed in **Figure 75-Figure 78**. Four bat species were detected namely *Tadarida aegyptiaca*, *Neoromicia capensis*, *Miniopterus natalensis*, and *Eptesicus hottentotus*.

Neoromicia capensis and *Tadarida aegyptiaca* were most commonly detected across both of the monitoring systems. These abundant species are of a large value to the local ecosystems as they provide a greater contribution to most ecological services than the rarer species due to their higher numbers.

The migratory species, *Miniopterus natalensis*, was detected by all monitoring systems and is rather prevalent on site. The relative abundance of this species was highest, as detected by all monitoring systems, over the months of September - October 2015 and February - April 2016 (**Figure 77– Figure 78**).

Bat activity detected at 80m monitoring height was low when compared with the monitoring results from 10m height (**Figure 75**). The greatest total bat abundance was detected by the 10m microphone of the meteorological mast.

Bat activity, especially with *Neoromicia capensis*, was generally higher over October 2015 for the Short Mast 1. The Met Mast has higher activity during January 2016 with the bat species *Tadarida aegyptiaca* (**Figure 77– Figure 78**). Generally, bat activity was low over the winter months with a sharp increase in spring. The elevated activity was more or less maintained over summer and has gradually declined into autumn.

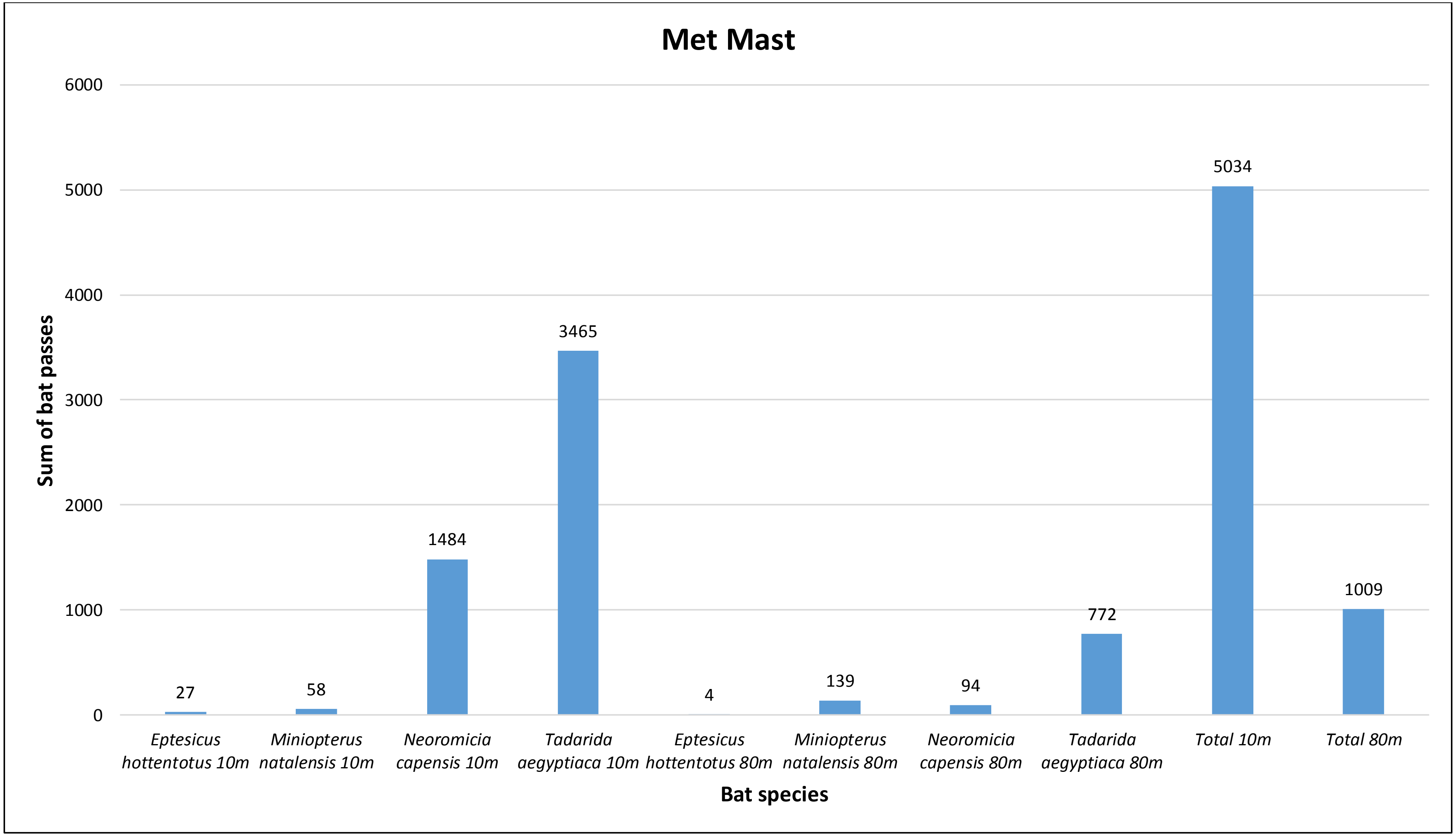


Figure 75: Total bat passes recorded over the monitoring period by the detector mounted on the Met Mast.

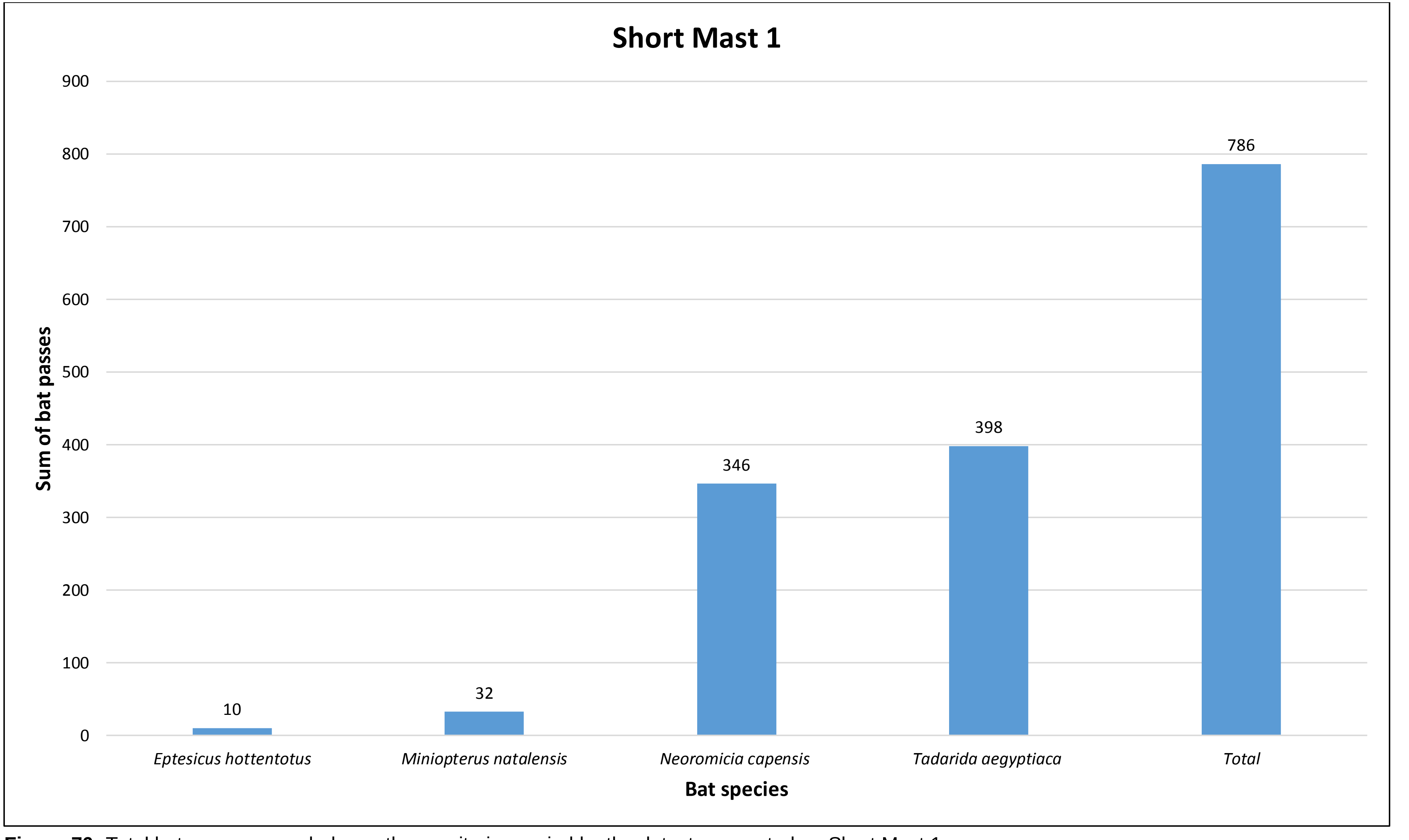


Figure 76: Total bat passes recorded over the monitoring period by the detector mounted on Short Mast 1.

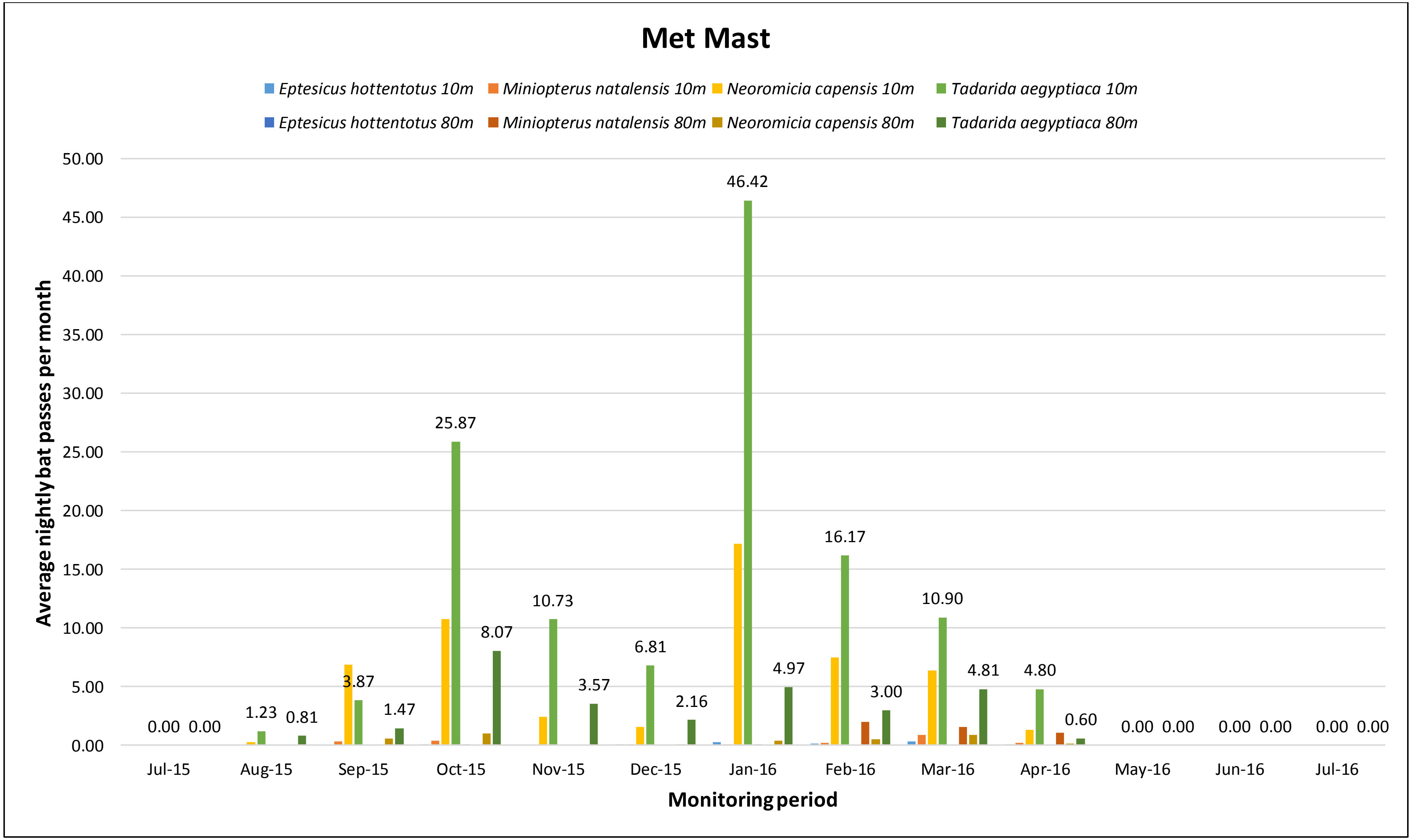


Figure 77: Average bat passes recoded per month by the detector mounted on the Met Mast.

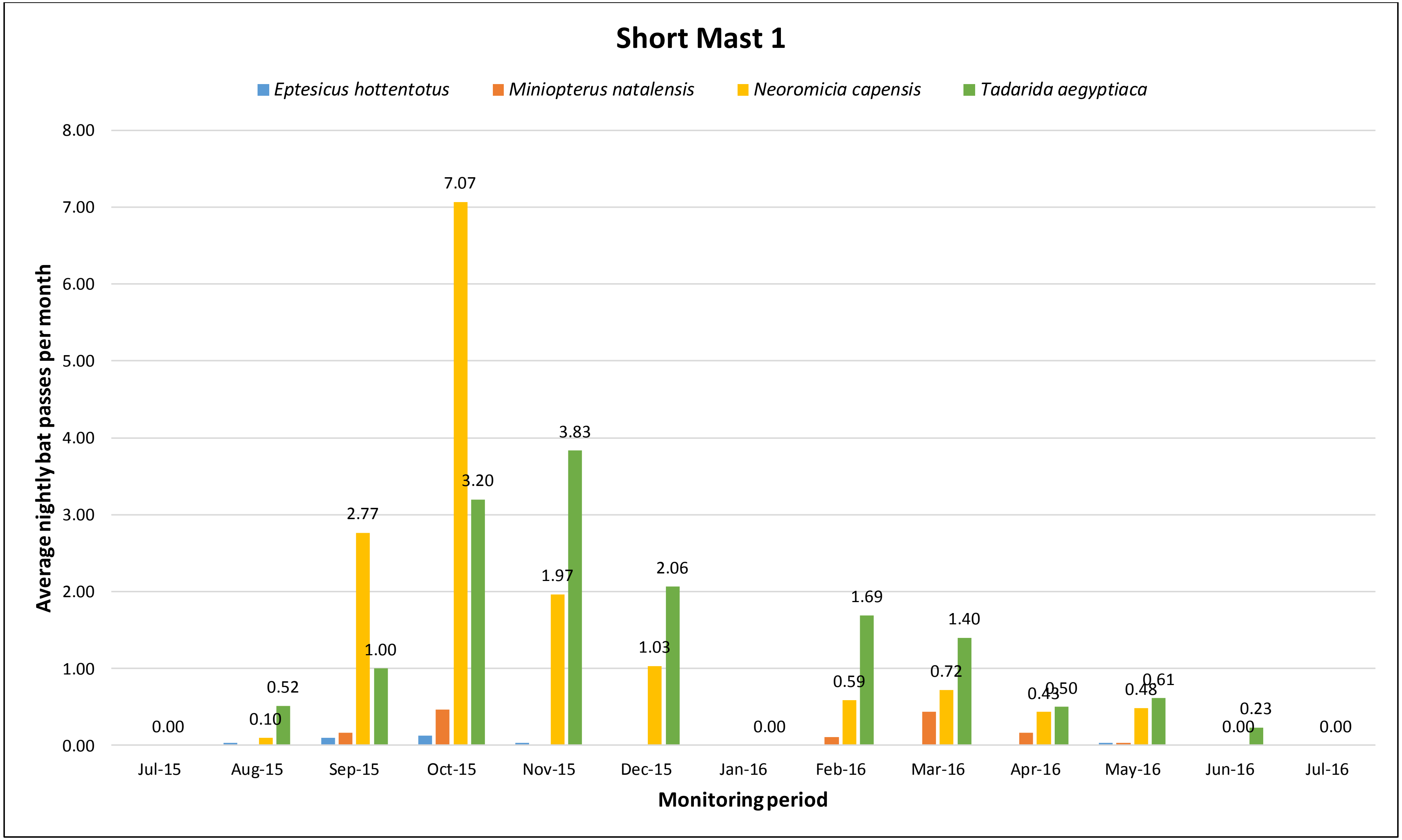


Figure 78: Average bat passes recorded per month by the detector mounted on Short Mast 1.

8.3.4.2 Temporal Distribution

The sum of all bat passes recorded by the monitoring systems of the particular species are displayed per night over the entire monitoring period (**Figure 79**- **Figure 80**). The peak activity times identified are mostly an amalgamation of the temporal distribution of *Neoromicia capensis* and *Tadarida aegyptiaca* as they were the species detected more often by a substantial margin.

The periods of elevated bat activity as depicted in **Figure 79**- **Figure 80** are as follows:

Met Mast

- 15 October – 30 November 2015
- 1 – 31 January 2016

Short Mast

- 16 September – 12 October 2015
- 16 October – 27 November 2015
- 23 December 2015 – 20 March 2016

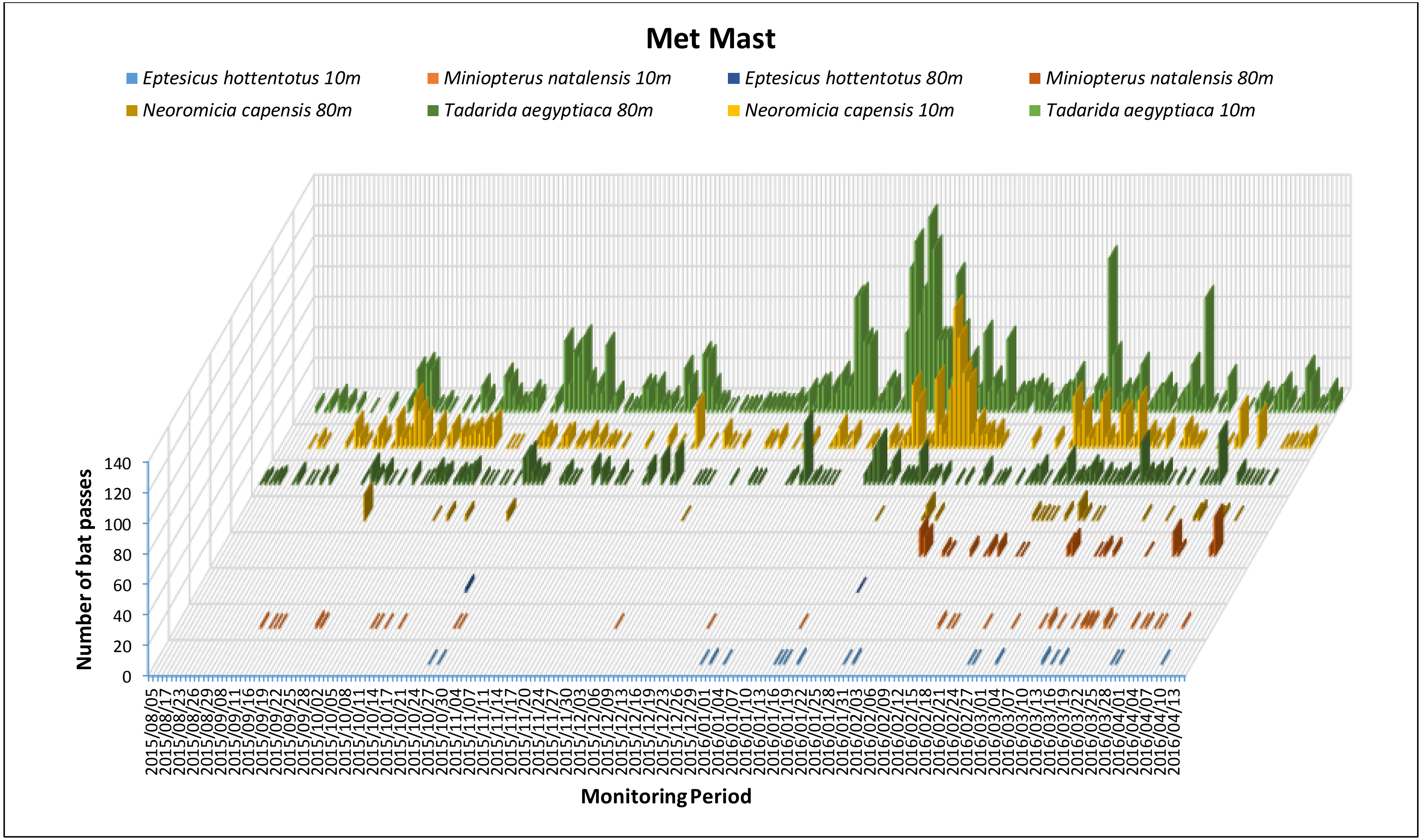


Figure 79: Temporal distribution of bat passes detected by the Met Mast.

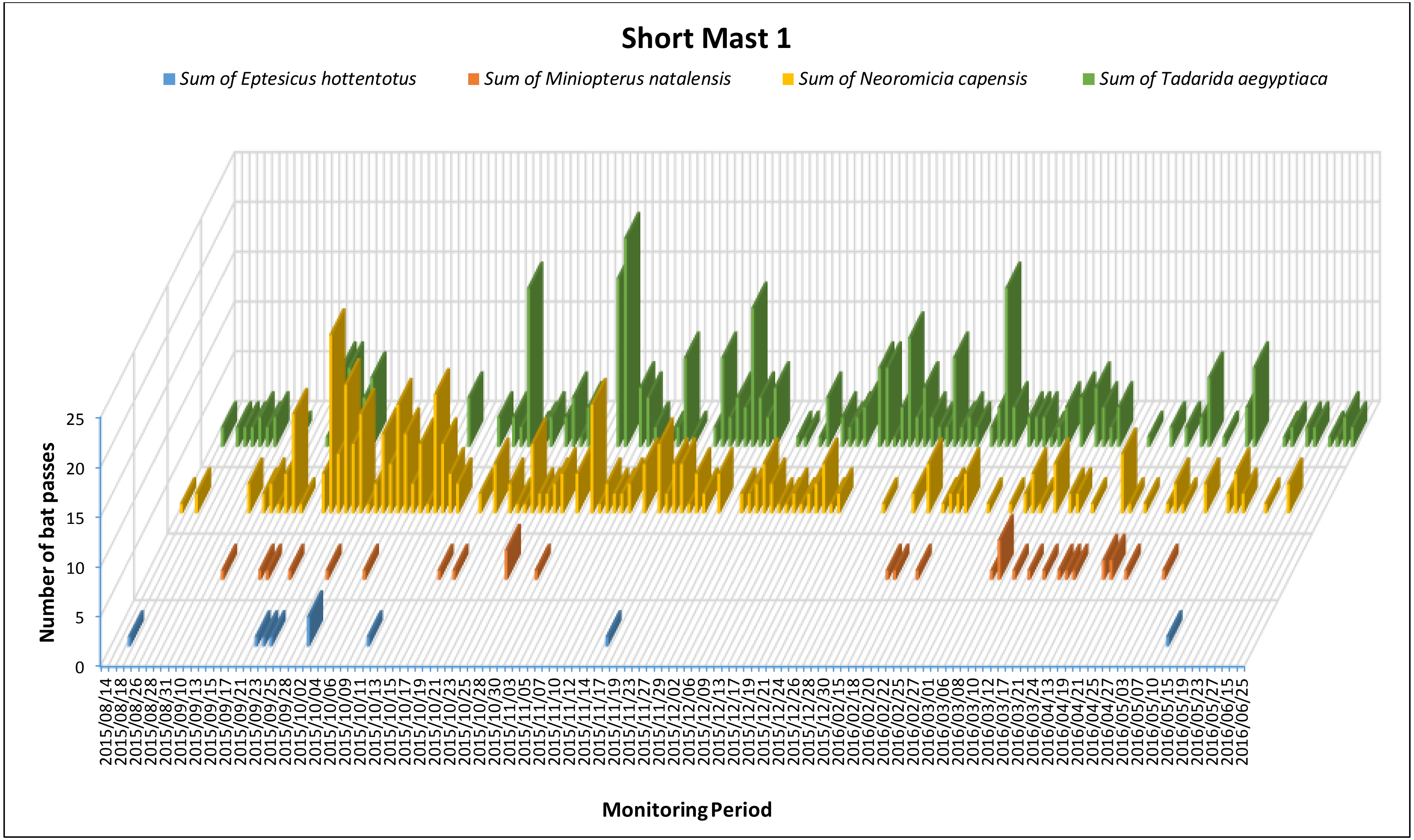


Figure 80: Temporal distribution of bat passes detected by Short Mast 1.

8.3.4.3 Distribution of bat activity across the night per season

The distribution of bat activity across the night, per season, has been analysed in this section. The 12-month monitoring period was divided based on generic calendar seasons outlined **Table 39**.

Table 39: Time frame of each season

Season	Monitoring period
Winter	1 June – 31 August
Spring	1 September – 30 November
Summer	1 December – 28 February
Autumn	1 March – 31 May

The number of bat passes per 10-minute interval over the seasonal monitoring periods were summed to generate the figures of bat activity over the time of night. Higher levels of activity indicate preference for activity over a particular period of the night. These periods will then be used to inform mitigation implementation when and where needed. Once again, peak activity times are mostly an amalgamation of the activity of *Tadarida aegyptiaca* and *Neoromicia capensis*, especially at 10m height. The figures show that there are seldom cases of other species being highly active in the absence of high activity levels of these two abundant species.

Miniopterus natalensis had an increase in activity, especially at 80m height, near the Met Mast during the autumn months. It is likely that this species migrates to nearby roosts over autumn and is therefore more prevalent in the area over such time, but not necessarily that the project site is located within the migration path followed for this movement.

8.3.4.4 Relation between Bat Activity and Weather Conditions

Several sources of literature describe how numerous bat species are influenced by weather conditions. Weather may influence bats in terms of lowering activity, changing time of emergence and flight time. It is also important to note the environmental factors are never isolated and therefore a combination of the environmental factors can have synergistic or otherwise contradictory influences on bat activity. For example, a combination of high temperatures and low wind speeds will be more favourable to bat activity than low temperatures and low wind speed, whereas low temperature and high wind speed will be the least favourable for bats. Below are short descriptions of how wind speed, temperature and barometric pressure influences bat activity.

- **Wind Speed**

Some bat species show reduced activity in windy conditions. Strong winds have been found to suppress flight activity in bats by making flight difficult (O'Farrell *et al*. 1967). Several studies at proposed and operating wind facilities in the United States have documented discernibly lower bat activity during 'high' wind speeds (Arnett *et al*. 2010).

Wind speed and direction also affects availability of insect prey as insects on the wing often accumulate on the lee side of wind breaks such as tree lines (Peng *et al*. 1992). At edges exposed to wind, flight activity of insects, and thus bats may be suppressed and at edges to the lee side of wind, bat activity may be greater. This relationship is used in the sensitivity map whereby the larger vegetation and man-made structures provide shelter from the wind. However, the turbine localities are usually situated on the ridges such that they will be in areas exposed to the wind and not protected by vegetation or structure.

- **Temperature**

Flight activity of bats generally increases with temperature. Flights are of shorter duration on cooler nights and extended on warmer nights. Rachwald (1992) noted that distinct peaks of activity disappeared in warm weather such that activity was mostly continuous through the night. During nights of low temperatures bats intensified foraging shortly after sunset (Corbet and Harris 1991).

Peng (1991) found that many families of aerial dipteran (flies) insects preferred warm conditions for flight. A preference among insects for warm conditions has been reported by many authors suggesting that temperature is an important regulator of bat activity, through its effects on insect prey availability.

The results present figures of the sum of bat passes that were detected within specific wind speed and temperature categories. However, the distribution of bat activity within each wind speed and temperature range may be biased due to the frequency of occurrence of each wind speed and temperature range. Thus the number of bat passes were 'normalised' wherein the frequency with which each wind speed and temperature range were recorded was taken into account. The 'normalised' sum of bat passes per wind speed and temperature range are presented below. Cumulative percentages of the normalised sum of bat passes per wind speed and temperature ranges are also presented. The lowest wind speed at which 80% of bats were detected (of the normalised sum of bat passes) are used to inform mitigation, if needed.

The aim of this analysis is to determine the wind speed and temperature range within which 80% of bat passes are detected. These values of wind speed and temperature are used to mitigate turbine operation where needed based on conserving 80% of detected bat passes, keeping in mind the synergistic or otherwise contradictory effects that the combination of wind speeds and temperatures can have on bat activity.

Time periods used in the analysis below for each monitoring system were identified as periods of elevated activity. The analysis was only performed for time frames of the highest activity levels. The time periods used in the analysis below corresponds with the time periods and systems used to inform mitigation in **Section 6** of the Bat Specialist Report.

8.4 Surface Water

The full Surface Water Assessment was conducted by Shaun Taylor of SiVEST and is included in **Appendix 6D**.

8.4.1 In-field Investigations, Verification and Refinement of Desktop Delineations

The in-field wetland delineation assessment took place from the 27th to the 29th of July 2016. The fieldwork verification, ground-truthing and delineation assessment was undertaken to scrutinise the results of the desktop identified features as well as to identify any potentially overlooked wetlands or other surface water resources in the field for the proposed development area. The results are displayed in **Figure 81**.

Within the proposed development area, two types of hydrogeomorphic units were identified. These include nine (9) watercourses (drainage lines) and twenty two (22) depressions (depression wetlands). For the depression wetlands, these were sub-divided into two sub-categories for the fifteen (15) natural depression wetlands and the seven (7) artificial (man-made) depression wetlands identified. A more detailed description of the environmental attributes (indicators) of the surface water resources characteristics is provided in the sub-sections below.

8.4.1.1 Channels (Drainage Lines)

- **Topography Associated with a Watercourse**

The proposed development area is predominantly flat to gently undulating for the majority of the central and western areas. However, near the eastern boundary of the proposed development area, an area of greater relief in the form of low hills and ridges can be found. As a result of the generally flat nature of the topography, overland sheet run-off is common and only in the northern areas does drainage flow either along broad valley bottoms (northern areas) and / or within more constrained but shallow channels (north western areas). Serving as tributaries, many of the drainage lines are first, second and third order streams or A section reaches. These drainage lines are considered A-section reaches due to the lack of a saturation zone for all. Hence, all drainage lines were identified as ephemeral watercourses. The direction of flow for all watercourses appeared to be in a southern direction.

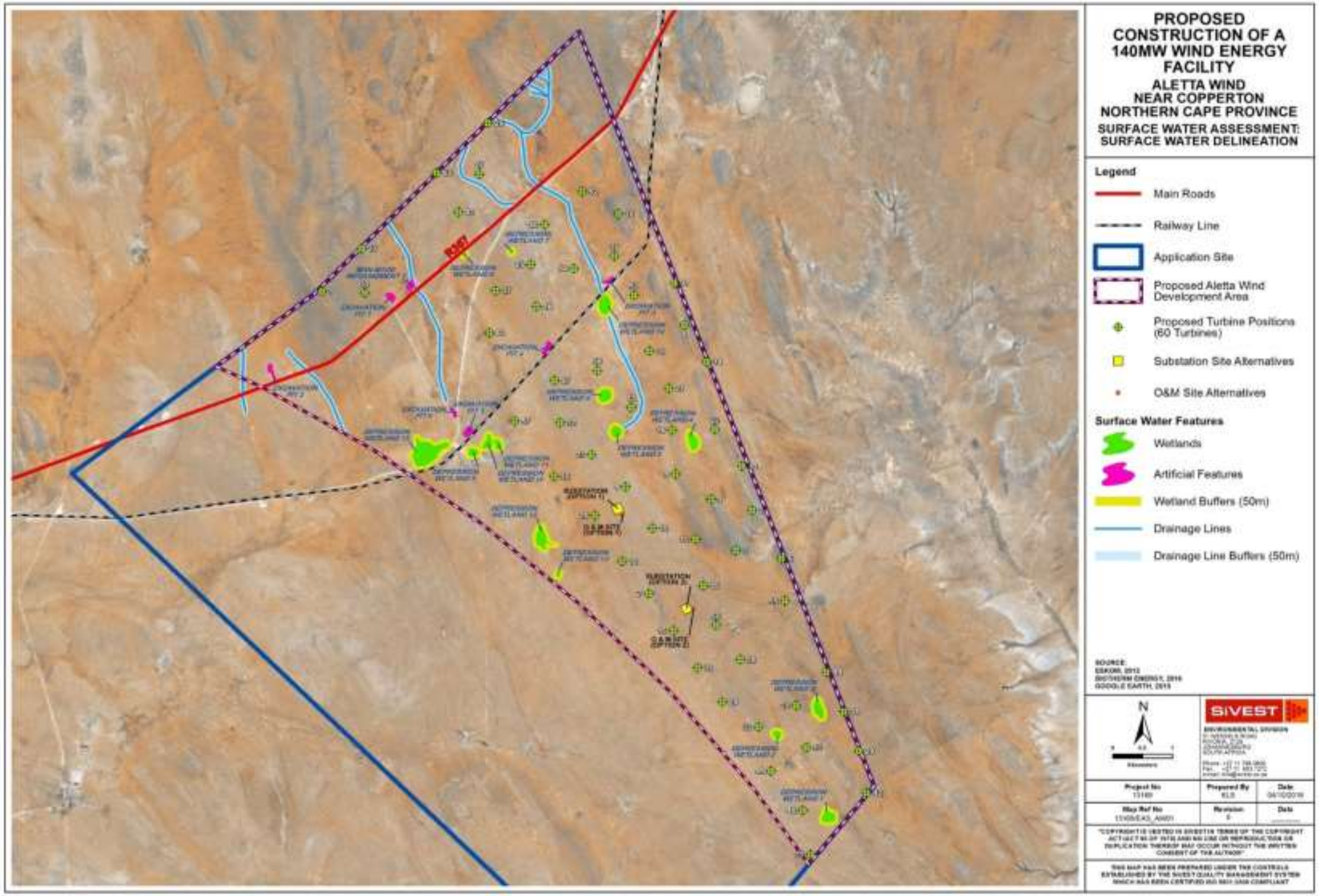


Figure 81: Aletta Wind Farm Facility Surface Water Delineation Map

Figure 82: Drainage Line

The depth of soils on the proposed development area are relatively shallow (approx. 0.1-0.5m), which means that flow is predominantly via surface run-off with limited sub-surface flow only where the depth and composition of the soil profile permits infiltration. Rocky outcrops are not uncommon across the proposed development area, especially along the northern and eastern boundary. Soil erosion is limited due to limited soil depth, but it is evident in few areas which compromises the geomorphological integrity of the drainage lines to a limited degree. Surface run-off in some drainage lines can transition to open wash areas where very little vegetation is present making these areas somewhat more susceptible to erosion Otherwise, geomorphological modification within the drainage lines have taken place in the form of berms which have been created to take advantage of flows when present for storage (presumably for cattle and sheep drinking water) purposes. Additionally, historical farming practices (tilling) have taken place within the drainage lines which have disrupted the soil profile (**Figure 83**).

Figure 83: Example of historical farming (tillage) practices.

- **Alluvial Soils and Deposited Materials**

Run-off from the surrounding landscape transports soil particles which get deposited in the drainage lines when flow subsides following rainfall events. The grain size of deposited materials range from fine clays, sand and gravel further along the more developed drainage lines. Stones and cobbles are more common in the drainage lines lying in the rocky flat areas of the application site.

Figure 84: Open Exposed Bare Areas (Wash Plains) found within the Broader Drainage Lines

- **Vegetation**

The vegetation within the drainage lines can be described as comprising loose thickets of *Parkinsonia africana*, *Lebeckia linearifolia* and *Acacia karroo* (Hoare, 2016). Ultimately, the vegetation therefor consists of thicket and some bushland. In terms of the thickets associated with the watercourses, these can be defined as riparian habitats.

Figure 85: Example of Loose Thickets forming the Riparian Habitat within a Drainage Line in the distance

8.4.1.2 Depression Wetlands (Natural)

- **Terrain and Wetland Soil Characteristics**

The depression wetlands identified within the proposed development area have formed in shallow hollowed out depressions which drain small localized catchments. The majority of the depression wetlands are endorheic (in-ward draining), with the exception of Depression Wetlands 5 and 14 which are situated within a drainage line. These two wetlands are therefore hydrologically connected to the ephemeral watercourse.

The distribution of the depression wetlands were found to be mainly situated in the northern half of the proposed development area. However, a few wetlands could be found in the southern half of the proposed development area. The scattered distribution across of depression wetlands across the proposed development area means that surface water occurrence is good when water is available following rainfall events. However, the prevailing climate acts as a constraint to the time that water is available or the duration of saturation (hydroperiod) for the wetlands. The wetlands are therefore rainfall driven and consequently ephemeral in nature. High temperatures and high evaporation rates in the region contribute to limited hydroperiod for the wetlands. However, substrates that contain higher amounts of clays are conducive to a slightly longer hydroperiod. These are typically the larger wetland systems with slightly deeper soil profiles, whilst the smaller shallower wetland systems tend to dry up quicker.

Soils samples were drawn from the wetlands to ascertain the characteristics of the substrate. The substrate of the wetlands was found to consist of a mixture of loamy light brown sandy and clay soil particles. Overall, the degree of loam and clay materials varied between the wetlands, with a slightly higher composition of loam sediments in the smaller wetlands, whilst a greater build-up of clays in the larger wetland systems were observed. Red iron oxide accumulations (mottles) were observed within the extracted soil matrix intermixed amongst grey depletions revealing redoximorphic characteristics within the wetland soil profile (**Figure 86**). Redoximorphic characteristics are indicative wetland soil signatures. The Westliegh Soil Form could be attributed to the wetlands on account of the soil characteristics explained above. The redoximorphic characteristics signify distinct wetting and drying phases and are indicative of ephemeral saturation cycles.

Figure 86: Soil Sample drawn from a Small Depression Wetland

Overall, most of the depression wetlands were found to be geomorphologically intact, with the exception of Depression Wetlands 9, 10, 11, 14 and 15 which had been affected by previously farming practices. Past disturbance of the soil as a result of tilling activities were evident. These wetlands appeared to still be recovering from these impacts.

- **Wetland Vegetation**

The general vegetation type covering most of the proposed development area can be described as shrubland and low fynbos (Hoare, 2016). Within the wetlands specifically, the depression wetlands were generally well vegetated and were predominantly scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, with a mixture of karroid dwarf shrubs (Hoare, 2016) (**Figure 87**). These scrubs are generally salt resistant and tend to dominate these wetlands as a result. Due to high evaporation rates, salts tend to remain in the soil profile of the wetlands which is a common occurrence under the prevailing climatic conditions. Interestingly however, hydrophytic vegetation (*Juncus* sp.) was observed in Depression Wetland 15. This wetland was found to also be affected by excavation activities near the southern edge of the wetland. Presumably, as a result of the deepened excavation, periodic pooling after rainfall events above the shallow bedrock produces suitable conditions for the establishment of *Juncus* sp.

Figure 87: Example of a Small Scrubs in a Wetland (Depression Wetland 2)

8.4.1.3 Depression Wetlands (Artificial)

- **Terrain and Wetland Soil Characteristics**

The artificial depression wetlands identified on the proposed development area comprised mostly old excavation pits, presumably created due to the need for construction materials for the existing road and railway infrastructure. However, one man-made impoundment created within a drainage line near the north western boundary of the proposed development area was identified. The man-made impoundment was presumably created to capture any flow within the drainage line when in present.

As a consequence of the excavation activities, the excavation pits were of greater depth (as opposed to the relatively shallow nature of the natural depression wetlands) often reaching bedrock (**Figure 88**). The excavation pits are expected to hold water at the surface until completely evaporated or taken up by vegetation colonizing the pits. These artificial wetlands are therefore expected to be ephemerally saturated.

Where soil samples could be drawn, the soils generally did not show any specific soil signatures and were generally well drained. The only wetland to display soil signatures akin to the natural depression wetlands was the man-made impoundment. Again, the Westliegh Soil Form could be attributed to the wetlands on account of the sediment (loamy/clay) composition and mottling characteristics.

Figure 88: Exposed Bedrock within an Excavation Pit

From excavation activities, the edges of the artificial wetlands are generally steepened and susceptible to erosion during rain fall events. As a result, the edges are characteristically eroded. Erosion varies amongst the excavation pits from moderate to more severe in some cases (**Figure 89**). The man-made impoundment on the other hand was found to be geomorphologically intact.

Figure 89: Eroded Edges of an Excavation Pit

- **Vegetation**

Vegetation varied between the artificial wetlands from those which had little to no vegetation present (**Figure 90**) to those which had a more sparse distribution of the scrub species as per the vegetation description for the natural depression wetlands in **Section 6.2.2.2** of the Surface Water Specialist Report.

Figure 90: Vegetation observed within an Excavation Pit

8.4.2 Surface Water Buffer Zones

When determining the buffer zones for the watercourses and wetlands, critical factors that need to be considered that may be affected by the proposed development include the drivers of these hydrological features.

The primary threats related to the proposed wind farm and associated operation and maintenance buildings, substation and internal access roads are mainly during the construction phase. These include increased run-off, erosion and sediment inputs. Additional potential threats include direct physical degradation from vehicular activity, soil contamination and water quality impacts from spills and leakages of hazardous substances and liquids. Given this, increased run-off will have impacts on the hydrology of the surface water resources in terms of alteration of flood peaks. Clearing of vegetation can also affect the surface roughness of the catchment thereby also contributing to accelerated surface run-off, consequent sedimentation and erosion of surface water resources. Sedimentations and erosion impacts can affect the geomorphological integrity of the surface water resources. In terms of contamination impacts, leakages and spill of hazardous substances such as fuels and oils can affect the water quality and contaminate soils of the surface water resources following transportation of these substances and liquids in surface run-off following rainfall events. Potential negative impacts to the biota and vegetation inhabiting the surface water resources may result affecting the biodiversity and overall ecological functioning of the surface water resources.

For the operation phase, degradation impacts as a result of vehicle movement is the main concern. Compaction impacts and degradation of vegetation associated with the surface water resources is the main concern from a surface water perspective. Compaction impacts negatively impacts on the geomorphological integrity of the surface water resources potentially causing alteration of the physical conditions of the soil as well as making surface water resources vulnerable to erosion.

Given the above, a buffer zone of 50m for watercourses and the natural depression wetlands have been applied in consideration of the factors above. No buffer zone was applied to the artificial depression wetlands as these were not identified to be of any major ecological significance. The artificial depression wetlands would however need to be avoided and should be viewed as exclusion zones.

8.4.3 Legislative Implications

In the context of NEMA (1998) and the EIA Regulations (2014), considering the layout of the proposed development, no listed activities will be triggered based on the wind turbine, substation and operation and maintenance building facility layout since none of these structures are directly within or within close proximity (within 32m) to the identified surface water resources. However, it is presumed that internal access roads will be required which will need to route to the respective wind turbines locations and various buildings and infrastructure to be constructed. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, there is a good chance the internal access roads and other associated infrastructure not shown on the current layout will need to cross or be within close proximity to the delineated surface water resources. Therefore, provisionally, Activities 12 and 19 of Government Notice 983 Listing Notice 1 are identified to potentially be triggered thereby requiring Environmental Authorization. The aforementioned potentially applicable activities are elaborated on in more detail below.

8.4.3.1 National Environmental Management Act, 1998 (Act No. 108 of 1998) and Environmental Impact Assessment Regulations (2014)

- **Environmental Impact Assessment Regulations 2014, Listing Notice 1, GN. 983, Activity 12:**

The development of-

(xii) *infrastructure or structures with a physical footprint of 100 m2 or more;*

where such development occurs-

(a) within a watercourse;
(c) if no development setback exists, within 32 m of a watercourse, measured from the edge of a watercourse; -

- **Environmental Impact Assessment Regulations 2014, Listing Notice 1, GN. 983, Activity 19:**

The infilling or depositing of any material of more than 5 m³ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 m³ from-

(i) a watercourse;

8.4.3.2 National Water Act, 1998 (Act No. 36 of 1998)

In the context of the NWA (1998) and the proposed development, a “water use” is required where construction activities will impact on a water resource. In this light, “water use” is defined *inter alia* as follows:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in stream flow reduction activity contemplated in Section 36 of the NWA;
e) Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1) of the NWA;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;

h) Disposing of waste in a manner of water which contains waste from, or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

In this context, a water use license will be required where any of the above water uses are required for a development. As such, for the proposed development, since there is no anticipated direct impact or any potential indirect impact based on the current wind turbine, substation and operation and building layout, it is anticipated that no water uses will be triggered. However, as stated above, it is anticipated the internal roads and other associated infrastructure not displayed on the current layout may need to cross or be within 500m of the identified wetlands and / or watercourses thereby triggering water uses (c) and (i). The application of these water uses can however only be confirmed once the internal road layout is available.

8.5 Soils and Agricultural Potential

The full Soils and Agricultural Potential Assessment was conducted by Garry Paterson and is included in **Appendix 6E**.

8.5.1 Soil Pattern

Lithosols (Coega soil form, 50–150 mm depth) and a shallow phase (<300 mm depth) of the Plooysburg soil form along with patches of slightly deeper (300–600 mm) Plooysburg and some Garies soils underlain by calcrete, dominates the survey area. Sporadic dorbank and rock outcrops also occur. This distribution is shown on **Figure 91**.

Table 40: Soil Legend

General Soil Description					
Map unit	**Dominant Soil form/family > 80%**		**Subdominant Soil form/family < 20%**	**Effective depth (mm)**	**General Description**
	Taxonomic System	**Binomial System**			
Cg1	Cg1000, Cg2000	Ms12, Ms22	Py1000, Ms1100	50-150	Very shallow, stony, reddish-brown, fine-grained, sandy Coega (Cg) soils underlain by calcrete. Patches of deeper, sandy Plooysburg (Py) soils (100–300 mm) occur throughout the area. With sporadic occurrences of rock

					outcrops and Mispah soils (< 150 mm)
Py1	Py1000, Py2000,	Hu33	Cg1000, Hu3100 Ms1100	150-300	Shallow, reddish-brown, fine-grained, sandy Plooysburg (Py) and occasional Coega (Cg) soils with underlying calcrete or rock. Sporadic patches of deeper, sandy Plooysburg (Py) soils (300–600 mm) occur throughout the area.
Py2	Py1000 Py2000 Gr1000	Hu33 Hu36	Cg1000, Cg2000	300-800	Shallow to moderately deep, reddish-brown, fine-grained, sandy Plooysburg (Py) soils underlain by calcrete and occasionally dorbank.
R	Rock Ms1100	Ms10	Cg1000 Py1000	<150	Very stony, shallow soils on hillslopes.

Figure 91: Semi-detailed soil map, Aletta WEF study area

Randomly selected soil observations were made throughout the area and are listed in **Table 41**.

Table 41: Soil observations

Obs. No.	Soil form/ family	Soil depth (mm)	Depth Limiting material	Latitude (Deg.)	Longitude (Deg.)	Comment
O36	Py1000	600	Calcrete	-29,87273821	22,43423223	
O37	Py2000	450	Calcrete	-29,86648866	22,43274629	
O38	Py1000	200	Calcrete	-29,85975095	22,43111551	
O39	Py1000	300	Calcrete	-29,84983751	22,42873907	
O40	R	100	Rock	-29,84272429	22,42699564	Stony
O41	Py1000	150	Calcrete	-29,83821281	22,42790222	
O42	Py1000	200	Calcrete	-29,82918450	22,43055761	
O43	Py1000	250	Calcrete	-29,81214174	22,43546069	
O44	Py1000	450	Calcrete	-29,83134636	22,42023110	
O45	Py1000	400	Calcrete	-29,82554742	22,41110623	
O46	Py1000	200	Calcrete	-29,86014792	22,42032766	Cg 10% in vicinity
O47	Py1000	150	Calcrete	-29,85971876	22,41500616	Cg 40% in vicinity
O48	Py1000	200	Calcrete	-29,86251899	22,40524292	Stony, Cg 40% in vicinity
O49	Py1000	350	Calcrete	-29,86154803	22,39977121	Cg 60% in vicinity
O50	Py1000	250	Calcrete	-29,84434434	22,40363359	Stony
O51	Cg1000	150	Calcrete	-29,84433361	22,40064025	Stony
O52	Cg1000	100	Calcrete	-29,84162458	22,40081191	Stony, Py 20% in vicinity
O53	Py1000	600	Calcrete	-29,84160312	22,40393400	
O54	Cg1000	100	Calcrete	-29,86590394	22,38688588	Stony
O55	Cg2000	100	Calcrete	-29,87459966	22,38455236	Stony
O56	Cg2000	50	Calcrete	-29,87458357	22,38143563	Py10% in vicinity
O57	Cg2000	100	Calcrete	-29,87721213	22,38149464	Py10% in vicinity
O58	Cg1000	100	Calcrete	-29,87728723	22,38458991	
O59	Py1000	280	Calcrete	-29,87774857	22,39061415	
O60	Py1000	300	Calcrete	-29,88922306	22,39424050	
O61	Gr2000	400	Dorbank	-29,89792415	22,39612877	
O62	Cg2000	50	Calcrete	-29,89114353	22,39148319	Stony
O63	Cg1000	100	Calcrete	-29,88372453	22,38624215	Stony
O64	Py1000	100	Calcrete	-29,88066145	22,37795949	Stony
O65	Py1000	150	Calcrete	-29,88028594	22,37252533	Cg 30% in vicinity
O66	Cg1000	100	Calcrete	-29,87908431	22,35738158	Stony, Py 20% in vicinity

8.5.2 Agricultural Potential

The agricultural potential for this area corresponds with the initial findings in the scoping report. Thus, an overall low potential for irrigation for map units Cg1, Cg2, Py1 with a low to moderate irrigation potential for map unit Py2, consisting of gravelly Plooysburg and Hutton soils, with soil depth 300-800 mm onto rock.

Virtually all of the study area comprises shallow, often calcareous soils with rock outcrops, as can be seen from the information contained in **Table 41** and the photos in the Appendix of the agricultural specialist report.

Coupled with these shallow soils, the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area (**Figure 92**) shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

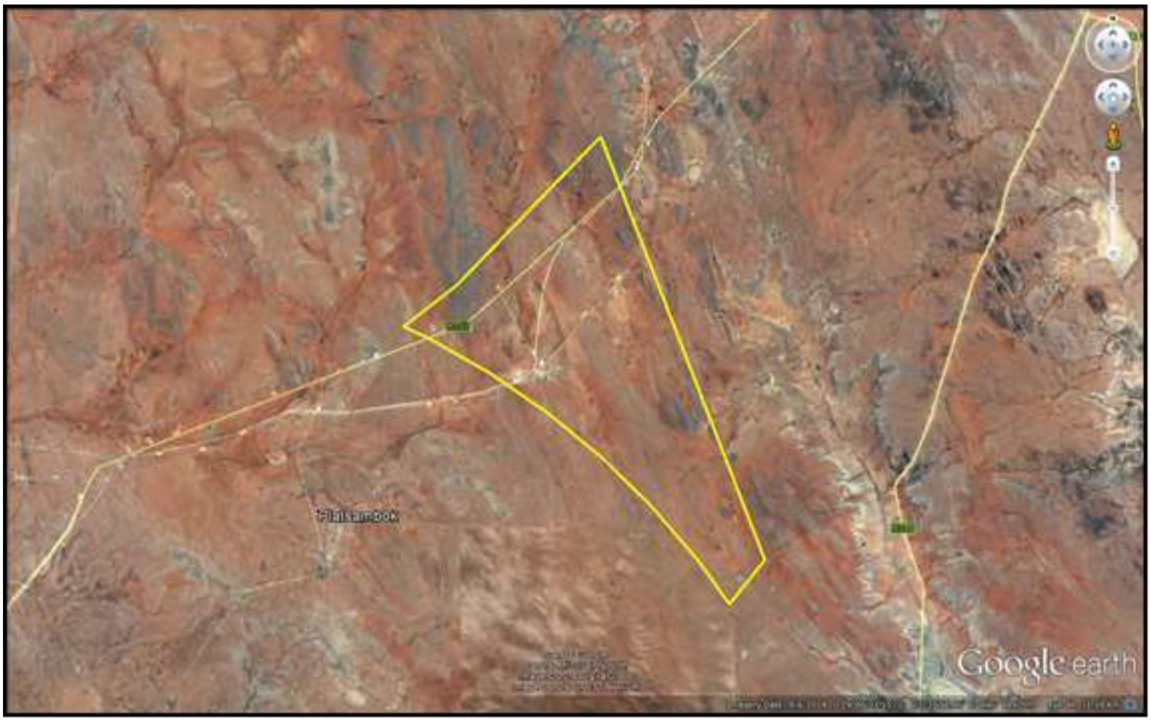


Figure 92: Google Earth image of the study area

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20 ha/large stock unit (ARC-ISCW, 2004).

8.5.3 Land Use

The land use in the area is dominantly "shrubland and low fynbos" with some small areas of "bare rock and soil (natural)" as classified by the National Land Cover (Thompson, 1999). As previously mentioned, there are no areas of cultivation that were identified, only a few small, isolated areas of "Improved grassland". This is confirmed by the photos in the Appendix of the specialist agricultural report.

Due to the occurrence of shallow soils, coupled with the extremely hot and dry nature of the climate, there are no significant impacts from the project.

8.6 Noise

The full Noise Assessment was conducted by Adrian Jongens of Jongens Keet Associates and is included in **Appendix 6F**.

8.6.1 Noise Impact – Construction & Decommissioning Phase

The following construction and related activities that might result in a noise impact were identified:

- Construction of access roads to each wind energy turbine location.
- Site works viz. preparation & clearance, excavation and construction of foundations.
- Establishment of lay down areas on site.
- Transport of components & equipment to site:
    - Wind turbine components
    - Cranes & lifting equipment
    - Other civil construction equipment
- Assemble towers and turbines.
- Establishment of ancillary equipment
- Connection of wind turbines to the existing substation.
- Site remediation.
- Disassembling of towers and turbines, removal from site of same and rehabilitation of land upon decommissioning.

It was assumed that all activities would be confined to normal weekday working hours.

8.6.1.1 Road Construction

It was assumed that the existing gravel farm road would need to be upgraded and new roads constructed to accommodate ultra-heavy-duty vehicles required to transport wind turbine components and cranes to the turbine sites.

The level of noise emitted by machinery is related to the mechanical power required by the machine to perform the required function. Thus, greater power is required, for example, by a bulldozer to move earth than a road scraper or a paver to lay a new bituminous road surface. Thus, in principle, higher noise emissions may be expected from a bulldozer during new road construction than machinery used during road rehabilitation. However, noise emission is strongly dependent on the “noise reduction packages” incorporated by the manufacturer of the machinery. With the increasing enforcement of noise control legislation throughout the world, manufacturers have been “encouraged” and are capable of supplying new heavy-duty machinery/vehicles with very low noise emission levels.

The noise emitted by earth moving machinery and heavy duty vehicles can vary considerably during normal operating conditions. The results are rarely repeatable making it difficult to compare the noise emissions of different vehicles and at different times. For certification purposes the noise emission is measured under controlled conditions such that the same values are obtained when repeated under the same operating condition.
The author has measured the noise emission of numerous types of heavy-duty vehicles and of earth moving machinery of different manufacturers under controlled conditions as well as under normal operating

conditions. Results obtained under controlled conditions were within 0,5 dB of those provided by the manufacturer, where the information was supplied. However, such results excluded additional sounds as are produced by rocks falling into trucks during loading, squealing of the rubble as it slides out of the truck during dumping, reverse warning signal and the effect of the engine operating under differing loads. Sound measurements were therefore also recorded of front end loaders, trucks and bulldozers during normal operating conditions.

Table 42 records the sound power levels, LW (dB), emitted by typical heavy-duty machinery that might be used during new road construction and the calculated separation distance required for the daytime LReq,d (dBA), during continuous operation for 8 hours, to decrease to 37 dBA (6dB above residual of 31 dBA). These represent the LReq,d of two of the "noisier" activities recorded, including reverse hooters and noise associated with dumping of rubble, and can thus be considered to be worst-case scenarios. In practice, however, vehicles/machinery on a construction site seldom operate continuously throughout the working day.

Table 42: L_W emission of heavy-duty machinery and separation distances required for reduction of $L_{Req,d}$ to 37 dBA for 8 hour operation

Machinery & operating conditions	L_W, dB	Distance, m, to reduce to 37 dBA
CAT D11 bulldozer moving earth, reversing and repeating – several cycles	122	1700
CAT5130B front-end loader loading CAT777D truck after approaching and subsequently leaving loading area – several cycles	112	1150

This information provides an indication of the range within which road construction noise would be audible but not necessarily intrusive. The significance of any noise impact would depend upon the number and types of machinery/equipment used.

It is apparent from Figure 2 that the residences on the WEF site are located adjacent to the existing access farm road. Were this road to be upgraded the impact on residents would be **high**. Construction of a new road at least 1 000 m from any residences would reduce the impact to **Low**.

8.6.1.2 Site Works

Table 43 provides indicative A-weighted sound levels, LA, (dBA) which may be experienced from typical heavy-duty items of equipment at the WEF site (BS 5228 – 1). These exclude the influence of reverse warning signals and activities described in **Section 6.1** of the Noise Specialist Report.

Table 43: Predicted typical sound levels (dBA) of construction equipment

Equipment	Distance from equipment		
	800 m	1000m	2000 m
Front end loader/dozer	50	48	42
Excavator	48	46	40

Grader	46	44	38
Tip lorry	47	45	39
Concrete mixer	38	36	30
Crane	42	40	34

The information provides an indication of the range within which site construction noise might be audible but not necessarily intrusive. The significance of any noise impact would depend upon the number and types of machinery/equipment used, distance to noise sensitive receptor locations and the total duration of the construction activities in the vicinity of receptor locations. The impact would be confined to receptors within the site boundaries.

8.6.1.3 Blasting

Blasting is a highly regulated process encompassing numerous obligatory safety procedures for the protection of humans, animals, equipment and structures. Contrary to widespread belief, blasting can occur with minimal audible sound produced. Previously, this author was near a quarry conversing with personnel without being aware that blasting was taking place less than 100 m behind him other than a momentary and slight pressure variation felt by the ears. Noise from blasting was therefore excluded from further consideration.

8.6.1.4 Transport of Construction Vehicles and Equipment to Site

The potential impact of construction and transportation vehicles to and from the site would depend on the routes to be used, the number of movements, the types of vehicles and the total construction period. This information was not available at the time of writing. It is anticipated that the movement of normal construction and transportation vehicles would result in a noise impact of low intensity on dwellings located close to the access route for the duration of the construction period.

8.6.1.5 Decommissioning

The levels of noise relating to decommissioning would be similar to noise associated with construction but with additional noise from jack hammers or rock breakers if the turbine concrete bases were to be removed.

8.6.1.6 Impact on Wildlife

The influence of humans and man made noise on wildlife is complex and dependent on the particular species exposed. The arrival of humans and machinery to an area would generally result in wildlife moving away from the area, thereby disturbing their habitat.

The construction phase would be of short duration. Once humans have vacated the area, upon completion of the construction phase, wildlife in most instances would return to the area. This excludes subsequent effects of noise during the operation phase (refer to **Section 7.5** of the Noise Specialist report).

8.6.2 Noise Impact – Operation Phase

8.6.2.1 Wind Turbine Noise Emission Levels

It is proposed that 60 wind energy turbines with a hub height of up to 120m and rotor diameter up to 150 m, generating a total of 140 MW, be installed at the WEF. The manufacturer of the turbines provided A-weighted octave frequency band sound power emission levels for a 120 m hub height and rotor diameter of 125 m. The emission levels during a wind speed of 7 m/s are displayed in **Figure 93** with the overall A-weighted sound power level displayed in the legend. Emission levels for a 150 m rotor diameter were not made available.

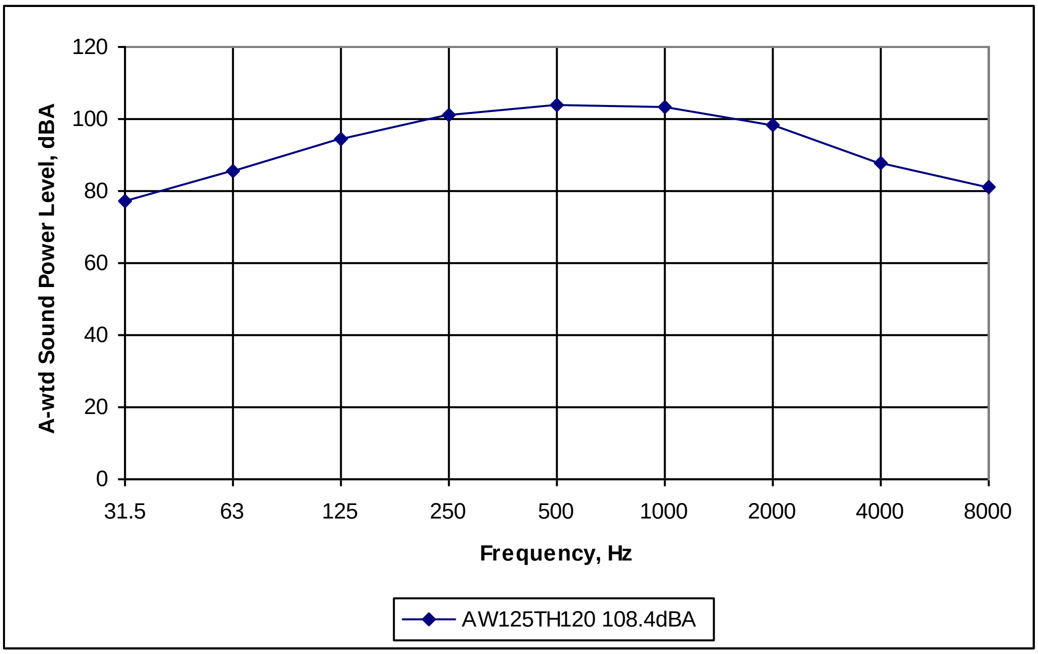


Figure 93: A-weighted sound power emission levels of wind energy turbine

8.6.2.2 Wind Turbine Noise Level Calculations

The calculation of the predicted equivalent continuous A-weighted level, LAeq,T, of noise at various distances from the wind energy turbines is summarised hereunder.

- A 3-dimensional digital terrain model (DTM) was generated of the land extending approximately 4 km beyond the proposed wind farm boundaries and entered into the noise propagation computer program.
- The 3-D location of each wind energy turbine, hub height above local ground elevation and noise emission data was entered in the noise propagation computer program.
- The attenuation of noise with distance from each source was calculated in accordance with SANS 10357:2004, *The calculation of sound propagation by the Concawe method*. Meteorological category 6 was used that represents conditions most favourable for the propagation of noise from

each noise source to each receptor. This includes the effects of light winds blowing from noise source(s) to receiver notwithstanding the actual prevailing conditions in the area. A receptor height of 2 m was chosen as this is the average height of the top of a ground storey window.

- From the results of the calculations LAeq contours at 5 dB intervals were generated and overlaid on a Google Earth image of the study area as displayed in Figure 5. The LAeq contours represent a worst case scenario at any receptor located 360 degrees in the horizontal plane around the noise sources. Specifically, they do not represent the influence of any specific seasonal condition.

In **Figure 94** the site boundaries are outlined in dark blue and noise sensitive receptors are within the numbered light blue circles. The respective LAeq contour values have been denoted by numerals on a white background with a lowest value of 20 dBA. This is below the LAeq values measured in the study area. Areas that would be exposed to levels less than 20 dBA contain no colour shading

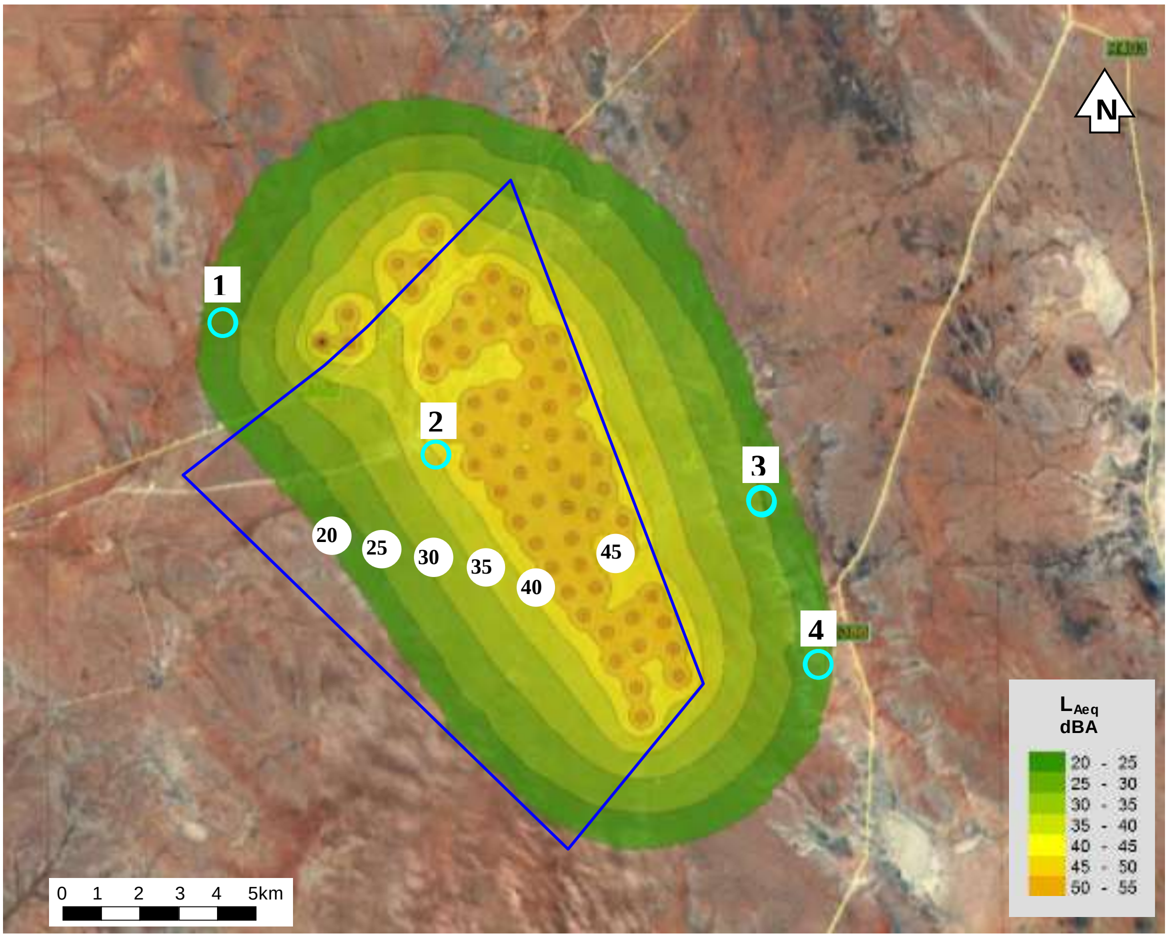


Figure 94: Predicted L_{Aeq} contours of noise from the wind energy turbines

A detailed analysis was conducted on the predicted level of noise at the identified noise sensitive residences within the blue circles.

The calculated octave frequency band LAeq spectrum level due to turbine noise at each of the respective noise sensitive receptors is displayed in the graph of **Figure 95** together with the measured night-time LAeq spectrum. The respective overall, single-figure LAeq values are recorded in the legend.

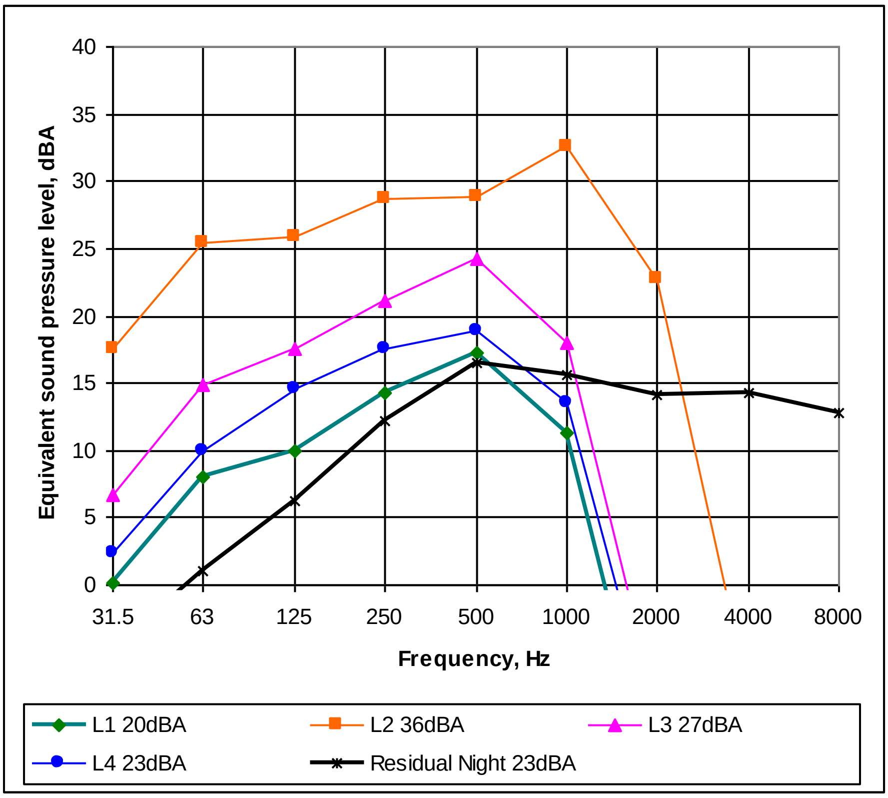


Figure 95: Calculated octave band spectrum levels at noise sensitive receptors and the night-time residual spectrum levels

8.6.2.3 Assessment of the Results

- **Assessment in terms of SANS 10103:2008**

The impact of noise from wind turbines occurs primarily between sunset and sunrise. The predicted impact should therefore be based on the measured night-time residual LAeq of 23 dBA.

It is apparent from **Figure 94** that the proposed location of many wind turbines would be on or close to the northern, eastern and southern boundaries of the WEF. The predicted LAeq just beyond the boundaries would exceed 45 dBA and would thus be more than 22 dB above the measured night-time residual LAeq of 23 dBA with an associated **Very High** intensity of noise impact.

A study of the LAeq contours shows that an LAeq of 23 dBA would occur at a separation distance of approximately 3 500 m from the nearest turbines. Within this distance the impact of noise on adjacent land would range between **Negligible** and **Very High**.

Within this distance this would include residences at locations L3 and L4. The residences at location L2 within the WEF boundaries would be within 1 km of the nearest turbine. With reference to Table 5 of SANS 10103 the intensity of noise impact would be:

Location	Distance from turbines, m	Excess, dB	Intensity of noise impact
L2	1 000	13	High
L3	3 100	4	Low
L4	3 100	0	Negligible

Although the owner of the land would have a vested interest in the wind farm this would not alter the impact of noise on the residents at location L2 including any farm support staff.

Location L3 would be exposed to noise from more turbines than at location L4 whence a higher level of excess for the same distance to the nearest turbine.

- **Assessment of detailed analysis at residences**

A difference in sound level of 10 dB is subjectively considered to be very significant whether comparing overall, single-figure LAeq values or parts of the audio spectrum as facilitated by the graphs in **Figure 95**.

Comparison of the spectrum levels at the respective residence locations with the spectrum levels of residual noise indicate that the residual noise would have no masking effect on wind turbine noise below 500 Hz at locations L1 and L4; below 1 000 Hz at location L3; and below 4 000 Hz at Location L2.

At Location L2 the predicted levels of turbine noise at frequencies below 2 000 Hz would exceed the residual levels by more than 10 dB. This indicates that the noise would be distinctly audible throughout the low and medium audio frequency range and would be considered to be highly intrusive.

Similarly, at Location L3 it is probable that low frequency noise below 250 Hz would be audible and considered to be intrusive.

At Location L4 there would be a low probability that low frequency noise below 250 Hz would be audible and might be considered to be intrusive.

At Location L1 the probability of low frequency noise being audible would be very low.

With reference to Section 4 of the Noise Specialist Report any additional impact due to Amplitude Modulation is not predictable and could therefore not be included in this study.

- **Assessment in terms of the Noise Control Regulations**

In terms of the NCR the assessment of noise is outside the boundary of the property from which noise emanates. This encompasses the common law principle that the owner or occupier of land has the duty to exercise his or her rights of ownership or use in such a manner that they do not infringe on the rights of peace and enjoyment of property of adjoining owners whether it is occupied or not and accordingly may not influence the value of their property.

The noise level (LAeq) would exceed the ambient sound level (residual level) by 7 dB or more beyond the northern, eastern and southern boundaries and would thus be adjudicated as a disturbing noise. In accordance with the NCR noise mitigation measures would need to be implemented to lower the level of noise so as to conform to the requirements of the NCR. This would imply a noise level less than 23 + 7 = 30 dBA.

From **Figure 94** the distance between a turbine and a 30 dBA contour is approximately 2 600 m. Compliance with the legal requirements of the NCR would require all turbines to be set back 2 600 m from the WEF boundaries. Alternatively, a written application for exemption of provisions of the NCR should be made to the local authority with the due consideration and approval by all affected parties.

8.6.2.4 Noise Mitigation

The only practical means of mitigating the noise impact would be to increase the separation distance between wind energy turbines and the WEF boundaries and between the turbines and noise sensitive receptors.

In order to reduce the intensity of noise impact on the farm residences within the WEF boundaries to **Low** would require a minimum distance of 3 000 m between the residences and any turbine.

No mitigation would be required for the identified neighbouring residences at locations L3 and L4. However, in order to reduce the intensity of noise impact on adjacent land to **Low** would require a setback distance of at least 3 000 m between turbines and boundary.

8.6.2.5 Impact on Wildlife

The effects of wind turbine noise described in Section 4 may have an equal if not more traumatic effect on wildlife. Anecdotal evidence derived from a critical biodiversity area adjacent to an existing wind farm showed that all herbivores moved permanently far away from the wind farm boundary and resulting in overgrazing in the areas they had moved to.

8.7 Visual

The full The Visual Assessment was conducted by Andrea Gibb and Stephan Jacobs of SiVEST and is included in **Appendix 6G**.

8.7.1 Visual Sensitivity

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be 'key issues' (Oberholzer: 2005).

Based on the criteria in the matrix (**Table 44**), the visual sensitivity of the area is broken up into a number of categories, as described below:

i) **High** - The introduction of a new development such as the erection of a wind energy facility would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors

ii) **Moderate** - Presence of receptors, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

iii) **Low** - The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 44: Environmental factors used to define visual sensitivity of the study area

FACTORS	RATING									
	1	2	3	4	5	6	7	8	9	10
Pristine / natural character of the environment										
Presence of sensitive visual receptors										
Aesthetic sense of place / scenic visual character										
Value to individuals / society										
Irreplaceability / uniqueness / scarcity value										
Cultural or symbolic meaning										
Scenic resources present in the study area										
Protected / conservation areas in the study area										
Sites of special interest present in the study area										
Economic dependency on scenic quality										
Local jobs created by scenic quality of the area										

International status of the environment										
Provincial / regional status of the environment										
Local status of the environment										
Scenic quality under threat / at risk of change*										

**A rating above '5' for this factor will trigger the need to undertake an assessment of cumulative visual impacts.

Low							**Moderate**							**High**
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**

Based on the above factors, the study area is rated as having a low visual sensitivity. This is mainly owing to the relatively uninhabited character of the area as well as the presence of degraded land and anthropogenic elements (such as the R357, R386 and the railway line) which would likely reduce the scenic quality of the area. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. As described below, a significant amount of 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 area would still be valued as a typical Karoo cultural landscape.

Several renewable energy facilities are proposed within relatively close proximity to the proposed wind energy facility. As such, an assessment of the cumulative impact that will be experience from each potentially sensitive receptor is addressed in **Section 11**.

Although the area is associated with a low visual sensitivity, it should be stressed that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of the likelihood of the area to be sensitive to the visual impacts, and is based on the physical characteristics of the study area, economic activities and land use that predominates. This does not mean that high visual impacts could not potentially be experienced in areas of low visual sensitivity. The potential presence and perception of sensitive receptors as discussed below must also be taken into account.

8.7.2 Sensitive and Potentially Sensitive Visual Receptor Locations

A sensitive receptor location is defined as a location, from where receptors would potentially be adversely impacted by a proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. As described above, the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the wind energy facility into a 'view', which may affect the 'sense of place'. The identification of sensitive receptor locations is typically undertaken based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas with a natural visual character;
- the presence of leisure-based (esp. nature-based) tourism in an area;
- the presence of sites / routes that are valued for their scenic quality and sense of place;

- the presence of homesteads / farmsteads in a largely natural settings where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the EIA study.

A distinction must be made between a receptor location and a sensitive receptor location. A receptor location is a site from where the proposed wind energy facility may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities, scenic sites and residential dwellings in natural settings.

Distance bands were used to assign zones of visual impact from the proposed development site, as the visibility of the development would diminish exponentially over distance. As such, the proposed development would be more visible to receptors located within a short distance and these receptors would experience a higher adverse visual impact than those located at a moderate or long distance from the proposed development. The distance of sensitive receptors from the proposed development site was taken into account when rating the visual impact of the proposed development on these receptors.

Based on the height and scale of the project, the radii chosen to assign these zones of visual impact are as follows:

- 500m (very high impact zone)
- 500m < 2km (high impact zone)
- 2km < 5km (moderate impact zone)
- 5km < 8km (low impact zone)
- 8km < (Negligibly low impact zone)

During the EIA phase VIA, a number of potentially sensitive visual receptor locations were identified. These are indicated in **Figure 100** below and each receptor is identified by a specific number (e.g. VR 1 = Visual Receptor 1). Of the potentially sensitive visual receptors identified, two (2) receptor locations were identified as being sensitive within the study area due to their significance as tourism facilities, namely the Boesmansberg Guest Farm and the Nelspoortjie Karoo Guest Farm (VR 1 and VR 2 respectively). These guesthouses have been regarded as sensitive visual receptors as they are used as tourism facilities and visitors to these facilities are may likely perceive the proposed development in a negative light.

The Nelspoortjie Karoo Guest Farm (VR 2) is located approximately 3.8km to the west of the proposed Aletta Wind Energy Facility application site and is accessible via the R357 Copperton Road (**Figure 96**). In addition, this tourism facility is located approximately 47km from the town of Prieska, 15km from Copperton and 20km from the Alkantpan Test Range. The Nelspoortjie Karoo Guest Farm caters for all business class guests, especially international and local military personnel performing tests at the Alkantpan Test Range as well as the solar and wind energy facility staff working on renewable energy developments in the Copperton area. It should also be noted that this guesthouse offers several different accommodation facilities for guests (**Figure 97**), with sixteen (16) double, standard or luxury rooms available (http://www.aatravel.co.za/accommodation/south-africa/northern-cape/prieska/nelspoortjie-karoo-guest-farm-PA45745).

Figure 96: View of the entrance of the Nelspoortjie Karoo Guest Farm (VR 2) which is accessible via the R357 Copperton Road

Figure 97: Typical views of the different accommodation facilities which can be found at the Nelspoortjie Karoo Guest Farm (VR 2)

The Boesmansberg Guest Farm (VR 1) is a new guesthouse, which is located approximately 44km from the small town of Prieska. This guesthouse is located approximately 2.3km north-west of the proposed

Aletta Wind Energy Facility application site and is accessible via the R357 Copperton Road (**Figure 98**). This guesthouse offers country hospitality and the beauty of the Karoo. The Boesmansberg Guest Farm is regarded for its largely scenic character and provides guests with opportunities to take beautiful pictures of nature. Guests can enjoy and experience a late afternoon walk in the field. In addition, this tourism facility also offers veld paths where you can ride with mountain bikes (http://boesmansberggasteplaas.co.za/boesmansberg-guest-farm-accommodation/). Similarly to the Nelspoortjie Karoo Guest Farm (VR 10), the Boesmansberg Guest Farm (VR 15) provides several different accommodation facilities for guests in the form of double and single rooms (**Figure 99**).

Figure 98: View of the entrance of the Boesmansberg Guest Farm (VR 1) which is also accessible via the R357 Copperton Road

Figure 99: Typical views of the different accommodation facilities which can be found at the Boesmansberg Guest Farm (VR 1)

During the EIA Phase site visit, several scattered farmsteads / homesteads were identified within the study area. These dwellings are located within a mostly rural setting and the proposed development will likely alter the natural vistas experienced from these dwellings. It is important to note that these visual receptor locations are regarded as potentially sensitive to the proposed development as the degree of visual impact experienced from these locations will vary from one inhabitant to another, as it is largely based on the viewer's perception and sentiments toward the development. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).
- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

As far as possible, each sensitive and potentially sensitive visual receptor that was identified via desktop means was visited to determine the current use of the facility and rate the impact of the proposed development from the location. As mentioned above, only two (2) sensitive visual receptor locations with tourism significance were identified within the study area. This is mainly due to low levels of leisure-based or nature based tourism activities in the assessment area.

Table 45 below provides details of the visually sensitive and potentially sensitive visual receptors that were identified within the study area.

It should be noted that a few of the farmsteads / homesteads identified during the scoping phase were excluded as potentially sensitive receptor locations for the purposes of the EIA phase study as it was discovered during the time of the site visit that these were uninhabited and/or abandoned. No further assessment was undertaken from these abandoned farmsteads / homesteads as no individuals currently live in these farmsteads / homesteads and therefore no visual impact will be experienced from these locations.

Table 45: Sensitive and potentially sensitive visual receptor locations identified within the study area

Name	Details	Coordinates	Proximity to the proposed wind energy facility application site	Visual Impact Zone
VR 1	Boesmansberg Guest Farm	29°54'51.57"S 22°27'50.41"E	Approximately 2.4km	Moderate
VR 2	Nelspoortjie Karoo Guest Farm	29°57'43.78"S 22°24'55.99"E	Approximately 6.8km	Low
VR 4	Humansrus Farmstead	29°59'52.89"S 22°27'1.67"E	Approximately 7.6km	Low
VR 5	Uitzigt Farmstead	29°57'18.58"S 22°36'28.36"E	Approximately 3.2km	Moderate
VR 8	Jackalswater Farmstead 1	29°49'58.45"S 22°34'53.67"E	Approximately 6.7km	Low
VR 9	Jackalswater Farmstead 2	29°51'31.78"S 22°33'6.44"E	Approximately 2.7km	Moderate
VR 11	Platsjambok Farmstead	30°0'1.44"S 22°27'7.13"E	Approximately 7.8km	Low
VR 12	Klein Modderfontein Farmstead	29°59'38.38"S 22°37'24.68"E	Approximately 3.1km	Moderate
*VR 14	Drielingspan Farmstead 1	29°59'19.69"S 22°31'12.51"E	Approximately 2.9km (located within Aletta Wind application sie)	Moderate
*VR 15	Drielingspan Farmstead 2	29°56'50.01"S 22°31'20.40"E	Located within the Aletta Wind development area	Very high

Name	Details	Coordinates	Proximity to the proposed wind energy facility application site	Visual Impact Zone
*VR 16	Drielingspan Farmstead 3	29°56'47.61"S 22°31'16.07"E	Located within the Aletta Wind development area	Very high

**VR 14 is located within the proposed Aletta Wind application site. In addition, VR 15 and VR 16 are located within the proposed Aletta Wind development area. It is assumed that the occupants of these dwellings would have a vested interest in the development and would therefore not perceive the proposed Aletta Wind Energy Facility in a negative light. During the EIA phase fieldwork it was verified that the owner of VR 15 supports the proposed development.*

**It should be noted that VR 14 and VR 16 are currently uninhabited and no one lives in these dwellings. During the site visit, it was however discovered that VR 14 belongs to the occupant of VR 15 and that this dwelling is sometimes used as accommodation for individuals that have to undertake specific tasks (such as erecting fences) on the farm. The occupant of VR 15 has however indicated that this dwelling might be used as a home for one of the family members in the future and should therefore still be assessed as a potentially sensitive visual receptor. In addition, VR 16 is currently being used as a holiday home by a family member of the occupant of VR 15. The occupant of VR 15 has indicated that this family member has inherited this dwelling from their father and might occupy it permanently in the future. VR 16 has therefore also been assessed as a potentially sensitive visual receptor for the purpose of this EIA phase study.*

The visually sensitive and potentially sensitive receptor locations in relation to the zones of visual impact are indicated in **Figure 100** below.

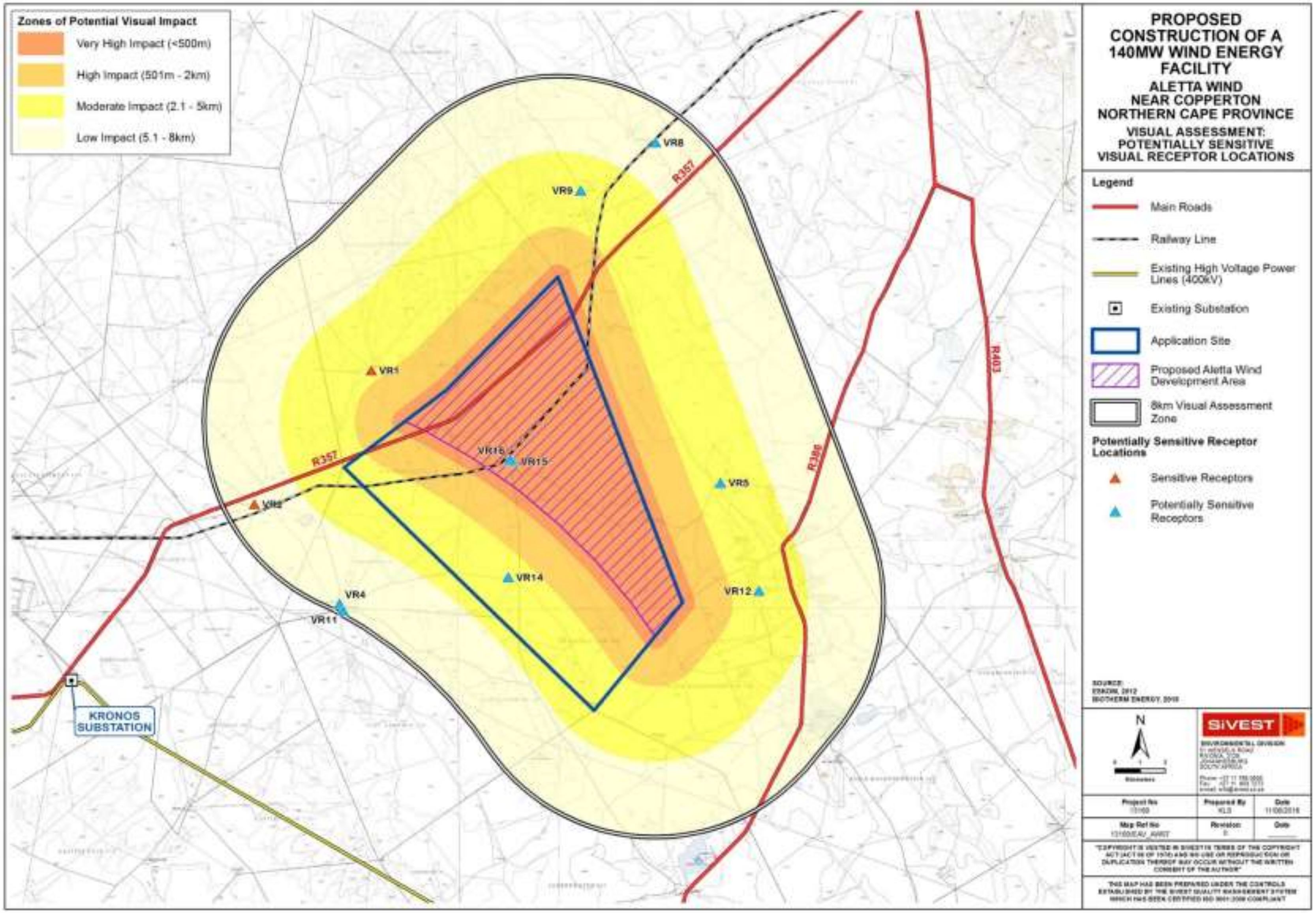


Figure 100: Visually sensitive and potentially sensitive visual receptors within the study area

In many cases, roads, along which people travel, are regarded as sensitive receptors. The closest roads to the Aletta Wind Energy Facility application site are the R357 tar road, as well as the R386 and R403 gravel roads. The R357 traverses the northern section of the application site and provides access to the site. This road is a single carriage way tar road and is in relatively good condition (**Figure 101**). This road is primarily used by local farmers to gain access to surrounding farms / properties as well as when travelling to and from the town of Prieksa to the north-east. It must however be noted that a section of the R357 to the south-west of the application site becomes a gravel road and provides access to the existing Kronos Substation (**Figure 102**). In addition, the R386 gravel road can be found to the east of the site and traverses the south-eastern corner of the visual assessment zone. Similarly to the R357, this gravel road is also primarily used by local farmers to gain access to surrounding farms / properties as well as when travelling to and from the town of Prieksa to the north-east. It must be noted that the R403 gravel road is located outside of the visual assessment zone and is therefore not regarded as a sensitive receptor road. The R357 and R386 roads are however also not considered to be sensitive receptor roads as they are used almost exclusively as local access roads, with very little use for any other purposes. In addition, these roads do not form part of any scenic tourist routes, and are not specifically valued or utilised for their scenic or tourism potential.

Figure 101: View of the R357 tar road which traverses the proposed Aletta Wind Energy Facility application site and provides access to the site

Figure 102: View of the south-western section of the R357 road which becomes a gravel road and provides access to the existing Kronos Substation

As mentioned above, the south-western section of the R357 becomes a gravel road and provides access to the existing Kronos Substation (**Figure 103**) to the south-west of the application site. In addition, this section of the road also passes close by the now disused Copperton Mine and associated slimes dam (**Figure 104**). It should also be noted that existing high voltage power lines traverse certain sections of the R357 and R386 roads (**Figure 105**). Certain areas along these roads can therefore be considered to be visually 'degraded' by the prevalence of large human infrastructure, and are highly unlikely to be associated with any visual sensitivity.

Figure 103: View of the existing Kronos Substation which can be found along the south-western gravel section of the R357 road

Figure 104: View of the Copperton Mine slimes dam which can be seen from sections of the R357 road. The south-western gravel section of the R357 road passes close to this slimes dam

Figure 105: Photo of existing high voltage power lnes which traverses a section of the R357 tar road

It must also be noted that the N10 national road passes close by the town of Prieska and connects Port Elizabeth (on the Eastern Cape) to the Namibian border. Prieska is therefore often used as a stopover destination by tourists or vacationers travelling to Namibia or other parts of the Northern Cape. Despite this, the road is not expected to be a potentially sensitive receptor road as it is located a great distance from the visual assessment zone.

Other thoroughfares in the study area include gravel access / secondary roads which are primarily used by local farmers to gain access to surrounding farms / properties. These roads are therefore not regarded as visually sensitive as they do not form part of any scenic tourist routes, and are not specifically valued or utilised for their scenic or tourism potential.

There are therefore no visually sensitive roads within the visual assessment zone.

8.7.3 Impact Assessment

8.7.3.1 Receptor Impact Rating

In order to assess the impact of the proposed development on the sensitive / potentially sensitive receptor locations listed above, a matrix that takes into account a number of factors has been developed (**Table 47**), and is applied to each receptor location.

The matrix has been based on a number of factors as listed below:

- Distance of a receptor location away from the proposed development (zone of visual impact)
- Primary focus / orientation of the receptor
- Presence of screening factors (topography, vegetation etc.)
- Visual character and sensitivity of the surrounding area
- Visual contrast of the development with the landscape pattern and form

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a sensitive / potentially sensitive receptor location in this context. It should be noted that this rating matrix is a relatively simplified way to assign a likely representative visual impact, which allows a number of factors to be considered. Experiencing of visual impacts is however a complex and qualitative phenomenon, and thus difficult to accurately quantify. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

As described above, distance of the viewer / receptor location from the development is an important factor in the context of experiencing of visual impacts. A high impact rating has been assigned to receptor locations that are located within 2km of the proposed development. Beyond 8km, the visual impact would be virtually nil, as the development would appear to merge with the elements on the horizon. Any receptor location beyond this distance has therefore been assigned an overriding negligible impact rating. As such, despite the impact rating assigned to the other visual factors, the overall impact rating would remain negligible, as the proposed development is unlikely to visually influence any receptors located more than

8km from the development. Where a receptor is located within more than one distance band, such as a receptor road, it is assigned the score according to the closest distance it will get from the proposed development i.e. the highest visual impact experienced.

The orientation of a receptor becomes important in many cases, as a receptor is typically oriented in a certain direction, e.g. with views towards a certain area from a highly frequented area like a porch or garden. The visual impact of a development could thus be potentially much greater if the development intruded into such a view, and thus the highest rating has been given to a situation where the development would cross directly across an ‘arc of view / orientation’ – i.e. the 180º panorama in a certain direction. Where the receptor does not have a primary orientation, such as a residential community where the dwellings are focused in different directions, a medium rating has been specified.

The presence of screening factors is equally important in this context as the distance away from the development. Screening factors can be vegetation, buildings, as well as topography. For example, a grove of trees located between a receptor location and an object could completely shield the object from the receptor. Topography (relative elevation and aspect) plays a similar role as a receptor location in a deep or incised valley will have a very limited viewshed and may not be able to view an object that is in close proximity, but not in its viewshed. As such, the complete screening of the development has also been assigned an overriding negligible impact rating, as the development would not impose any impact on the receptor.

The visual character of the surrounding area and views is also considered in the matrix, as introducing a new development into a natural area may adversely affect or degrade scenic views experienced by receptors. Although pastoral’ or rural landscapes often have a relative density of anthropogenic (human) infrastructure (e.g. fences, centre pivots, buildings such as barns and farmhouses), views of these landscape are often perceived as sensitive to visual impacts, particularly to visual impacts of more industrial or large-scale infrastructure. A moderate rating is thus assigned to the visual character of these views. Transformed industrial landscapes have been assigned a low impact rating as a new development is unlikely to be regarded as negative within this context.

The visual contrast of a development refers to the degree to which the development would be congruent with the surrounding environment. This is based on whether or not the development would conform with the land use, settlement density, structural scale, form and pattern of natural elements that define the structure of the surrounding landscape. The visual compatibility is an important factor to be considered when assessing the impact of the development on receptors within a specific context. A development that is incongruent with the surrounding area could have a significant visual impact on sensitive receptors as it may change the visual character of the landscape.

Through the matrix a score for each receptor location is calculated. The range in which the score falls, as listed in **Table 46** below, determines the visual impact rating for each receptor location.

Table 46: Ratings scores

Rating	Overall Score
High Visual Impact	13-15

Medium Visual Impact	9-12
Low Visual Impact	5-8
Negligible Visual Impact	(overriding factor)

An explanation of the matrix is provided in **Table 47** below.

Table 47: Visual assessment matrix used to rate the impact of the proposed development on sensitive / potentially sensitive visual receptors

	VISUAL IMPACT RATING			
VISUAL FACTOR	**HIGH**	**MEDIUM**	**LOW**	**OVERRIDING FACTOR: NEGLIGIBLE**
Distance of receptor away from proposed development	0 ≤ 2km **Score 3**	2km ≤ 5km **Score 2**	5km ≤ 8km **Score 1**	8km <
Primary focus / orientation of receptor	'Arc of view' directly towards the proposed development **Score 3**	'Arc of view' partially towards the proposed development / no primary orientation **Score 2**	'Arc of view' in opposite direction of the proposed development **Score 1**	
Presence of screening factors	No / almost no screening factors – development highly visible **Score 3**	Screening factors partially obscure the development **Score 2**	Screening factors obscure most of the development **Score 1**	Screening factors completely block any views towards the development, i.e. the development is not within the viewshed
Visual character and sensitivity of the area / surrounding views	Scenic: Highly natural; almost no visually 'degrading' factors, the area is valued for its scenic quality and is highly sensitive to change **Score 3**	Rural / pastoral: Mostly natural with typical rural infrastructure present, the area is valued for its uninhabited nature and is potentially sensitive to change **Score 2**	Transformed: Presence of industrial-type infrastructure (e.g. urban areas and outlying residential areas), not highly valued and not sensitive to change **Score 1**	
Visual Contrast	High contrast with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or	Moderate contrast with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or	Corresponds with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or	

	human elements (infrastructural form) **Score 3**	human elements (infrastructural form) **Score 2**	human elements (infrastructural form) **Score 1**	

The tables below present the results of the visual impact matrix. The impact of the development on each sensitive and potentially sensitive receptor location has been determined based on the factors detailed above (**Table 47**). As previously mentioned, a few of the farmsteads / homesteads identified during the scoping phase were excluded as potentially sensitive receptor locations for the purposes of the EIA phase study as it was discovered during the time of the site visit that these were uninhabited and/or abandoned. No further assessment was undertaken from these abandoned farmsteads / homesteads as no individuals currently live in these farmsteads / homesteads and therefore no visual impact will be experienced from these locations.

Table 48: Visual impact of the proposed Aletta Wind Energy Facility at VR 1 – Boesmansberg Guesthouse

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**MEDIUM:** The farmstead / residential dwelling is located approximately 2.4km from the proposed Aletta Wind Energy Facility development area. **Score 2**
Primary focus / orientation of receptor	**MEDIUM:** The Boesmansberg Guest Farm consists of a number of buildings / houses which are used as accommodation for guests (**Figure 106**). As such, the Boesmansberg Guest farm has no primary orientation. **Score 2**
Presence of screening factors	**MEDIUM:** Screening factors in the form of tall trees and a localised hill / koppie to the east of the guesthouse are expected to partially obscure views towards the proposed development (**Figure 107**) and only some the turbines are likely to be visible. **Score 2**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse are mostly natural with typical pastoral infrastructure and other anthropogenic elements present which include; garden vegetation, large trees, telephone poles and wire fences. **Score 2**
Visual Contrast	**HIGH:** The proposed wind turbines would contrast with the dominant natural / scenic character of the landscape. There are no tall linear or industrial elements in view from the farmhouse, except for telephone poles, and as such the tall wind turbines would contrast significantly with the elements in the surrounding landscape. **Score 3**
OVERALL IMPACT RATING	**MEDIUM** **Total score 11**

Figure 106: Typical views of the guesthouse buildings / facilities which can be found at the Boesmansberg Guest Farm (VR 1)

Figure 107: View of the tall trees and the localised hill / koppie found to the east of the Boesmansberg Guest Farm (VR 1). These screening factors are expected to partially obscure views towards the proposed Aletta Wind Energy Facility.

Figure 108: Typical view towards the Aletta Wind Energy Facility application site from the south-eastern side of the main guesthouse building / facility at the Boesmansberg Guest Farm (VR 1)

Table 49: Visual impact of the proposed wind energy facility at VR 2 – Nelspoortjie Karoo Guest Farm

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The Nelspoortjie Karoo Guest Farm is located approximately 6.8km from the proposed Aletta Wind Energy Facility development area. **Score 1**
Primary focus / orientation of receptor	**MEDIUM:** The Nelspoortjie Karoo Guest Farm consists of a number of buildings / houses which are used as accommodation for guests (**Figure 109**). As such, the Nelspoortjie Karoo Guest Farm has no primary orientation. **Score 2**
Presence of screening factors	**LOW:** There is a relatively large amount of tall trees and other types of vegetation surrounding this receptor location (**Figure 110**). Despite the presence of these vegetative screening factors, some of the wind turbines are still expected to be visible from the guesthouse. The screening factors are therefore expected to obscure most of the proposed development. **Score 1**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmstead / residential dwelling are largely natural / scenic with typical rural / pastoral infrastructure and other anthropogenic elements present which include telephone poles and wire farm fences. **Score 2**
Visual Contrast	**MEDIUM:** The proposed wind turbines would contrast moderately with the dominant natural landscape elements present. There are no tall linear

	elements in view from the farmstead / residential dwelling except for the telephone poles. **Score 2**
OVERALL IMPACT RATING	**LOW** **Total score 8**

Figure 109: Typical views of the guesthouse buildings / facilities found at the Nelspoortjie Karoo Guest Farm (VR 2).

Figure 110: Typical views towards the Aletta Wind Energy Facility application site from some of the guestroom buildings / facilities at the Nelspoortjie Karoo Guest Farm (VR 2). Note the presence of a significant amount of vegetative screening.

Table 50: Visual impact of the proposed wind energy facility at VR 4

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The farmstead / residential dwelling is located approximately 7.6km from the proposed Aletta Wind Energy Facility development area. **Score 1**
Primary focus / orientation of receptor	**HIGH:** The farmstead / residential dwelling is orientated to the north-east, directly towards the proposed Aletta Wind Energy Facility application site. **Score 3**
Presence of screening factors	**MEDIUM:** The most significant screening factors surrounding this farmstead / residential dwelling include tall trees around the farmstead / residential dwelling and slight undulations in the landscape to the east. The presence of these above-mentioned screening factors are therefore expected to partially obscure the proposed Aletta Wind Energy Facility development. **Score 2**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse / residential dwelling are largely natural / scenic. In addition, typical rural / pastoral infrastructure and other anthropogenic elements are also present which include tall trees, farm fences, wind mills and telephone poles. It must also be noted that existing high voltage power lines are visible to the south-west of this farmstead / residential dwelling (**Figure 111**). **Score 2**
Visual Contrast	**MEDIUM:** The proposed wind turbines are expected to contrast with the dominant elements within the landscape. However, the presence of the wind mills, existing high voltage power lines and other linear infrastructure is expected to marginally lower the visual contrast of the proposed wind energy facility and therefore result in a moderate visual contrast. In addition, from this distance the turbines would appear to be relatively equal in size to the existing infrastructural form and begin to merge with the elements on the horizon.

	Score 2
OVERALL IMPACT RATING	**MEDIUM** **Total score 10**

Figure 111: Typical view of the existing high voltage power lines that can be found to the south-west of the farmstead / residential dwelling at VR 4.

Figure 112: View of the farmhouse / residential dwelling at VR 4 as well as the typical view towards the proposed Aletta Wind Energy Facility application site from VR 4.

Table 51: Visual impact of the proposed wind energy facility at VR 5

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**MEDIUM:** The farmstead / residential dwelling is located approximately 3.2km from the proposed Aletta Wind Energy Facility development area. **Score 2**
Primary focus / orientation of receptor	**LOW:** The farmstead / residential dwelling is oriented to the east, in the opposite direction of the proposed Aletta Wind Energy Facility application site. **Score 1**
Presence of screening factors	**MEDIUM:** The screening factors surrounding the farmstead / residential dwelling are expected to partially obscure the proposed Aletta Wind Energy Facility. **Score 2**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse / residential dwelling are largely natural with typical rural infrastructure present. Almost no visually degrading factors can be found within close proximity to this farmstead / residential dwelling and the area is valued for its scenic quality. In addition, views from the farmhouse at VR 5 have only been partially transformed due to pastoral practices and typical rural infrastructure. **Score 2**
Visual Contrast	**HIGH:** The presence of wind turbines would contrast with the pattern and form of the natural landscape elements, typical land use and/or human elements, as there are no tall linear or industrial elements in view from the farmhouse. **Score 3**
OVERALL IMPACT RATING	**MEDIUM** **Total score 10**

Due to access limitations during the time of the site visit, the impact assessment for VR 5 was done via desktop means and therefore photographs could not be provided. This farmstead / residential dwelling is however still considered to be a potentially sensitive visual receptor and was included as part of the impact assessment.

Table 52: Visual impact of the proposed wind energy facility at VR 8

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**N/A:** The farmstead / residential dwelling is located approximately 6.7km from the proposed Aletta Wind Energy Facility development area. The screening factors are however expected to completely block any views towards the proposed wind energy facility development.
Primary focus / orientation of receptor	**N/A:** The farmhouse is oriented to the north-east, in the opposite direction of the proposed Aletta Wind Energy Facility application site. The screening factors are however expected to completely block any views towards the proposed wind energy facility development.
Presence of screening factors	**NEGLIGIBLE:** The presence of topographical undulations to the south-west, as well as the tall trees and other vegetation surrounding the farmhouse / residential dwelling at VR 8 are expected to completely block any views towards the proposed Aletta Wind Energy Facility, i.e. the development is not within the viewshed. **Overriding factor**
Visual character and sensitivity of the area / surrounding views	**N/A:** Views from the farmhouse are largely natural /scenic with some typical rural / pastoral infrastructure present. Other anthropogenic elements which are present include wire farm fences, tall trees and telephone poles. The overall impact rating would however remain negligible due to the presence of screening factors that are expected to completely block any views towards the proposed wind energy facility development.
Visual Contrast	**N/A:** As mentioned above, the overall impact rating would remain negligible due to the presence of screening factors that are expected to completely block any views towards the proposed wind energy facility development.
OVERALL IMPACT RATING	**NEGLIGIBLE**

Figure 113: View of the farmstead / residential dwelling at VR 8 as well as the typical view towards the proposed Aletta Wind Energy Facility application site from VR 8.

Table 53: Visual impact of the proposed wind energy facility at VR 9

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**MEDIUM:** The farmstead / residential dwelling is located approximately 2.7km from the proposed Aletta Wind Energy Facility development area. **Score 2**
Primary focus / orientation of receptor	**LOW:** The farmstead / residential dwelling is orientated to the north-east, in the opposite direction of the proposed Aletta Wind Energy Facility application site. **Score 1**
Presence of screening factors	**LOW:** The presence of large trees and localised hills / koppies to the south-west of this farmstead / residential dwelling (**Figure 114**) are expected to obscure most views of the proposed Aletta Wind Energy Facility development. **Score 1**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from this farmhouse are largely natural /scenic with some typical rural / pastoral infrastructure present. Existing power lines are however visible to the south-east of the farmstead / residential dwelling (**Figure 115**). In addition, other anthropogenic elements such as wind mills, wire farm fences, tall trees and telephone poles are also present. **Score 2**
Visual Contrast	**MEDIUM:** Despite the largely natural / scenic character of the surrounding environment and limited transformation within this part of the study area, the presence of vertical elements and tall electrical infrastructure (in the form of existing high voltage power lines) are expected to result in a moderate contrast with the proposed Aletta Wind Energy Facility. **Score 2**
OVERALL IMPACT RATING	**LOW** **Total score 8**

Figure 114: View of the localised hills / koppies found to the south-west of the farmstead / residential dwelling at VR 9. These localised hills koppies are expected to provide a significant amount of screening from the proposed Aletta Wind Energy Facility.

Figure 115: View of the existing power line which can be found to the south-east of the farmstead / residential dwelling at VR 9. This power line is expected to slightly and lessen the visual contrast of the proposed Aletta Wind Energy Facility.

Figure 116: View of the farmstead / residential dwelling at VR 9 as well as the typical view towards the proposed Aletta Wind Energy Facility application site from VR 9.

Table 54: Visual impact of the proposed wind energy facility at VR 11

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The farmstead / residential dwelling is located approximately 7.8km from the proposed Aletta Wind Energy Facility development area. **Score 1**
Primary focus / orientation of receptor	**LOW:** The farmstead / residential dwelling is orientated to the north-west, in the opposite direction of the proposed Aletta Wind Energy Facility application site. **Score 1**
Presence of screening factors	**MEDIUM:** A large amount of tall trees have been established around the farmstead / residential dwelling at VR 11. In addition, the surrounding area is characterised by slight undulations in the landscape. Despite the presence of tall trees and the slightly undulating terrain of the landscape, the above-mentioned screening factors are expected to only partially obscure views towards the proposed Aletta Wind Energy Facility development. **Score 2**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse / residential dwelling are largely natural / scenic. In addition, typical rural / pastoral infrastructure and other anthropogenic elements are also present which include tall trees, farm fences, wind mills and telephone poles. Existing high voltage power lines are visible to the south-west of this farmstead / residential dwelling (**Figure 117**). **Score 2**
Visual Contrast	**MEDIUM:** The proposed wind turbines are expected to contrast with the dominant elements within the landscape. However, the presence of the existing high voltage power line and other vertical anthropogenic elements are expected to marginally lower the visual contrast of the proposed wind energy facility and therefore result in a moderate visual contrast. In addition, from this distance the turbines would appear to be relatively equal in size to the existing infrastructural form and begin to merge with the elements on the horizon. **Score 2**
OVERALL IMPACT RATING	**LOW** **Total score 8**

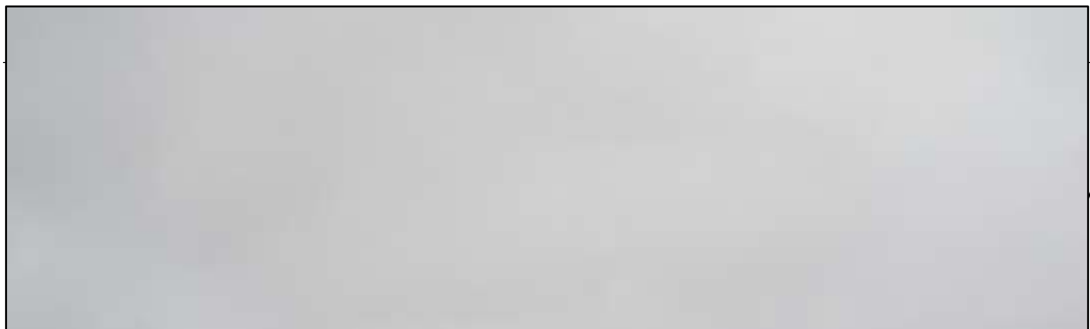


Figure 117: View of the existing high voltage power line which can be found to the south-west of the farmstead / residential dwelling at VR 11. This power line is expected to alter the natural / scenic character of the surrounding area slightly and lessen the visual contrast of the proposed Aletta Wind Energy Facility.

Figure 118: View of the farmstead / residential dwelling at VR 11 as well as the typical view towards the proposed Aletta Wind Energy Facility application site from VR 11.

Table 55: Visual impact of the proposed wind energy facility at VR 12

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**MEDIUM:** The farmstead / residential dwelling is located approximately 3.1km from the proposed Aletta Wind Energy Facility development area. **Score 2**
Primary focus / orientation of receptor	**LOW:** The farmstead / residential dwelling is orientated to the east, in the opposite direction of the proposed Aletta Wind Energy Facility application site. **Score 1**
Presence of screening factors	**LOW:** A large amount of tall trees have been established around the farmstead / residential dwelling at VR 12. In addition, the surrounding area is characterised by slight undulations in the landscape to the west of the farmstead / residential dwelling (**Figure 119**). As such, the above-mentioned screening factors are expected to obscure most views towards the proposed Aletta Wind Energy Facility development. **Score 1**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse / residential dwelling are largely natural / scenic with typical rural / pastoral infrastructure and other anthropogenic elements also present which include tall trees, farm fences, wind mills and telephone poles. In addition, mountains can be found to the south-east of the farmstead / residential dwelling and are expected to add to the scenic character of the surrounding area (**Figure 120**). **Score 2**
Visual Contrast	**MEDIUM:** The proposed wind turbines would contrast with the dominant natural / scenic character of the landscape. There are no tall linear elements in view from the farmhouse, except for telephone poles, and as such the tall wind turbines would contrast moderately with the elements in the surrounding landscape. **Score 2**
OVERALL IMPACT RATING	**LOW** **Total score 8**

Figure 119: View of the undulating terrain to the west of the farmstead / residential dwelling at VR 12. These undulations in the landscape are expected to screen the farmstead / residential dwelling from the proposed Aletta Wind Energy Facility.

Figure 120: View of the localised mountains located to the south-east of the farmstead / residential dwelling at VR 12. These mountains are expected to add to the scenic character of the surrounding area.

Figure 121: View of the farmstead / residential dwelling at VR 12 as well as the typical view towards the proposed Aletta Wind Energy Facility application site from VR 12.

Table 56: Visual impact of the proposed wind energy facility at VR 14

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**MEDIUM:** The farmstead is located within the proposed Aletta Wind Energy Facility application site. However, it is located approximately 2.9km from the proposed development area. **Score 2**
Primary focus / orientation of receptor	**HIGH:** The farmstead is orientated to the east, directly towards the proposed Aletta Wind Energy Facility development area. **Score 3**
Presence of screening factors	**HIGH:** This farmstead / residential dwelling has almost no large trees and other vegetation to provide screening. In addition, the surrounding landscape is largely flat. The generally flat landscape and lack of vegetative screening factors will therefore result in the proposed Aletta Wind energy Facility being highly visible. **Score 3**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from this farmhouse are largely natural /scenic with some typical rural / pastoral infrastructure present. Other typical anthropogenic elements which are present near the farmhouse include wire farm fences, a man made dam and a wind mill. **Score 2**
Visual Contrast	**HIGH:** Due to the largely natural / scenic character of the surrounding environment and lack of vertical elements within the surrounding area, the wind turbines are expected to have a high contrast with the surrounding environment. **Score 3**
OVERALL IMPACT RATING	**HIGH** **Total score 13**

As previously mentioned, VR 14 is currently uninhabited and no one lives in this farmstead. During the site visit, it was discovered that VR 14 belongs to the occupant of VR 15 and that this dwelling is sometimes used as accommodation for individuals that have to undertake specific tasks (such as erecting fences) on the farm. The occupant of VR 15 has however indicated that this dwelling might be used as a home for a family member in the future and should therefore still be regarded as a potentially sensitive visual receptor. As such, VR 14 has been regarded as a potentially sensitive visual receptor for the purpose of this EIA phase study. VR 14 is however located within the proposed Aletta Wind Energy Facility application site. It is assumed that the owner of this dwelling would have a vested interest in the development and would therefore not perceive the proposed wind energy facility in a negative light.

Figure 122: View of the farmstead at VR 14 as well as the typical view towards the proposed Aletta Wind Energy Facility Development area from VR 14.

Table 57: Visual impact of the proposed wind energy facility at VR 15

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The farmstead / residential dwelling is located within the proposed Aletta Wind Energy Facility development area. **Score 3**
Primary focus / orientation of receptor	**HIGH:** The farmstead / residential dwelling is orientated to the north-west, directly towards the proposed Aletta Wind Energy Facility development area. **Score 3**
Presence of screening factors	**HIGH:** The presence of relatively large trees and other surrounding vegetation is not expected to obscure views towards the proposed Aletta Wind Energy Facility development. In addition, the surrounding landscape is largely flat and this farmstead / residential dwelling is located within the proposed development area. As such, the proposed development is expected to be highly visible. **Score 3**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from this farmhouse are largely natural /scenic with some typical rural / pastoral infrastructure present. Other typical anthropogenic elements present near the farmhouse include wire farm fences, tall trees, telephone poles and other farm buildings. **Score 2**
Visual Contrast	**HIGH:** Due to the largely natural / scenic character of the surrounding environment and presence of only a few vertical elements within the surrounding area, the wind turbines are expected to contrast significantly with the surrounding environment. **Score 3**
OVERALL IMPACT RATING	**HIGH** **Total score 14**

As previously mentioned, VR 15 is located within the proposed Aletta Wind Energy Facility development area. During the EIA phase fieldwork it was verified that the owner of VR 15 supports the proposed *development. In addition, the occupant of this dwelling has a vested interest in the development and would therefore not perceive the proposed Aletta Wind Energy Facility in a negative light. Although the development is rated as having a high visual impact from this receptor location, the visual impact experienced by the occupant is likely to be less significant.*


Figure 123: View of the farmstead / residential dwelling at VR 15 as well as the typical view towards the proposed Aletta Wind Energy Facility development area from VR 15.

Table 58: Visual impact of the proposed wind energy facility at VR 16

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The farmstead / residential dwelling is located within the proposed Aletta Wind Energy Facility development area. **Score 3**
Primary focus / orientation of receptor	**HIGH:** The farmstead / residential dwelling is orientated to the east, directly towards the proposed Aletta Wind Energy Facility development area. **Score 3**
Presence of screening factors	**HIGH:** There are almost no vegetative screening factors surrounding this farmstead / residential dwelling apart from very few relatively tall trees. The surrounding landscape is also largely flat and offers limited screening. In addition, this farmstead / residential dwelling is located within the proposed wind energy facility development area. As such, the proposed Aletta Wind Energy Facility is expected to be highly visible. **Score 3**
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from this farmhouse are largely natural /scenic with some typical rural / pastoral infrastructure present. Other typical anthropogenic elements present near the farmhouse include wire farm fences, a few relatively tall trees, telephone poles other farm buildings. **Score 2**
Visual Contrast	**HIGH:** Due to the largely natural / scenic character of the surrounding environment and presence of only a few vertical elements within the surrounding area, the wind turbines are expected to contrast significantly with the surrounding environment.

	Score 3
OVERALL IMPACT RATING	HIGH Total score 14

As previously mentioned, VR 16 is currently uninhabited and no one lives in this dwelling. During the site visit, it was however discovered that VR 16 is currently being used as a holiday home by a family member of the occupant of VR 15. However, the occupant of VR 15 indicated that this family member has inherited this dwelling from their father and might choose to occupy it permanently in the future. VR 16 is however, located within the proposed Aletta Wind Energy Facility development area. It is assumed that the occupant of this dwelling would have a vested interest in the development and would therefore not perceive the proposed Aletta Wind Energy Facility in a negative light. Although the development is rated as having a high visual impact from this receptor location, the visual impact experienced by the occupant is likely to be less significant.

Figure 124: View of the farmstead / residential dwelling at VR 16 as well as the typical view towards the proposed Aletta Wind Energy Facility development area from VR 16.

A summary of the above impact ratings is provided in **Table 59** below.

Table 59: Visual Impact of the proposed 140MW Aletta Wind Energy Facility on the visually sensitive and potentially sensitive visual receptor locations identified within the study area- Summary and Results

RECEPTOR LOCATION	IMPACT RATING					
	Distance	Orientation	Screening	Character / Sensitivity	Contrast	OVERALL IMPACT RATING
VR 1	Medium	Medium	Medium	Medium	High	MEDIUM Score 11
VR 2	Low	Medium	Low	Medium	Medium	LOW Score 8
VR 4	Low	High	Medium	Medium	Medium	MEDIUM Score 10
VR 5	Medium	Low	Medium	Medium	High	MEDIUM Score 10
VR 8	N/A		Negligible	N/A		NEGLIGIBLE
VR 9	Medium	Low	Low	Medium	Medium	LOW Score 8

VR 11	Low	Low	Medium	Medium	Medium	**LOW Score 8**
VR 12	Medium	Low	Low	Medium	Medium	**LOW Score 8**
VR 14	Medium	High	High	Medium	High	**HIGH Score 13**
VR 15	High	High	Medium	Medium	High	**HIGH Score 14**
VR 16	High	High	High	Medium	High	**HIGH Score 14**

8.7.3.2 Visual Modelling

In order to provide an indication of what the proposed wind energy facility would look like from some of the potentially sensitive receptor locations currently in use, visual models were created to strengthen the findings of the receptor impact ratings. An indicative range of locations were selected for modelling purposes to provide an indication of the possible impacts from different locations within the study area. The models illustrate how views from the each vantage point will be transformed by the proposed development if the wind turbines are erected on the site as proposed.

As mentioned above, the following assumptions and limitations are of relevance for the visual models:

- The visual models represent a visual environment that assumes all vegetative clearing will be restored to its current state after the construction phase. This is however, is an improbable scenario as some trees and shrubs may be removed which may reduce the accuracy of the models generated.

- At the time of this study the proposed project was still in its early planning stages. Therefore, the layout plans of the turbines, as provided by BioTherm may change and all infrastructure associated with the facility has been excluded from the models.

8.7.3.2.1 Vantage Point 1 – View toward the proposed Aletta Wind Energy Facility development area from the Nelspoortjie Karoo Guest Farm (VR 2)

Figure 125: Existing view toward the proposed Aletta Wind Energy Facility development area from the Nelspoortjie Karoo Guest Farm (VR 2)

Figure 126: Visually modelled post-construction view toward the proposed Aletta Wind Energy Facility development area from the Nelspoortjie Karoo Guest Farm

As indicated in **Figure 126** above, vegetative screening factors surrounding this guesthouse are expected to obscure most views toward the proposed development, however some wind turbines are still expected to be visible. The visible wind turbines would contrast moderately with the dominant natural landscape elements as there are no tall linear elements in view from the guesthouse except for telephone and fence poles.

8.7.3.2.2 Vantage Point 2 – View toward the proposed Aletta Wind Energy Facility development area from the Boesmansberg Guest Farm (VR 1)

Figure 127: Existing view toward the proposed Aletta Wind Energy Facility development area from the Boesmansberg Guest Farm (VR 1)

Figure 128: Visually modelled post-construction view toward the proposed Aletta Wind Energy Facility development area from the Boesmansberg Guest Farm (VR 1)

As indicated in **Figure 128** above, the localised hill / koppie found to the east of this guesthouse is expected to provide some form of screening from the proposed wind energy facility development. The visible wind turbines would contrast highly with the dominant natural landscape elements as there are no tall linear elements in view from the guesthouse.

8.7.3.2.3 Vantage Point 3 – View toward the proposed Aletta Wind Energy Facility development area from the farmstead / residential dwelling at VR 14

As indicated in **Figure 130** to **Figure 134** below, very few screening factors are present in the surrounding area. In addition, the surrounding landscape is largely flat and offers very little screening. It must also be noted that this farmstead / residential dwelling is located within the proposed Aletta Wind Energy Facility application site and will therefore be located within close proximity to the wind turbines. The visible wind turbines would contrast highly with the dominant natural landscape elements as there are no tall linear elements in view from the farmhouse except for a wind mill and fence poles.

Figure 129: Existing view to the east (E) from the farmstead at VR 14, toward the proposed Aletta Wind Energy Facility development area

Figure 130: Visually modelled post-construction view to the east (E) from the farmstead at VR 14, toward the proposed Aletta Wind Energy Facility development area

Figure 131: Existing view to the north-east (NE) from the farmstead at VR 14, toward the proposed Aletta Wind Energy Facility development area

Figure 132: Visually modelled post-construction view to the north-east (NE) from the farmstead at VR 14, toward the proposed Aletta Wind Energy Facility development area

Figure 133: Existing view to the north north-east (NNE) from the farmstead at VR 14, toward the proposed Aletta Wind Energy Facility development area

Figure 134: Visually modelled post-construction view to the north north-east (NNE) from the farmstead at VR 14, toward the proposed Aletta Wind Energy Facility development area.

8.7.3.3 Night-time Impacts

The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely have a significant impact on the nightscape. In contrast, introducing light sources into a relatively dark night sky will impact on the visual quality of the area at night. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed wind energy facility at night.

The area surrounding the proposed development site is largely uninhabited and as a result, very few light sources are present. The town of Prieska is too far away to have an impact on the night scene. The town of Copperton is expected to have a limited impact on the night scene, as it is very small and is located more than 5km away. At night, the study area is characterised by a picturesque dark starry sky and the visual character of the night environment is considered to be mostly ‘unpolluted’ and pristine. The most prominent light sources within the study area at night include isolated lighting from the surrounding farmsteads, as well as transient light from the passing cars travelling along the R357 and R386 roads.

Operational and security lighting at night will be required for the proposed wind energy facility. In addition, a permanent aviation light or red aircraft warning light will be placed on the top of each wind turbine, which will create a network of red lights in the dark night-time sky. The type and intensity of lighting required was unknown at the time of writing this report and therefore the potential impact of the development at night has been discussed based on the general effect that additional light sources will have on the ambiance of the nightscape.

Although the area is not generally renowned as a tourist destination, the natural dark character of the nightscape will be sensitive to the impact of additional lighting at night. The operational and security lighting required for the proposed wind energy facility development is likely to intrude on the nightscape and create glare, which will contrast with the extremely dark backdrop of the surrounding area. In addition, the red warning lights may be particularly noticeable as their colour will differ from the few lights typically found within the environment and the flashing will draw attention to them. These lights will however have a low intensity and will create less contrast than white lights typically would (Vissering, 2011).

8.7.3.4 Visual Impacts of Associated Infrastructure

- **Access Roads**

As previously mentioned, the R357 road traverses the proposed wind energy facility application site and provides access to the site. This road is a single carriage way tar road and is in relatively good condition. This road is primarily used by local farmers to gain access to surrounding farms / properties as well as when travelling to and from the town of Prieska to the north-east. It must however be noted that a section of the R357 to the south-west of the application site becomes a gravel road and provides access to the existing Kronos Substation. In addition, the R386 gravel road can also be found to the east of the proposed wind energy facility application site. Similarly to the R357, this gravel road is also primarily used by local farmers to gain access to surrounding farms / properties as well as when travelling to and from the town of Prieska to the north-east. These roads are therefore not regarded as visually sensitive as they do not form part of any scenic tourist routes, and are not specifically valued or utilised for their scenic or tourism potential. It should be noted that existing high voltage power lines traverse certain sections of the R357 and R386 roads.

It is assumed that a network of gravel access roads will most likely be constructed to provide access to the wind turbines. These will most likely be positioned to follow the existing internal roads as far as possible. Where this is not possible or where no existing roads are available, new access roads will probably be constructed.

Roads are typically only associated with a visual impact if they traverse sloping ground on an aspect that is visible to the surrounding area. Considering that the access roads may be located on some undulating and hilly terrain within the application site, it is likely that the visual impact associated with constructing and upgrading these roads could impact on the surrounding area. As such, it is highly recommended that where possible, all roads should avoid steeper slopes in order to preserve the natural visual integrity of the landscape. In addition, if these roads are not maintained correctly during the construction phase, construction vehicles travelling along the gravel access roads could expose surrounding farmstead to dust plumes.

- **Underground cabling**

As with the internal gravel access roads, the underground cabling (if required) will most likely be positioned to follow the existing internal access roads. The visual impact of this cabling would be very similar to roads in that the 'scar' associated with the cable could create a visual contrast with the largely natural vegetation on the site. As with the access roads, it is recommended that where possible, all cables should avoid steeper slopes in order to preserve the natural visual integrity of the landscape. It is further recommended that all reinstated cable trenches should be re-vegetated with the same vegetation that existing prior to the cable being laid, in order to reduce the potential for creating unnatural linear features in the environment.

- **Power lines**

As previously mentioned, the wind turbines will be connected to the proposed Aletta IPP Substation using buried medium voltage cables. However, overhead power lines may also be used where a technical assessment of the proposed design suggests that they will be more appropriate, such as over rivers and gullies. As previously mentioned, power lines consist of a series of tall towers which make them highly visible. Power lines are not features of the natural environment, but are representative of anthropogenic transformation. Thus when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. Conversely, the presence of other anthropogenic elements associated with the built environment, especially other power lines, may result in the visual environment being considered to be 'degraded' and thus the introduction of a new power line into this setting may be less of a visual impact than if there was no existing built infrastructure visible. It is important to note that several high voltage power lines are located within close proximity to the proposed wind energy facility application site and are expected to lessen the visual contrast associated with the introduction of a new power line (**Figure 135**).

Figure 135: View of the existing high voltage power lines that can be found within close proximity to the proposed Aletta Wind Energy Facility application site

Power lines are anthropogenic elements that are typically found in the landscape, both in urban or industrial and in more natural rural settings. The visual impact of a power line would largely be related to the physical characteristics of the area, land use and the spatial distribution of potential receptors. These factors are also important factors used to determine whether a power line would be congruent within an environment as the degree of visual contrast is generally based on the land use, settlement density, visual character and presence of existing power lines. When combining this with the distribution and likely value judgements of visual receptors, the visual impact of the proposed power line can be determined. In areas, where the power line would contrast with the surrounding area it may change the visual character of the landscape and be perceived negatively by visual receptors.

As mentioned above, the presence of other linear structures such as roads, railways and especially other power lines would influence the perception of whether a power line is a visual impact. Where existing power lines are present the visual environment would already be visually 'degraded' and thus the introduction of a new power line in this setting may be considered to be less of a visual impact than if no existing built infrastructure were visible.

- **Substation**

An on-site substation (extent unknown at this stage) will most likely be constructed to supply the generated electricity to the national grid. In isolation, the on-site substation may be considered to be visually intrusive; however, it must be assumed that if the substation would be built to serve the needs of the power generated from the wind energy facility. Thus the on-site substation would only be constructed if the wind energy facility was developed as well. The substation would likely form part of the wind energy facility complex, as viewed from the surrounding farmsteads. Views of the substation would therefore be dwarfed by the large number of turbines that would be visible. As such, the substation is not expected to be associated with a significant visual impact, or even a measurable cumulative impact.

8.8 Heritage and Palaeontology

The full Heritage Assessment was conducted by Wouter Fourie from PGS, with Palaeontological input from Gideon Groenewald, and is included in **Appendix 6H**.

8.8.1 Field Work Findings

8.8.1.1 Methodology

A survey of the study area was conducted from 1 - 6 August 2016. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, two archaeologists and two field assistants of PGS conducted a vehicle and foot-survey that covered the study area. The fieldwork was logged with a GPS to provide a background of the areas covered (**Figure 137**).

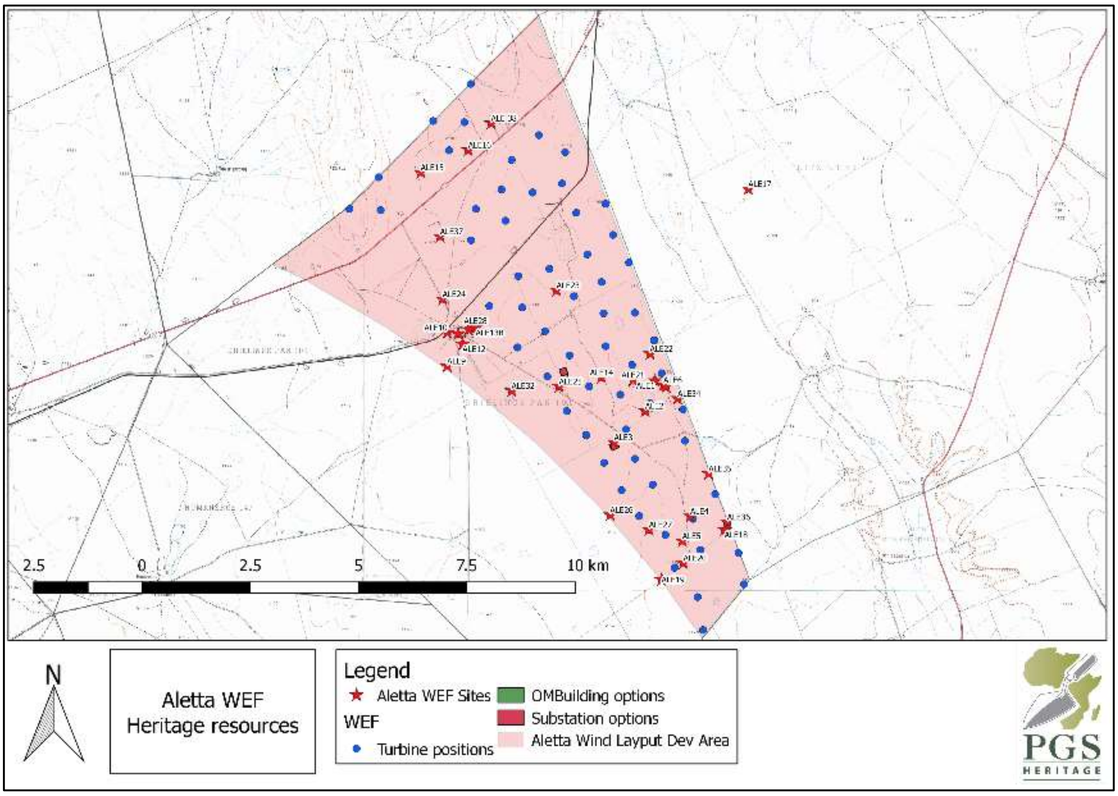


Figure 136: Position of Heritage resources within the Aletta WEF

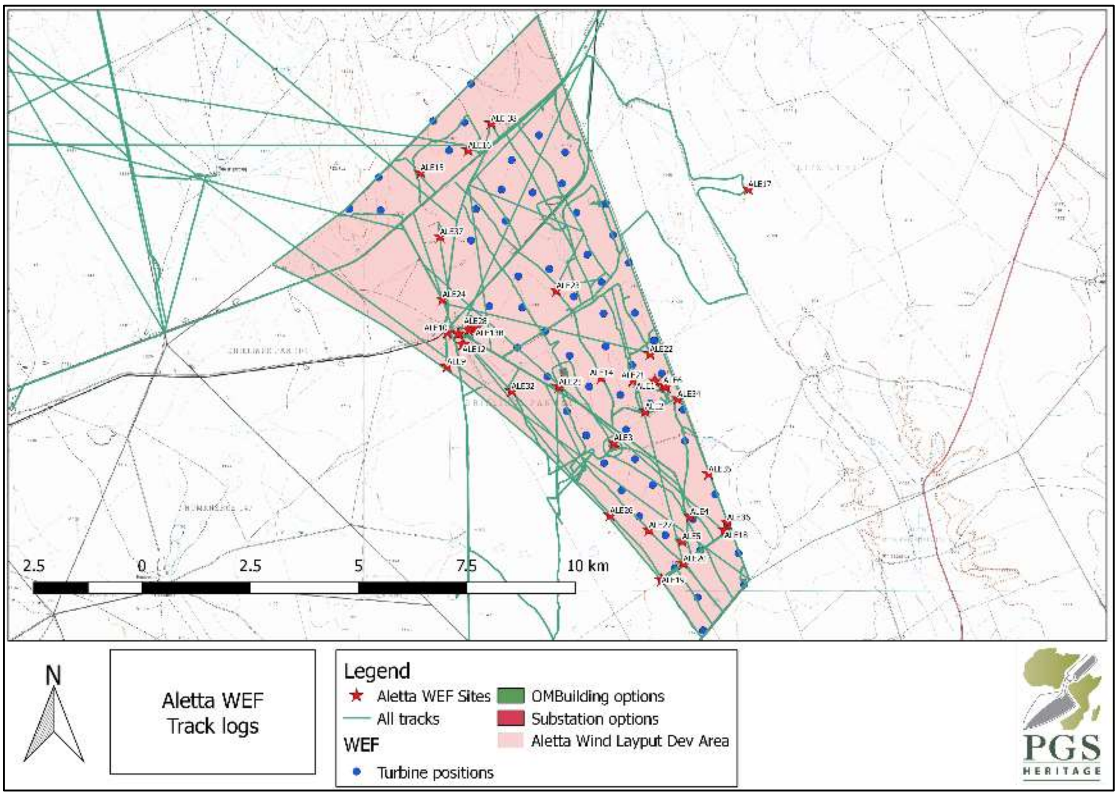


Figure 137: Track logs showing analysis of farm Drielings Pan

The fieldwork identified 32 heritage finds that were then classified either as find spots or sites. This information was then provided to the developer to take into account during the development of the layout alternatives. The following sections list and describe the finds and sites.

The fieldwork completed for the HIA component in August 2016, has confirmed the presence of 3 archaeological find spots, 3 gravesites, 21 archaeological sites/resources and 5 historical sites. The archaeological sites are associated with the Earlier Stone Age (ESA) Middle (MSA) and Later Stone Age (LSA) and are representative of archaeological sites with a medium to high significance.

8.8.1.2 Find Spots

The find spots (**Table 60**) identified during the fieldwork were found to correlate with ridges and drainage lines as predicted in the Scoping Phase of this study. This observation also correlates with the findings of the studies done by Webley (2012) and Orton (2014). The finds spots mostly consist of single or low density finds of Middle Stone Age (MSA) or Later Stone Age (LSA) lithics. The material was predominantly crypto-crystalline silica (CCS) and tigers eye with a very low concentration of hornfels material utilised.

Table 60: Find spots

Site Number	Lat	Lon	Description	Sensitivity	Heritage Rating
ALE 19	-29.998137°	22.570920°	Low density MSA scatter	Low	4C

ALE 20	-29.994649°	22.576126°	Low density LSA scatter	Low	4C
ALE 21	-29.956645°	22.564079°	Low density LSA and MSA scatter	Low	4C

8.8.1.3 Sites

- **Archaeological**

The archaeological sites (**Table 61**) identified were mostly associated with the MSA and LSA with some ESA artefacts. The sites are predominantly situated below rocky ridges or low rises and on flat planes. A large proportion of the sites consist of unweathered LSA material manufactured from CCS and tigers eye.

Site **ALE 6 and ALE 7** present stone walls and a historic water source which should be observed in more detail. **ALE 22** is a particularly significant site as it contained numerous artefacts, ostrich egg shell and pottery.

Due to their research value, sites the above mentioned sites as well as many of the others, which are described below, are given a Medium or High archaeological significance.

Table 61: Archaeological Resources

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 1	-29.956808°	22.569291°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated all along the valley floor in between two elongated rocky ridges. The artefacts occurred mostly within the sandy valley floor and fewer artefacts were found along the rocky ridges. The artefacts are mainly stone tools from the LSA and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz, hornfels and CCS. The artefacts were found scattered over an area which measured approximately 100m x 300m in size	Medium	4B
 **Figure 138: Medium density scatter at ALE1**				 **Figure 139: View of the landscape at ALE1**		
ALE 2	-29.963080°	22.567003°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated within a clearing at the foot of a rocky ridge. The artefacts vary between stone tools from the MSA and the LSA and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, hornfels and CCS. The artefacts were found scattered over an area, which measured approximately 40m in diameter.	Low	4C
 **Figure 140: Low density scatter at site ALE 2**				 **Figure 141: View of the landscape at ALE 2**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 3	-29.969593°	22.559574°	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated within one of the proposed transfer stations on one of the proposed power line routes. The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts vary between stone tools from the Middle Stone Age (MSA) and the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, hornfels and CCS. The artefacts were found scattered over an area which measured approximately 80m in diameter	Low	4C
 **Figure 142: Low density scatter at site ALE 3**				 **Figure 143: View of the landscape at ALE 3**		
ALE 4	-29.984924°	22.577786°	Site/Resource	Another low density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated at the foot of a rocky outcrop and extends onto the outcrop The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers and blades. A relative high number of cores were also identified. and a few hand axes. The artefacts are mainly made of weathered quartzite, gneiss and quartz. The artefacts were found scattered over an area, which measured approximately 60m in diameter.	Low	4C
 **Figure 144: Low density scatter at ALE4**				 **Figure 145:view of landscape at ALE4**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 5	-29.990058°	22.575886°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated along the edges of a small pan. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, hornfels, haematite and quartz. The artefacts were found scattered in concentrations all along the edges of the pan.	Low	4C

Figure 146: Medium density scatter at ALE5

Figure 147: View of landscape at ALE5

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 6	-29.957699°	22.571379°	Site/Resource	This site was shown by the farm manager, Mr. Jan Opperman, who called it "Boesman Putte" or wells. An area was cleared from rocks and soil was removed to expose a small spring. The cleared area measures approximately 5m in diameter and is situated half way up the slope of the hill and within a dry watercourse. A circular structure was also identified approximately 20m further down the watercourse. A low circular stonewall was built and it captured more of the water that was exposed further up the watercourse. This circular structure measures approximately 10m in diameter. The exact function of this structure is not known as yet This site should be protected not only for its historical value but more importantly because it is a water source in an arid landscape.	High	3A

Figure 148: Boesman wells ALE6

Figure 149 ; Circular structure at ALE6

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 7	-29.958016°	22.571968°	Site/Resource	A small stone packed kraal was identified at this location. The kraal was also shown by the farm manager, Mr. Jan Opperman. The kraal is situated at the foot of a rocky ridge right and at the end of the watercourse identified at Site **ALE 6**. The kraal measures approximately 3m x 3m and the walls, although mostly collapsed, measure approximately a half meter high. A collection of stone tools was also identified around the kraal. The scatter of stone tools extended up the slope of the ridge where the water well was identified. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz, hornfels and CCS. Glass fragments, porcelain fragments and several pieces of metal were identified in close proximity of the small kraal. These artefacts belong to the historic period and are most likely associated with the kraal when it was in use.	Low	4B

Figure 150: Stone packed kraal ALE7

Figure 151: Historical remains at ALE7

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 14	-29.956110°	22.556529°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated in a clearing and the artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 60m in diameter.	Medium	4B

Figure 152: Medium to low density scatter at ALE14

Figure 153: View of landscape at ALE14

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 15	-29.913538°	22.513270°	Site/Resource	This calcrete hollow was presented to us by the farm manager. He presented a story, which his father had relayed, to him regarding the discovery of this site. He explained that during a Jackal hunt, the jackal disappeared into the hollow, as the horses, which the hunters were riding, approached the site. They noticed a hollow sound beneath them and retreated some distance. The men returned on foot to access th hollow. They apparently came across many bones of all sizes. None of the bones remain at easy view at present. It is possible it is only scavenging remains, however closer analysis could reveal fossilized remains. As such the site is classed as medium significance.	Medium	4A
 Figure 154: Calcrete hallow ALE15						
ALE 18	-29.987774°	22.585998	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated on an open plain and the artefacts were identified amongst the exposed calcrete and quartzite gravels. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 50m in diameter.	Low	4C
 Figure 155: Low density scatter at ALE18				 Figure 156: View of landscape at ALE18		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 22	-29.951180°	22.568152°	Archaeological site	The farm manager, Mr. Jan Opperman, related a story from years ago when he found some ostrich eggs buried in the sand. He collected the eggs and took them home. He showed the place where he collected the eggs. Several other ostrich egg shell fragments were identified at this location. One ceramic potsherd was also identified amongst the collection of ostrich eggshell fragments. A medium/low density scatter of stone tools was also identified at this location (± 5-10 artefacts in 10m x10m). The site is situated within the valley floor in between the upper reaches of two parallel rocky ridges. a clearing at the foot of a rocky ridge. The artefacts are mainly part of the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, hornfels and CCS. The artefacts were found scattered over an area, which measured approximately 60m in diameter. A single potsherd was also located on this site. It is evident much activity took place on this ridge and therefor the site is rated as medium to high. The research value of this site is high.	Medium to high	3B

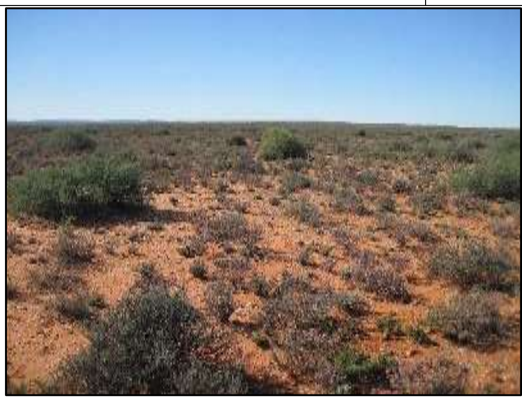
Figure 157: Archaeological site

Figure 158: View of landscape from ALE22

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 23	-29.938038°	22.545774°	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated along the edges of a small pan. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, and quartz. The artefacts were found scattered in small concentrations all along the edges of the pan. The site is given a Grade 3A heritage rating and a medium heritage significance.	Medium	4A

Figure 159: Low density scatter at ALE23

Figure 160: Pan at ALE23

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 25	-29.958014°	22.546378°	Site/Resource	A low density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, and quartz. The artefacts were found scattered over an area, which measured approximately 50m in diameter.	Low	4C
 Figure 161: Low density scatter at ALE 25				 Figure 162: View of the landscape from site ALE 25		
ALE 26	-29.958014°	22.546378°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 80m in diameter.	Medium	4A
 Figure 163: Medium density scatter at ALE26				 Figure 164: View of landscape at ALE 26		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 27	-29.987734°	22.567900°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 50m in diameter.	Medium	4B

Figure 165: Medium to low density scatter at ALE27

Figure 166: View of landscape from ALE27

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 28	-29.945407°	22.526367°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated along the edges of two large pans to the east of the farmstead. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. One fragmented upper grinding stone was also identified. The artefacts are mainly made of weathered quartzite, gneiss, quartz and CCS. The artefacts were found scattered in small concentrations all along the edges of the two pans.	Medium	4B

Figure 167: Medium density scatter at ALE28

Figure 168: Pans at ALE28

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 33	-29.958890°	22.535017°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated at the foot of a rocky ridge and has with red sandy soils. The majority of artefacts were identified at the foot of the ridge and not on the slopes of the ridge. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz, hornfels and CCS. The artefacts were found scattered over an area which measured approximately 60m x 60m along the foot of the rocky ridge	Medium	4B

Figure 169: Medium density scatter at ALE33

Figure 170: View of landscape at ALE33

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 34	-29.960508°	22.574759°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated at the foot of a rocky ridge. The artefacts were identified amongst the rocks at the foot of the ridge. The artefacts vary between stone tools from the Middle Stone Age (MSA) and the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss and some CCS. The artefacts were found scattered over an area, which measured approximately 80m x 40m along the ridge.	Low	4C

Figure 171: Medium to low density scatter at ALE34

Figure 172: View of the landscape at ALE34

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 36	-29.986138°	22.586636°	Site/resource	Another medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 60m in diameter..	Low	4C


Figure 173: Medium to low density scatter at ALE36


Figure 174: View of the landscape at ALE36

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 37	-29.926841°	22.517901°	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area which measured approximately 40m in diameter	Low	4C


Figure 175: Low density scatter at ALE 37


Figure 176: View of landscape from ALE37

- **Historical**

Four historical sites were located on the farm. A fifth site (**ALE17**), which has been noted, is located on the neighbouring farm, however **ALE 17** is an historical site that aids in placing the historical elements and past activities of the area as a whole

Table 62: Historical Sites

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE10	-29.946814°	22.519580°	Historical Site	A stone built kraal was identified at this location. The kraal measures approximately 30m x 20m in size and is divided in three similar sized sections. The walls of the kraal measures approximately 1.4m in height and the bottom half of the walls were built with rocks and mortar. The top half of the walls were built with compressed dung bricks. These bricks were cut and collected from the dung deposits within the kraal. The dung bricks were plastered over to protect them from the elements. A more recent building was placed in the middle section of the kraal. This building still serves as storeroom.	Medium	4A

Figure 177: Kraal at ALE10

Figure 178: Exposed compressed dung bricks

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE11	-29.947082°	22.522212°	Historical site	A farmstead with its associated buildings and infrastructure was identified at this location. The farmstead and its associated buildings and structures cover an area of approximately 400m x 500m in size. It consists of the main farmhouse and adjacent storerooms, another house for other family members, more storerooms and sheds, two sets of farm labourer homesteads and various kraals and other versatile structures. According to the farm owner, Mrs. Aletta de Jager, her grandparents, Mr. Cornelius Frans Vermeulen and his wife, bought the farm in 1893 and built the original farm house in 1905. The other buildings and alterations developed over the years after their occupation of the farm	High	3A

Figure 179: Family farm house near the main house (unused)

Figure 180: Main farm house

Figure 181: Associated structures

Figure 182: Associated structures

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE13 and ALE13B	-29.946219° -29.945847°	22.524762° 22.526425°	Historical site	Two water reservoirs/towers were identified to the east of the farmstead. The water reservoirs/towers were connected to boreholes and served the farmstead and its associated structures with water. The two water reservoirs/towers are similar in size, shape and construction. The reservoirs/towers are circular in shape and measures approximately 6m high and approximately 2m in diameter. They are brick and cement built and pipes were connected to them. They were also plastered and painted white	Medium	4B
 **Figure 183: Reservoir at ALE13**				 **Figure 184: Reservoir at ALE13B**		
ALE17	-29.916970°	22.591681°	Historical site	This site does not occur in the study area. However, its existence exhibits the extend of occupation in the area as a whole. The site occurred 3 km to the east of the present study area along a ridge. It is about 100m x 100m and includes stone walled structured, upper grinding stones and an assortment of historical debris. This site has a high research element and should be noted as being affected cumulatively by future projects in the area	Low (as not within the area)	3B
 **Figure 185: Historical debris**				 **Figure 186: Packed stone wall structure**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
 **Figure 187: Upper grinding stones**				 **Figure 188: Rectangular stone structure**		
ALE38	°-29.903310°	°22.530113	Site	The foundations and remains of three similar structures/buildings were identified at this location. The foundations/platforms of these buildings remained, but the rest of these structures were removed. They measure approximately 5m across and 20m in length. It seemed to be the foundations of three storerooms or classrooms. It could possibly also be the working space for the shearing of sheep as one of these structures has a kraal-kind of set-up placed on it. These structures/platforms don't look all that old and its origin might be from within the last sixty years	Low	4C
 **Figure 189: Foundations**				 **Figure 190: foundations converted into pens**		

- **Graves**

Table 63: Grave sites

<table>
<tr><th>Site Number</th><th>Lat</th><th>Lon</th><th>Type Find</th><th>Description</th><th>Significance</th><th>Heritage Rating</th></tr>
<tr><td>ALE9</td><td>-29.953765°</td><td>22.519571°</td><td>Cemetery</td><td>A cluster of fourteen graves was identified at this location. The graves are situated along and on the western side of one of the farm fences. Twelve of the graves were placed in a line next to each other. The two other graves were placed in a second line right next to two graves from the first line. All the graves are orientated from east to west.

The graves have oval shaped stone packed mounds as dressings. Most of the graves have upright rocks placed at the western and eastern ends</td><td>High</td><td>4A</td></tr>
<tr><td colspan="4">
Figure 191: View of 14 stone packed graves</td><td colspan="3">
Figure 192: Close up showing headstones</td></tr>
<tr><td>ALE12</td><td>-29.949224°</td><td>22.523287°</td><td>Cemetery</td><td>A small family cemetery was identified at this location. The cemetery is situated to the southwest of the farmstead. It is fenced and eight graves were placed in the cemetery. The graves belong to the Vermeulen and the De Jager families. The graves were placed in two lines next to each other and all are orientated from west to east. All of the graves have formal grave dressings and headstones except for the grave of Mr. Kerneels de Jager who passed away about seven months ago.</td><td>High</td><td>4A</td></tr>
</table>

 Figure 193: Vermeulen and De Jager family cemetery				 Figure 194: Vermeulen grave		
ALE24	-29.939855°	22.518489°	Cemetery	According to the farm owner, Mrs. Aletta de Jager, some graves, which belong to victims of the “groot griep”, were in the way of the railway line, which crossed the Farm. These graves were relocated for the railway line to be developed. The relocated graves were identified at this location as indicated by Mrs. De Jager. The grave/graves was/were situated next to the access road to the farm an approximately 150m to the north of the disused and decommissioned railway line. A large oval shaped stone packed dressing or outlined was identified. The remains of the exhumed graves were most probably interred in a single mass grave. No other indications, such as headstones or inscription were identified. The interred graves are unknown and the process of their relocation is very vague at this stage.	High	4A
 Figure 195: Relocated graves of "Groot griep" victims				 Figure 196: Relocated graves		

8.8.2 Palaeontological Sensitivity

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged (**Figure 197**). The different sensitivity classes used are explained in the Palaeontology Desktop Assessment.

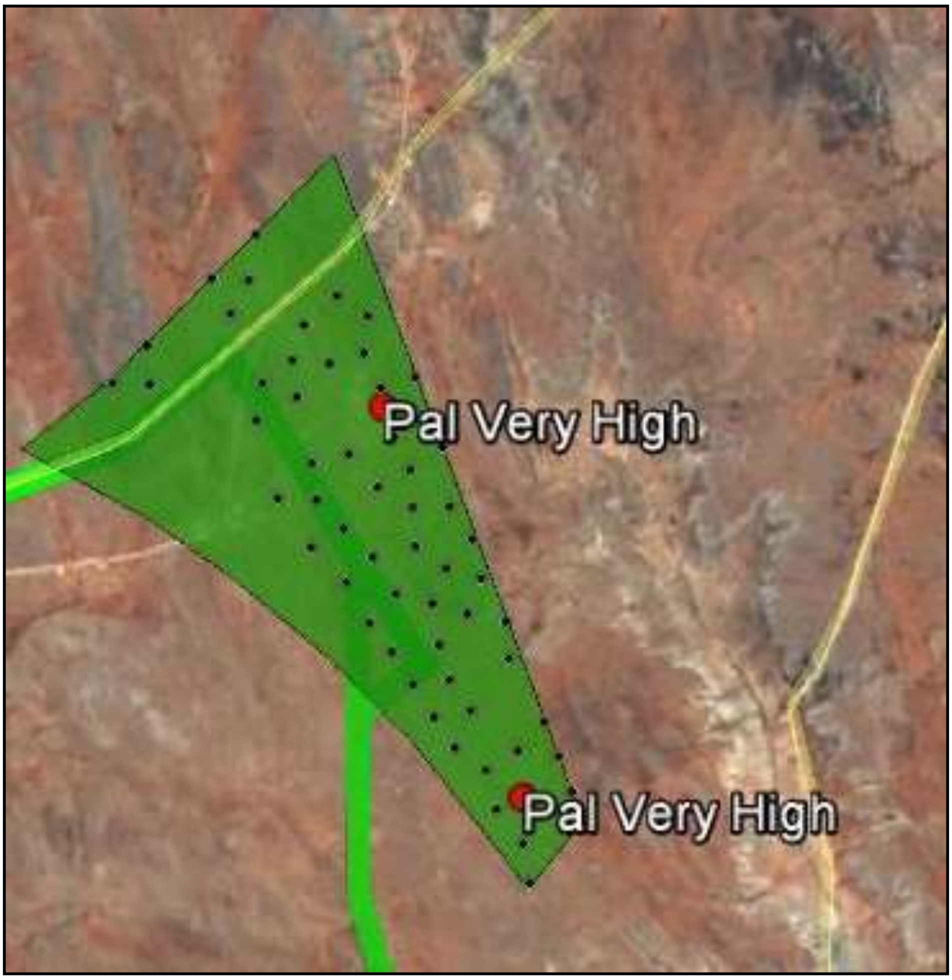


Figure 197: Palaeontological Sensitivity of the entire Study Area is presented. A moderate sensitivity is allocated to all the geological formations except the two spring sites (Groenewald, 2016)

The Mokolian aged Uitdraai Formation, Carboniferous to Permian aged Dwyka Group and Quaternary aged Gordonia Formation underlying all the alternative layouts for the Aletta as well as the Eureka WEF areas and the power line corridors are similarly rated for Palaeontological Impact.

Exceptions are the two historic spring sites that are rated Very Highly sensitive for Palaeontological Heritage.

The allocation of a Moderate sensitivity for Palaeontological Heritage to the entire study area except the two historic spring sites, indicate Very High point sources of Groundwater Heritage.

8.9 Socio Economic

The full Social Assessment was conducted by Elena Broughton and Memory Madondo from Urban-Econ Development Economists and is included in **Appendix 6I**.

8.9.1 Site-related information

The site-related information section will investigate the various dynamics of the proposed site to ensure that the current land use activity does not conflict with the establishment of the proposed facility. If there are any conflicts identified, then they will be investigated further in the next phase.

- **Land-use profile**

Figure 198 illustrates the proposed site (purple region) for the Aletta wind facility near Copperton. The planned wind facility is proposed to be located on Portion 1, 2, 3 and the remainder of the farm Drielingspan No. 101 situated in the Siyathemba LM. The proposed site lies on the urban edge of Copperton, approximately 7km away from the city centre and is easily accessed by the R357 main road.

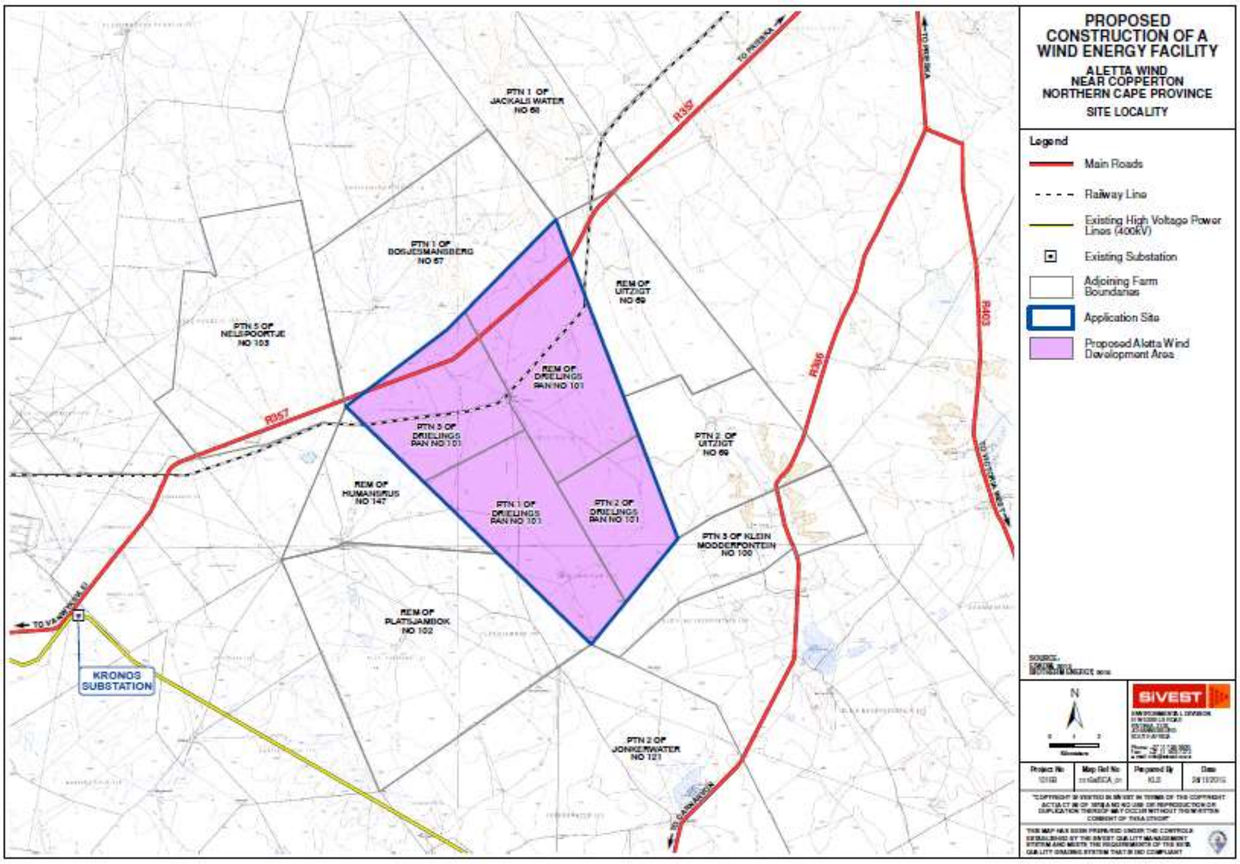


Figure 198: Aletta proposed site and land portions (SiVEST, 2016)

The area surrounding the proposed Aletta wind facility is, to a large extent, used for commercial sheep farming. In order to determine the impact that the proposed development may have on the existing land use, telephonic interviews were conducted with property owners situated in close proximity to the proposed development site. The property owners were asked a series of questions regarding basic demographics and general operational information about the respective property, the number of labourers employed on the property and economic information regarding their agricultural operations. The information obtained during these interviews is summarised in **Table 64**.

Table 64: Land uses in the zone of influence

Farm	Type of effect	Demographics	Economic activity	Concerns raised
Portion1,2,3 and Rem of Drielingspan no. 101 Remainder of Uitzigt no. 69	Directly affected (Wind facility site)	• 24 people live on the farm	• Farm size: 14 200 ha(11000+3200ha) • Commercial sheep farming • Approximately 4 000 sheep • 7 people employed (5 males and 2 females) • Labourers paid above minimum wage	• **Impact on property during construction** • **Environmental effects during construction**
Remainder of Platsjambok no. 102	Adjacent	• Two people live on the farm permanently	• Farm size: 7 000 ha • Commercial sheep farming • Approximately 500 sheep • No employees	• **Concerned about the effect the facility might have on radio frequency and cell phone reception**
Portion 5 of Nelspoortjie no. 103	**Adjacent**	• **15 people live on farm permanently**	• **Farm size: 5 500 ha** • **Commercial sheep farm and guest house** • **About 750 sheep** • **10 people employed (5 on farm and 5 at the guest house)**	• **Security concerns – specifically access control** • **Livestock theft** • **Farming activities will be disrupted during construction** • **The owner's portion has been approved for another wind farm project (Garob Wind Farm)**

- **Resources and land capability**

Generally, the area does not have any significant mineral deposits. To the south of Prieska, on the farm Doornfontein, a medium-sized mineral deposit of Phosphate can be found. Various small mineral deposits can be found near Niekerkshoop. These include Tiger's-eye and Crocidolite (i.e. asbestos). Small deposits of Alluvial Diamonds can be found in the Orange River. Other small mineral deposits within the municipal boundary include Salt, Gypsum, Iron and Uranium (Siyathemba LM, 2014).

The arid nature of the associated farm portions creates difficulties for traditional irrigation farming; as a result, commercial farming in the area is limited to sheep/goat farming. These farming types require minimal inputs with respect to water and grazing capacities. Even so, the drought experienced over the last few years has resulted in reduced livestock capacities leading to many farmers downscaling their farming activities.

- **Access to infrastructure**

Bulk infrastructure on the affected farm portions is limited. The R357 is in close proximity to the new site, but other roads will have to be created for transport into the farthest reaches of the proposed site. Electricity supply is sufficient mainly due to existing substation located in Copperton, while access to water remains limited and many farmers have resorted to bore holes for their water supply. Copperton itself does have a water supply network but it is too far away and too expensive to be considered for everyday use by the affected farm portions. There is no existing infrastructure on the proposed site for stormwater pipes, which can be attributed to the arid nature of the region and the fact that it is farmlands, which do not require diversion of heavy rainfall associated water.

The LM has not made provision for improving infrastructure in the area due to low population densities and subsequently lower service delivery priority assigned for the area. This might indicate that the responsible company may have to fund the provision of necessary infrastructure.

8.10 Traffic

The Traffic Assessment was conducted by Dirk van der Merwe of BVi Consulting Engineers and is included in **Appendix 6J**.

8.10.1 Permits & Consent Relating to Roads

The permits and consent required from authorities necessary for the transport of oversize loads are summarized in **Table 65** below. This summary is not necessarily exhaustive and further investigation will be needed by the route clearing consultant.

Table 65: Permits and consent requirements

Permit	Authorising Authority	Responsible Party
Abnormal Load/Vehicle Permit in terms of National Road Traffic Act 93 of 1996, Section 81	Western Cape Provincial Department of Roads and Transport	The Contractor will obtain the necessary road transportation permits.
The South African National Roads Agency Limited and National Roads Act, Act 7 of 1998	SANRAL Western Region	The Contractor will obtain clearance from the South African National Roads Agency.
Abnormal Load/Vehicle Permit in terms of National Road	Northern Cape Provincial Department of Roads and Transport	The Contractor will obtain the necessary road transportation permits.

Traffic Act 93 of 1996, Section 81		

8.10.2 Summary

- **Abnormal Load Route**

Both Routes 1 and 4 can be used for the transportation of the wind turbine components. However, since Route 4 is much shorter, with no gravel roads, it should be the preferred route. Further investigation i.e. route clearing may prove that minor variations are necessary.

- **Normal load route**

The delivery of materials such as cement, aggregate and sand will in all probability be from Upington along the National Route N10. Steel will be delivered from either Gauteng via the N12 or Cape Town via the N1 and N12.

It is assumed that labour will commute from Prieska as it is the nearest town to provide amenities.

8.10.3 Trip Generation

- **Current AADT on Affected Route**

It is assumed that the portion of average daily traffic that occur during the design hour (30th highest volume) is no more than 10% (K=10). TRH17: Geometric Design of Rural Roads provides service volumes for LOS B to be retained, which translates to 4900vpd as an estimated maximum average annual daily traffic (AADT7) for two lane rural highways. A number of dual carriageway sections are located on both Route 1 and Route 4, mainly near the ports of origin, being Saldanha or Coega. For equivalent levels of service to be retained on these dual carriageway sections an upper limit of 23300vpd is estimated.

The roadways affected by the component delivery are:

Table 66: Current ADT of Route 1

Station	ADT (vpd)	% Heavy
R27 near Saldanha	4365	8%
N7 south of Vanrhynsdorp	1300	30%
N7 north of Vanrhynsdorp	950	24%
R27 near Calvinia	700	21%
R63 near Williston	190	16%
R63 near Carnarvon	140	25%
R384 near Britstown	200	12%
N10 near Prieska	300	21%

It is clear from the volumes in **Table 66** that these roadways are operating well within the level of service parameters. The average heavy vehicle volume along Route Alternative 1 is 20%.

Table 67: Current ADT of Route 4

Station	ADT (vpd)	% Heavy
N2 north of Coega	11500	17%
N10 south of Cradock	1670	36%
R61 near Tarkastad	1220	15%
R401 near Middelburg	-	-
N10 south of Britstown	700	23%
N10 near Prieska	300	21%

It is also clear from **Table 67** that the current daily volumes are well within its limits and that the roadways are operating with an abundance of additional capacity. The average heavy vehicle volume along Route Alternative 4 is 22%.

- **Expected Trip Generation during Construction**

The table below summarises the estimated total trips generated over the construction period. These trips will then be assigned to their expected routes in order to analyse their impact.

Table 68: Trip Generation

<table>
<tr><th colspan="2"></th><th>Components</th><th>Trips / Turbine</th><th>No of Turbines</th><th colspan="2">Total Construction Trip (18 months)</th></tr>
<tr><td colspan="2">Site Establishment</td><td>All</td><td>-</td><td>-</td><td>20</td><td>20</td></tr>
<tr><td rowspan="7">Turbines</td><td rowspan="3">Abnormal Load</td><td>Blade</td><td>3</td><td>60</td><td>180</td><td rowspan="7">6042</td></tr>
<tr><td>Tower</td><td>3</td><td>60</td><td>180</td></tr>
<tr><td>Nacelle</td><td>2</td><td>60</td><td>120</td></tr>
<tr><td rowspan="4">Normal Load</td><td>Aggregates</td><td>53.1</td><td>60</td><td>3186</td></tr>
<tr><td>Cement</td><td>20</td><td>60</td><td>1200</td></tr>
<tr><td>Sand</td><td>9.6</td><td>60</td><td>576</td></tr>
<tr><td>Steel</td><td>10</td><td>60</td><td>600</td></tr>
<tr><td colspan="2" rowspan="4">Substation</td><td>Substation</td><td></td><td></td><td>2</td><td rowspan="4">5</td></tr>
<tr><td>Diesel Tank</td><td></td><td></td><td>1</td></tr>
<tr><td>Hydraulic Oil Tank</td><td></td><td></td><td>1</td></tr>
<tr><td>Lubricating Oil Tank</td><td></td><td></td><td>1</td></tr>
<tr><td colspan="2" rowspan="3">Erection of Turbine</td><td>Construction vehicles</td><td></td><td></td><td>5</td><td rowspan="3">798</td></tr>
<tr><td>Crane transport</td><td></td><td></td><td>1</td></tr>
<tr><td>Labour transport</td><td></td><td></td><td>792</td></tr>
<tr><td colspan="6">Total</td><td>6845</td></tr>
</table>

From the above information it is calculated that the development will generate 6845 trips over an 18 month period. The trips generated by the construction activities are mainly due to the transport of components and materials. The assumed construction period is deemed to be quite short in terms of other contracts currently under way. This however will provide a conservative result in terms of the generated traffic per day.

Table 69: ADT Comparison of Route 1

Station	ADT (vpd)	% Heavy	Abnormal trips per day	Normal trips per day	New ADT (vpd)
R27 near Saldanha	4365	8%	3	-	4368
N7 south of Vanrhynsdorp	1300	30%	3	-	1303
N7 north of Vanrhynsdorp	950	24%	3	-	953
R27 near Calvinia	700	21%	3	-	703
R63 near Williston	190	16%	3	-	193
R63 near Carnarvon	140	25%	3	-	143
R384 near Britstown	200	12%	3	-	203
N10 near Prieska	300	21%	3	15	318

Table 70: ADT Comparison of Route 4

Station	ADT (vpd)	% Heavy	Abnormal trips per day	Normal trips per day	New ADT (vpd)
N2 north of Coega	11500	17%	3	-	12803
N10 south of Cradock	1670	36%	3	-	1673
R61 near Tarkastad	1220	15%	3	-	1223
R401 near Middelburg	-	-	3	-	-
N10 south of Britstown	700	23%	3	-	703
N10 near Prieska	300	21%	3	15	318

It was assumed that two (2) turbines will be delivered to site each week which roughly equates three (3) deliveries per day. Fifteen normal heavy and light vehicles will also travel to and from site daily but, over a much shorter distance. The latter was therefore only added to the traffic on the N10.

- **Expected Trip Generation during Operation**

The operation and maintenance personnel will in all probability be stationed in the town of Prieska. It is envisaged that a very small number of trips would be generated to the site each day. These trips would however be of no significance to the road network.

- **Expected Trip Generation during Decommissioning**

It can be assumed that the decommissioning trip generation would be equal to that of the construction and installation with full loads running in the reverse direction. The road network would need to be assessed at that stage.

8.10.4 Route Assessment

- **Assessment of Impact on Long Distance Route**

The HCM 2010 Chapter 15: *Two lane Highways* was consulted as the greatest portion of the route to be travelled by the delivery trucks are rural two lane highways of Class I, II or III. The trips generated by this development were evaluated in relation to the quantum of trips needed to change the Level of Service

(LOS) on a portion of the rural highway and the ultimate capacity of two lane highways. The projected truck trips per day are deemed to be of no consequence to the LOS of the travelled route from Saldanha to Prieska or Coega to Prieska.

With regard to the speed at which these vehicles travel it is advised to allow queuing vehicles to pass at regular intervals as needed. The abnormal load vehicles should also under no circumstances travel in groups of two or more trucks. This will frustrate the general road user and cause irrational actions and possibly accidents. The bulk of the roadways being used are very low trafficked roads and should therefore not pose much of a problem.

- **Assessment of Impact on Local Traffic**

The ultimate accepted capacity of a two lane highway is 3200 vehicles per hour. From historic traffic count data it was observed that the N10 roadway at Prieska has an abundance of spare capacity, as the current annual daily traffic (ADT) along this roadway is around 300vpd. This therefore indicates that the estimated additional traffic generated by the construction staff travelling to and from site, can be accommodated on the existing roadways. An impact rating table is provided in **Section 9**.

Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period as well as on the National Road N10.

8.10.5 Assessment of Intersections

Route alternative 4 was further assessed in terms of intersection geometry and capacity. A preliminary route clearance was performed as a desktop study and would therefore need to be performed in further detail for the transport phase of the project.

- **Preliminary Route Clearance**

All of the intersections mentioned below was analysed using a turning movement simulation. Only one abnormal load vehicle was used to analyse the turning movements and is included as **Annexure C** in the Traffic Specialist Report. It was reasoned that if the wind blade vehicle can turn at each intersection, every other vehicle will be able to, since it is the largest component to be transported to site. The analysis was done to determine whether there would be adequate clearance for all turning movements along the haulage route, when transporting the wind turbine components. The Autoturn analyses of the effected intersections are included in **Annexure D** of the Traffic Specialist Report.

- ***Intersection before Neptune Road**: Turn right towards Neptune Road*

The geometric layout and aerial view of the intersection is shown in **Figure 199** below.

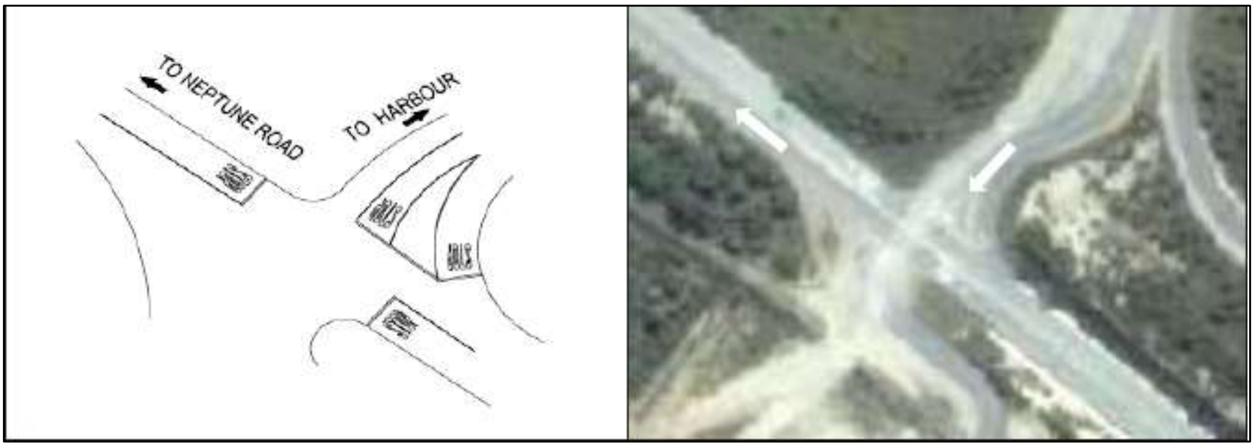


Figure 199: Geometric layout and aerial view of the intersection just before Neptune Road

The analysis revealed that there will be sufficient clearance for turning. However, it might be necessary to remove any shrubs in the surrounding area that will prevent this turning movement. Any signs in the vicinity may also need to be relocated. The detailed route clearance will reveal if this will be necessary.

- ***Neptune Road:*** *Turn left into Neptune Road*

The geometric layout and aerial view of the intersection is shown in **Figure 200** below.

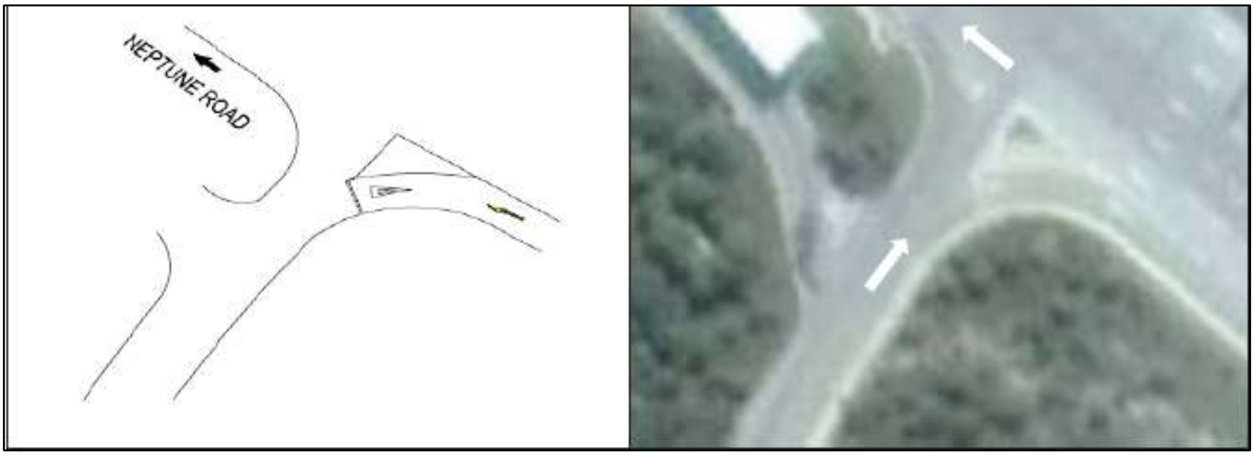


Figure 200: Geometric layout and aerial view of Neptune Road intersection

The intersection above will be able to accommodate the left turn movement into Neptune Road. It may be necessary to remove vegetation on the east side of the intersecting road, but will be determined with the detailed route clearance.

- ***Neptune Road / N2:*** *Turn left from Neptune Road onto the ramp and merge with N2*

The geometric layout and aerial view of the intersection is shown in **Figure 201** below.

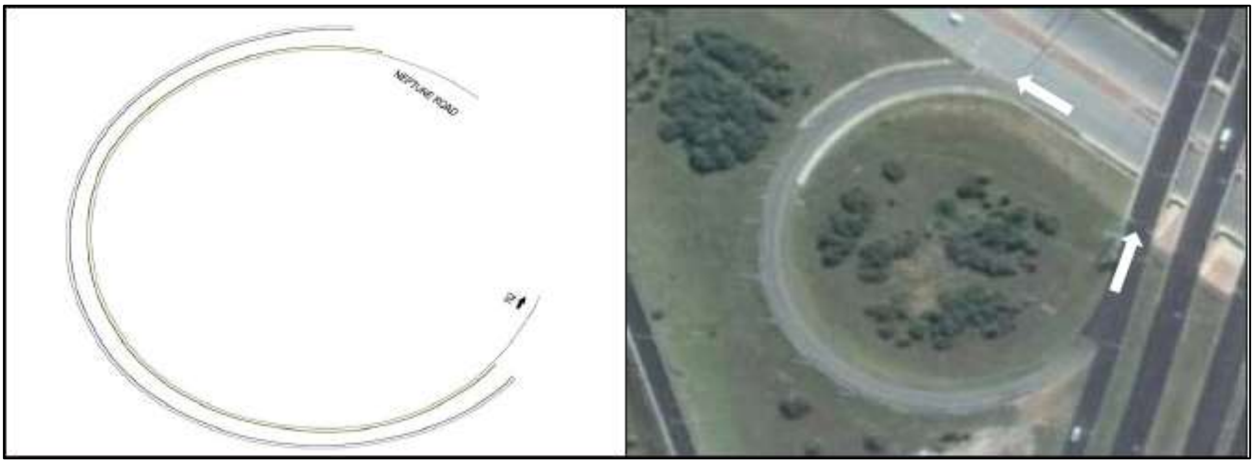


Figure 201: Geometric layout and aerial view of the Neptune Road / N2 merge

From the analysis it is apparent that the N2 on-ramp will be able to accommodate the abnormal load vehicle. Any signs that may possibly prevent this turning movement will need to be relocated for the duration of the construction period. The detailed route clearance will verify the above mentioned.

- ***N10 / R61:*** *Turn right from N10 onto R61*

The geometric layout and aerial view of the intersection is shown in **Figure 202** below.

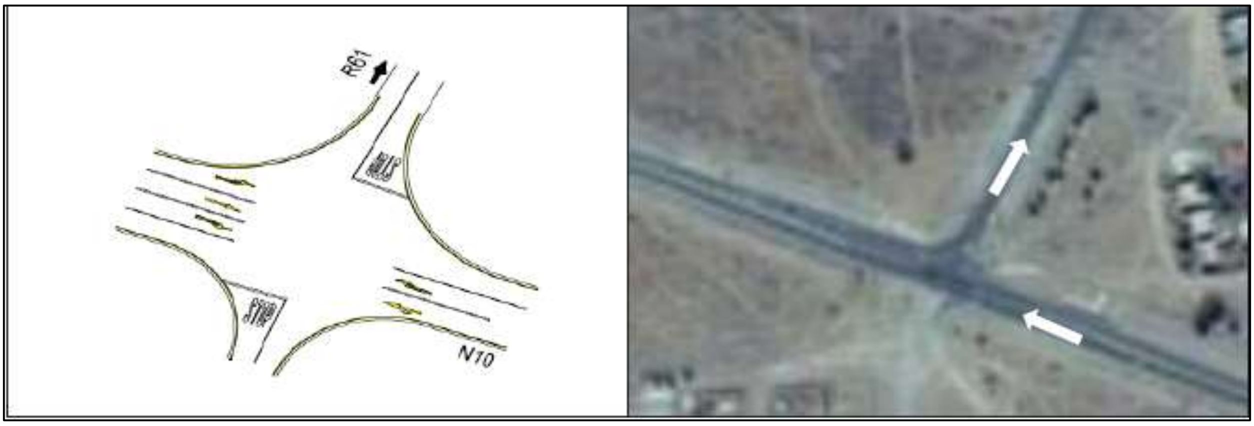


Figure 202: Geometric layout and aerial view of the N10 / R61 intersection

The abnormal load truck will have sufficient clearance to turn onto the R61. However, any signs on west and east side of the N10 may need to be removed that obstruct the turning movement. A detailed route clearance will reveal if such signs exist.

- ***R61 / R401:*** *Turn left from R61 onto R401*

The geometric layout and aerial view of the intersection is shown in **Figure 203** below.

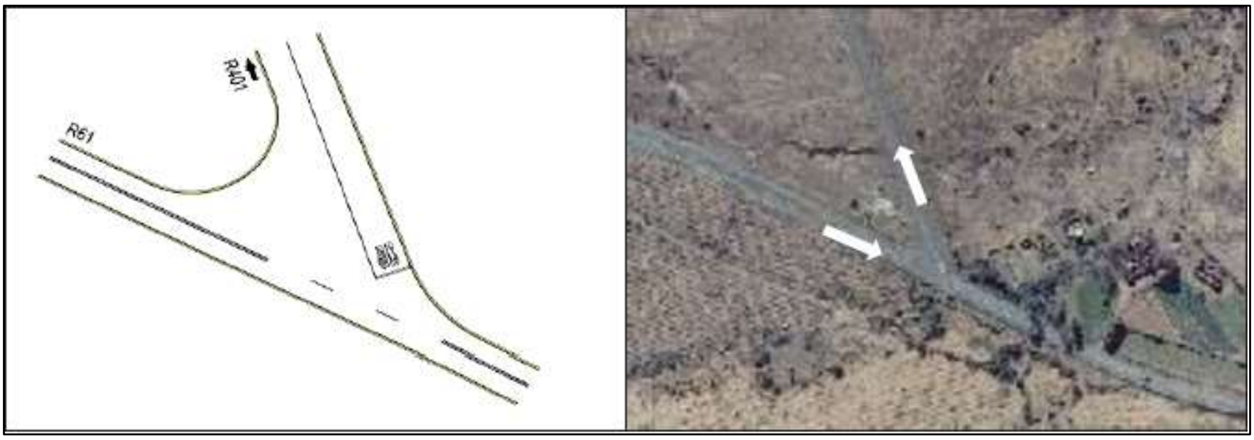


Figure 203: Geometric layout and aerial view of the R61 / R401 intersection

After analysing this intersection it was found that the R61 may be able to accommodate the turning movement, this will be confirmed through the detailed route clearance. There are signs on both the southwest and northwest side of the R61 that most probably need to be relocated. Additionally, the fence line on the north side may also require to be moved backward.

- ***R401 / N10:*** *Turn right from R401 onto N10*

The geometric layout and aerial view of the intersection is shown in **Figure 204** below.

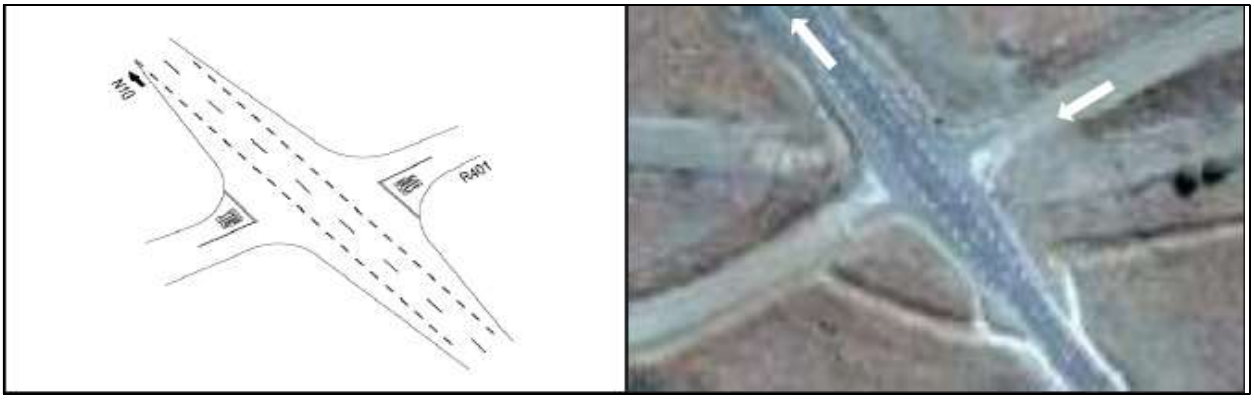


Figure 204: Geometric layout and aerial view of the R401 / N10 intersection

The analysis revealed that there is sufficient clearance for the abnormal load vehicle to turn right onto the N10. However, it might be necessary to temporarily relocate signs in the vicinity. This will be clarified during a detailed route clearance.

- ***N10 / N12:*** *Turn right from N10 onto N12*

The geometric layout and aerial view of the intersection is shown in **Figure 205** below.

Figure 205: Geometric layout and aerial view of the N10 / N12 intersection

After the analysis was carried out, it was found that the N10 may be able to accommodate for the right turn movement onto the N12. However, wooden posts situated on both sides of the N10 may need to be temporarily removed and signs in the surrounding area relocated. This will only be determined once the detailed route clearance is finalised.

- ***N12 / N10:** Turn left from N12 onto N10*

The geometric layout and aerial view of the intersection is shown in **Figure 206** below.

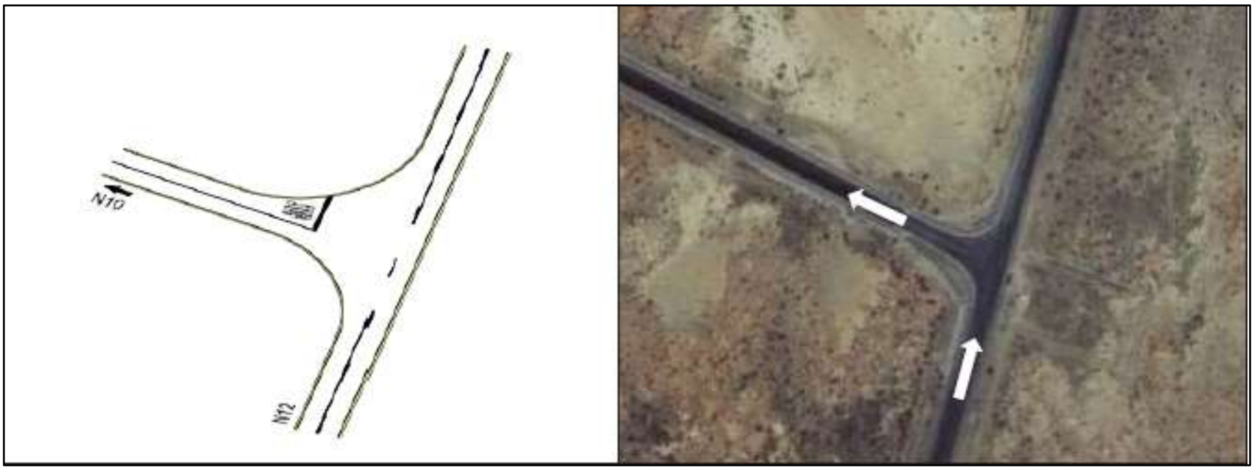


Figure 206: Geometric layout and aerial view of the N12 / N10 intersection

The above intersection will be able to accommodate the left turning movement. However, wooden posts may need to be temporarily removed on the west side, but will be clarified once the detailed route clearance is completed.

- ***N10 (towards Prieska):** Turn right from N10 towards R357*

The geometric layout and aerial view of the intersection is shown in **Figure 207** below.

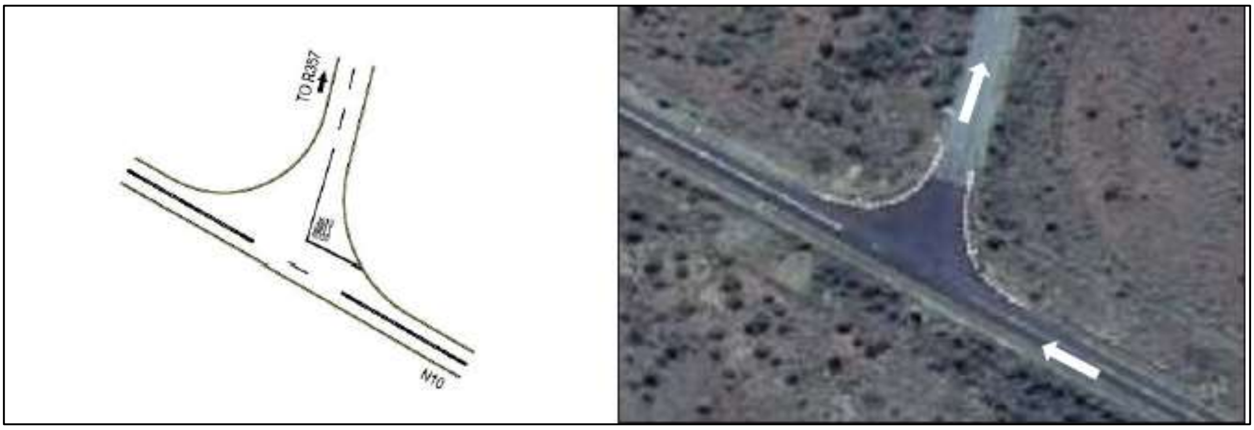


Figure 207: Geometric layout and aerial view of the N10 intersection

After analysis this intersection it was found that there will be sufficient clearance for the abnormal vehicle to turn. There is the possibility of a sign board obstructing the turning movement and this may need to be relocated. The existing fence lines may possibly need to be relocated as well. Everything will be clarified during the detailed route clearance.

- ***R357 (towards Aletta WEF):*** *Turn left onto R357*

The geometric layout and aerial view of the intersection is shown in **Figure 208** below.

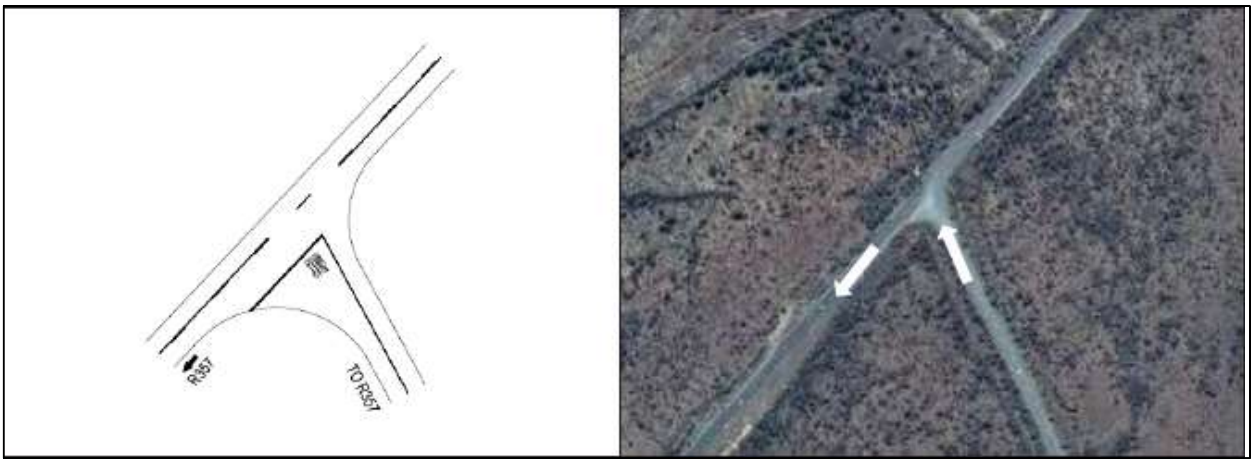


Figure 208: Geometric layout and aerial view of the R357 intersection

This intersection may require upgrading for the left turn movement onto the R357, but will only be verified during the detailed route clearance. Other work that may need attention is the removal of shrubs that will obstruct the widening and also the relocation of the fence lines.

- **Level of Services (LOS) of Intersections**

For all the intersections, mentioned in the section above, traffic will need to be blocked by traffic officials assisting the transport convey. The intersections will revert to normal operation once the turning movement of the abnormal load trucks is completed. This may affect the current level of service on the roadway, since these trucks travel at low speeds. To compensate for this, the queuing vehicles will be allowed to pass at regular intervals if needed and the oversize truck should not be allowed to travel in groups of two or more. The table below provides a summary of all vehicles passing by the intersections on the haulage Route Alternative 4.

Table 71: Main intersections affected on Route Alternative 4

Station	Intersection reference	Average traffic (vpd)	Abnormal load traffic (vpd)	Total delay at intersection (s)
N2 north of Coega	**Figure 201**	11500	3	45
N10 south of Cradock	**Figure 202**	1670	3	75
R61 near Tarkastad	**Figure 203**	1220	3	75
N10 south of Britstown	**Figure 205**	700	3	75
N10 near Prieska	**Figure 206** **Figure 207**	300	3	75

These delays are estimates only and are considered to be acceptable. Assisting vehicles with amber lights and reflective markings must be in constant radio contact with each other and the truck driver to ensure the safety of the traveling public.

8.10.6 Effected Communities

It is expected that the community of Prieska will participate in the construction phase of this development.

From a traffic point of view, the total daily construction traffic is deemed to be very low and will not significantly impact this community. The cumulative effect on the community was rated as a positive low impact.

For route alternative 4 abnormal load vehicles will be using an alternative route and subsequently bypass towns. The community of Cradock will only be affected at the R61 turn off just before town, but as stated earlier in the report, the intersection will be blocked off for a very short duration.

8.10.7 Summary and Conclusion

The impact of the construction traffic on the general traffic and the surrounding communities along the haulage route is considered to be low. The level of service on the roadways on which the components are transported may experience some additional delay which can be mitigated by:

- Allowing the general traffic to pass the transport vehicle at regular intervals.
- The abnormal vehicles should not travel in groups of two or more so as to limit the delays caused by the relatively slow vehicles.

All the components will be transported by truck from Saldanha or Coega harbour to the site using the defined routes with possible minor deviations. These vehicles are classified as oversize vehicles and permits must be obtained in order to transport the turbine components.

The access to the site is on road R357 which is a Provincial road and will necessitate the involvement of the Northern Cape provincial roads and transport department.

SANRAL Western/ Southern Region will also need to be contacted in order to obtain consent for the abnormal load transport on their roadways.

Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period.

The cumulative impact and significance of the development of the wind energy facility is considered to be low negative and low positive impacts when traffic and surrounding community parameters, respectively, are examined.

8.11 Electromagnetic Interference (SKA)

The full Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan) was conducted by C Fouché of Interference Testing and Consultancy Services (ITC) and is included in **Appendix 6K.**

This assessment and Electromagnetic Control Plan with its associated procedures addresses mitigation actions required to reduce the radiated emissions of the AW 125 TH 100A wind turbine generator (WTG) to levels acceptable for installation within the declared Karoo Central Astronomy Advantage Area. The AW 125 TH 100A is the model within the AW 3000 platform that will be evaluated for this project. This Plan will be updated based on additional measurement results and design information as it becomes available.

With reference to the letter from the South African SKA Project Office dated 14th April 2016, the intent of this plan is to ensure that this facility poses a low risk of detrimental impact on the SKA by describing specific mitigation measurements to be implemented in order to achieve 40 dB of attenuation, as agreed with SKA South Africa. This plan provides general Electromagnetic Compatibility guidelines as well as specific guidelines to assist and maintain electromagnetic compatibility between the windfarm and Square Kilometer Array (SKA) facility.

This plan refers to the radiated emissions of the AW3000/125 TH100 50Hz wind turbine and it concerns itself with the goal of eliminating causes of electromagnetic interference (EMI), which can adversely affect the performance of the SKA Radio telescope.

8.11.1 EMC Requirements

The current requirement is a 30dB reduction in radiated emissions to ensure the cumulative emission level of a wind farm is within the requirements of SKA. This requirement is based on measurements on the Acciona AW 125 TH100A WTG at the Gouda facility in South Africa and Barosoain windfarm, Navarra, Spain. Very similar design will be used for the Copperton/ Garob facilities.

8.11.2 Potential Noise Sources

8.11.2.1 Nacelle

The top controller cabinet consists of two sections: the Power Section and Control section.

Sensors and motors in the nacelle are connected to the Top Controller Cabinet. All the contactors, plc's etc. are housed inside the Top Controller Cabinet.

Although the components that generate the interference are located inside the cabinet, it would be the interconnecting cables between the cabinet and the equipment that would form the radiating element.

- **Lighting**

Fluorescent lights are a known broadband emission source and all lights in the at least the tower (due to the height) and in the nacelle should be LED or incandescent types.

Due to the arcing nature of strobe lights, aircraft warning light for Garob and Copperton windfarms will be LED type. The synchronization among these obstruction light will be done through GPS.

- **Wind Speed Sensor**

The FT702LT/D50-v22-FF sensor uses a RS-485 communication link of 15m. The cable is a 3 pair twisted screened cable. The sensor complies to CISPR 22 Class B for radiated emissions.

8.11.2.2 Tower

The tower does not have any equipment installed; however the cabling between the nacelle and base running inside the tower is considered a radiating source. Mitigation techniques will be applied. Refer to Paragraph 12 of the Electromagnetic Interference (SKA) Specialist Report.

8.11.2.3 Base

- **Ground controller cabinet**

The ground controller cabinet differs from the nacelle mounted top cabinet in it being a top- bottom configuration rather than a side-by-side configuration.

As with the top controller, interference generated inside the controller cabinet will be radiated by the interconnecting cables. Test results currently show no additional attenuation is required. Refer to Paragraph 12 of the Electromagnetic Interference (SKA) Specialist Report.

- **Ground convertor**

The ground converter is the most likely main interfering source as high dV/dT and dI/dT signals are generated.

- **Other Base Equipment**

Other base installed equipment such as the auxiliary transformer, switching cabinets etc is seen as low risk equipment as they are in a static switched position.

Regarding the elevator, there isn't a PLC. The contactors and switches are installed inside the elevator control cabinet at the ground level.

8.11.3 EMC Analysis

As a working system is available for measurements, actual values are to be used during further analyses rather than a theoretic analysis. Measurements were taken at the Barasoain windfarm (Spain) and Gouda Windfarm (South Africa).

Three WTG locations (WTG 1, WTG 25 and WTG 31) and four SKA installations were used for the evaluation.

- **Distance Table**

Table 72: New Aletta layout distance from SKA infrastructure

	Aletta WTG 1	Aletta WTG 25	Aletta WTG 31
SKA 004 (Phase 1)	46.52km	50.22km	44.63km
SKA ID 1895 (Phase 2)	29.77km	29.39km	42.46km
SKA ID 1890 (Phase 2)	26.78km	30.65km	24.99km
SKA ID 2348 (Phase 2)	53.42km	53.38km	40.88km
MeerKAT (Core)	119.82km	121.6km	119.96km

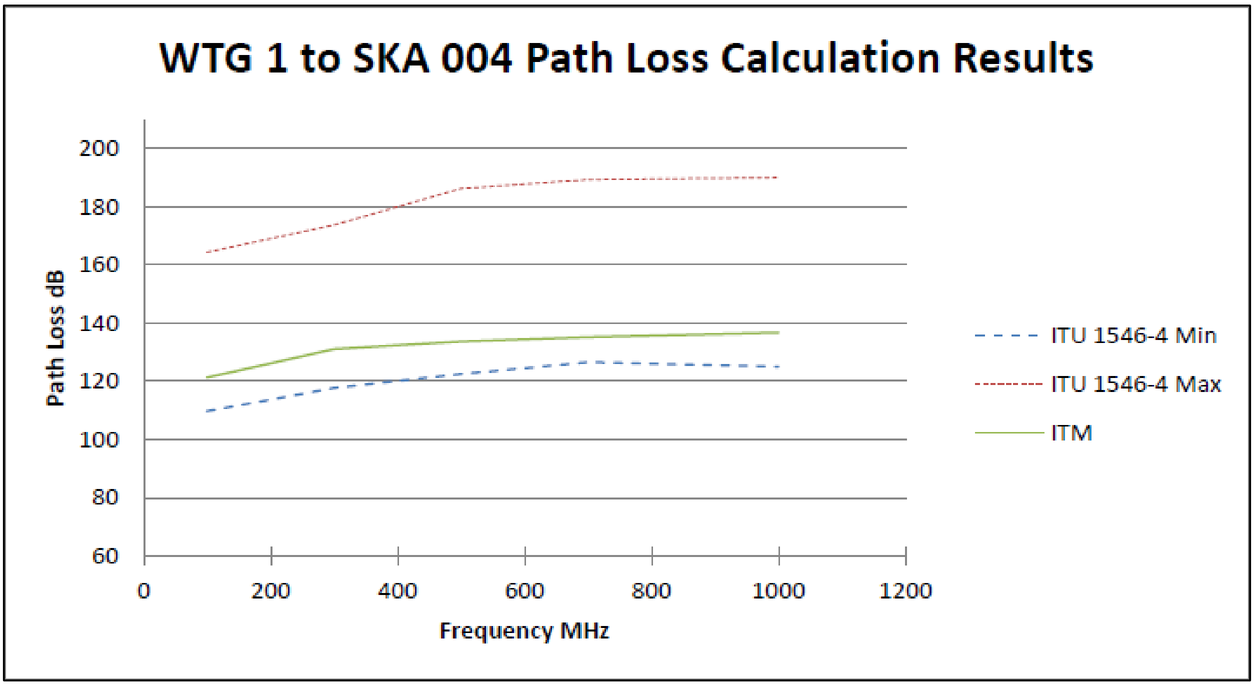
8.11.3.1 Path Loss Calculations

The path loss was calculated using the parameters as specified in **Table 73**: Path loss input data.

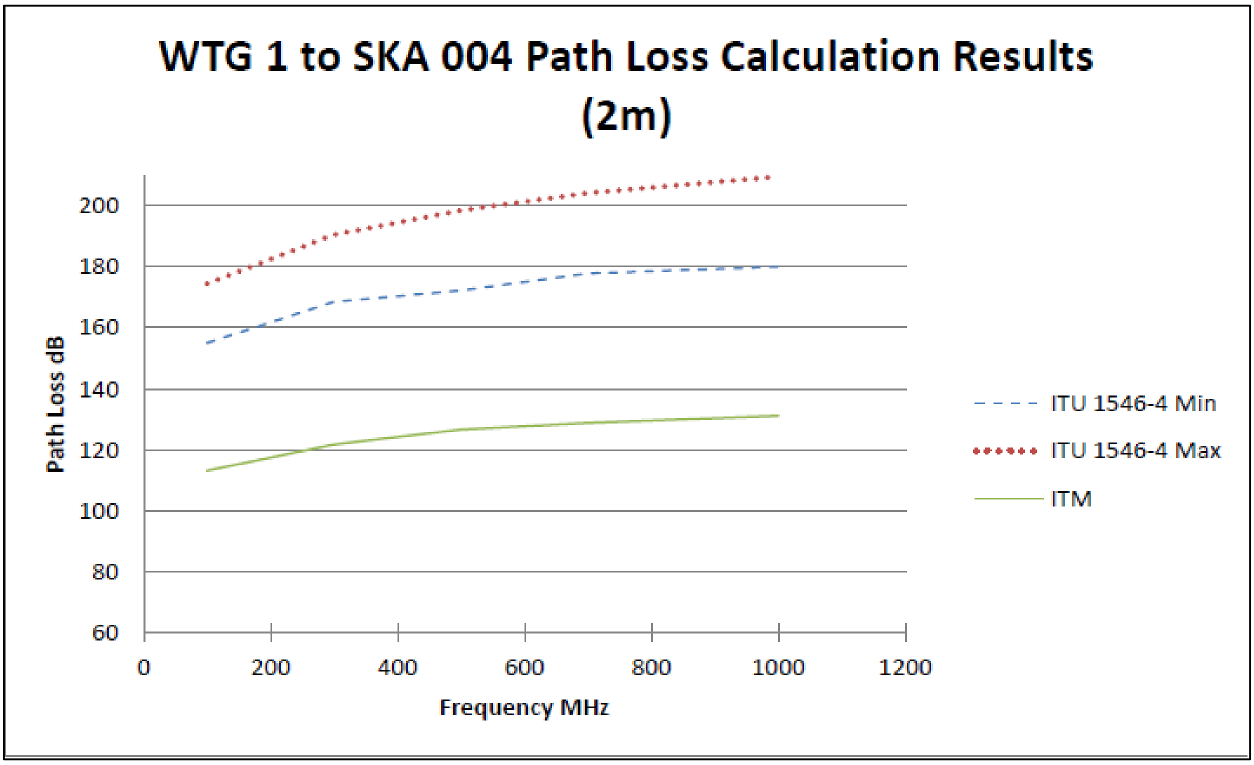
Table 73: Path loss input data

Parameter	Description	Quantity	Comment
Source/ Victim separation distance	SKA 004 to WTG 31	44.63km	Line of sight conditions
Frequency	Frequencies assessed	100MHz, 300MHz, 500MHz, 1000MHz, 3000MHz, 6000MHz	Free space loss increases with frequency
SARAS	Protection level	dBm/Hz = -17.2708 log 10 (f) -192.0714 for f<2GHz	Government Gazette 10 February 2012

Location Location	WTG 31 SKA 004	Latt: -29.860263° Long: 22.360129° Latt: -30.262608 Long: 22.221794	Waypoint received from Biotherm Energy (Pty) Ltd Waypoint received from SKA SA (Pty) Ltd
TX height	Nacelle Base	100m 2m	Height of nacelle eqp Height of base eqp
RX height	All SKA receivers	15m	Height used for SKA receive horn



Graph 1: WTG 1 (100m height) to SKA 004 Path Loss Calculation result



Graph 2: WTG 1 (2m) to SKA 004 Path Loss Calculation result

Graph 1 and Graph 2 shows worst case path loss calculations for the nacelle equipment emissions at 100m hub height and for base equipment at a 2m height. Although not the worst case, these values were used for the analysis as they are within 6dB of the WTG 1 to SKA ID 1895 values. SKA 004 is however a SKA 1 installation and SKA ID 1895 is a SKA 2 installation.

SPLAT! (Signal Propagation, Loss And Terrain) analysis was used to calculate the ITM path loss values. SPLAT! Is based on the Longley –Rice Irregular Terrain Model and Irregular Terrain With Obstruction Model. The digital elevation model resolution data used was 3-arc –seconds.

The ITU 1546-4 was calculated with Monte Carlo based ITU 1546-4 path loss software to obtain a minimum and maximum path loss values.

A factor of $10 \log_{10} N$ where N = the number of turbines to account for cumulative emissions is normally account for.

8.11.4 Emission Analysis

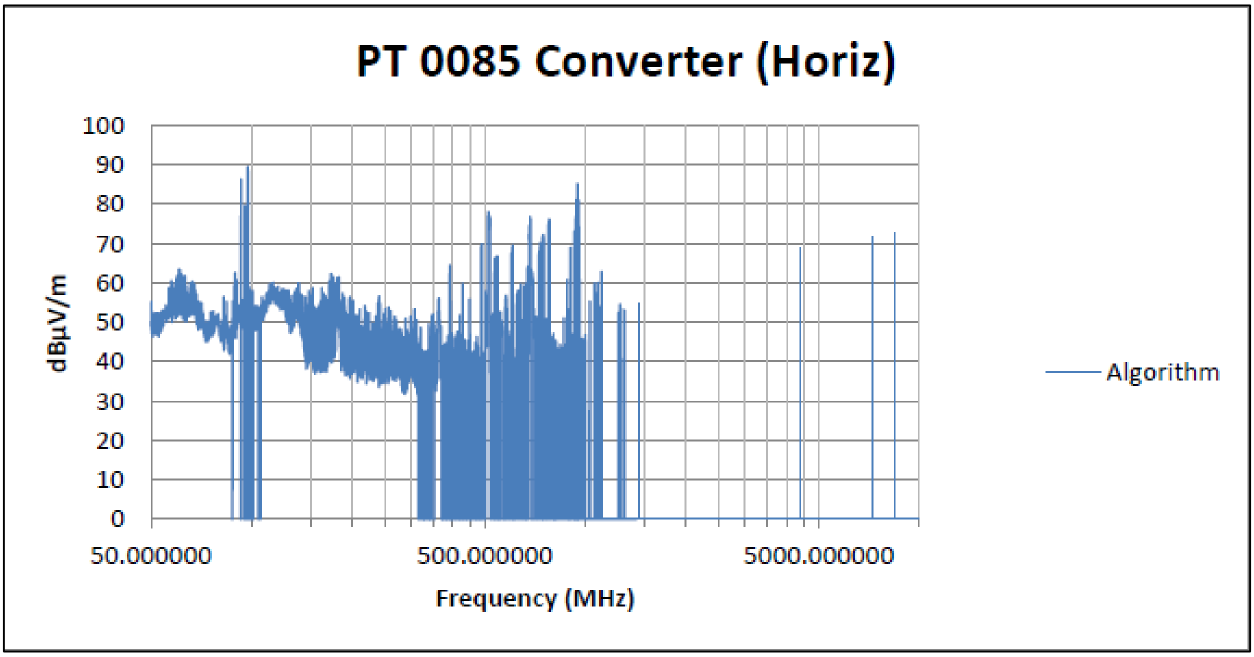
Test were done in Gouda windfarm (South Africa) from the 18^{th} to 20^{th} August 2015 and again on the 4^{th} and 5^{th} of March 2016 and from the 16^{th}-19^{th} of May 2016 in Barasoain windfarm (Spain)

8.11.4.1 Radiated Emissions

The CISPR 22 Class B limit line adjusted to the requirement at 1m will be 50dBμV/m below 230MHz and 57dBμV/m above 230MHz.

- **Convertor Cabinet**

The converter cabinet can be divided into three major blocks, Grid Cell, Converter Cell and Machine Cell.

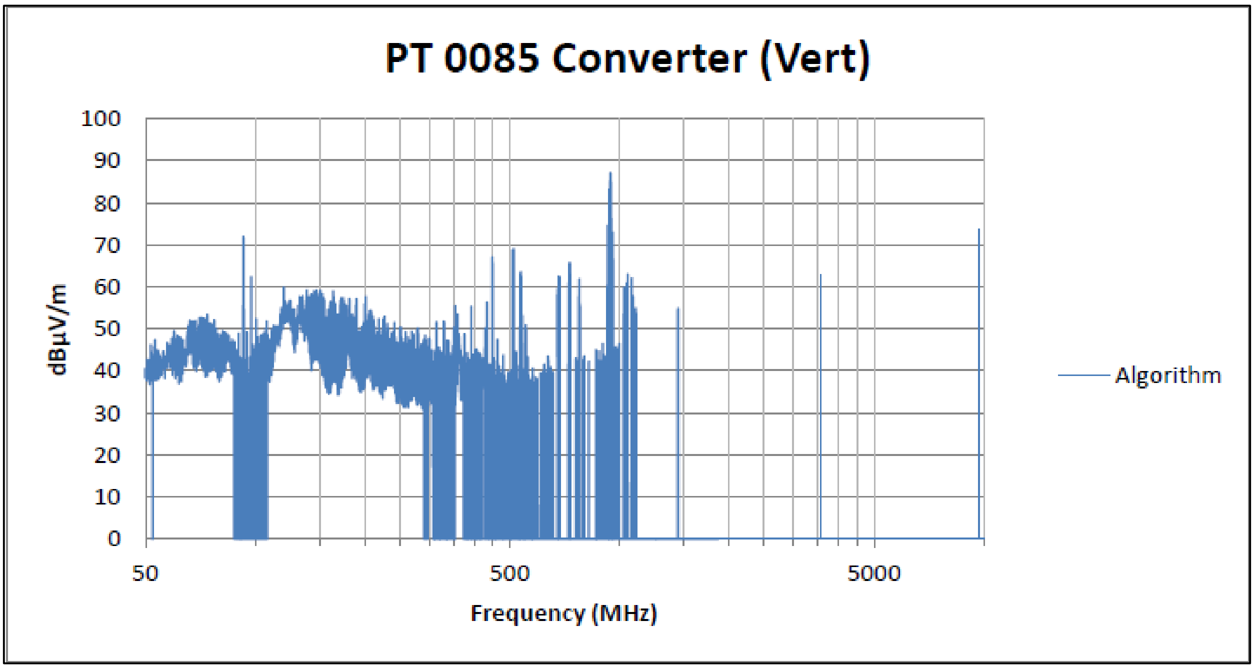


Graph 3: PT0085 Convertor with ambient algorithm (Horizontal)

The following algorithm was used to represent the horizontally polarized radiated emissions from the PT0085 converter as shown in **Graph 3**. The vertically polarized radiated emissions are shown in **Graph 4**.

If radiated emissions machine side > radiated emissions grid, then plot machine; else plot grid.
If (radiated emissions – ambient) < 3dB then plot 0; else plot radiated emissions.

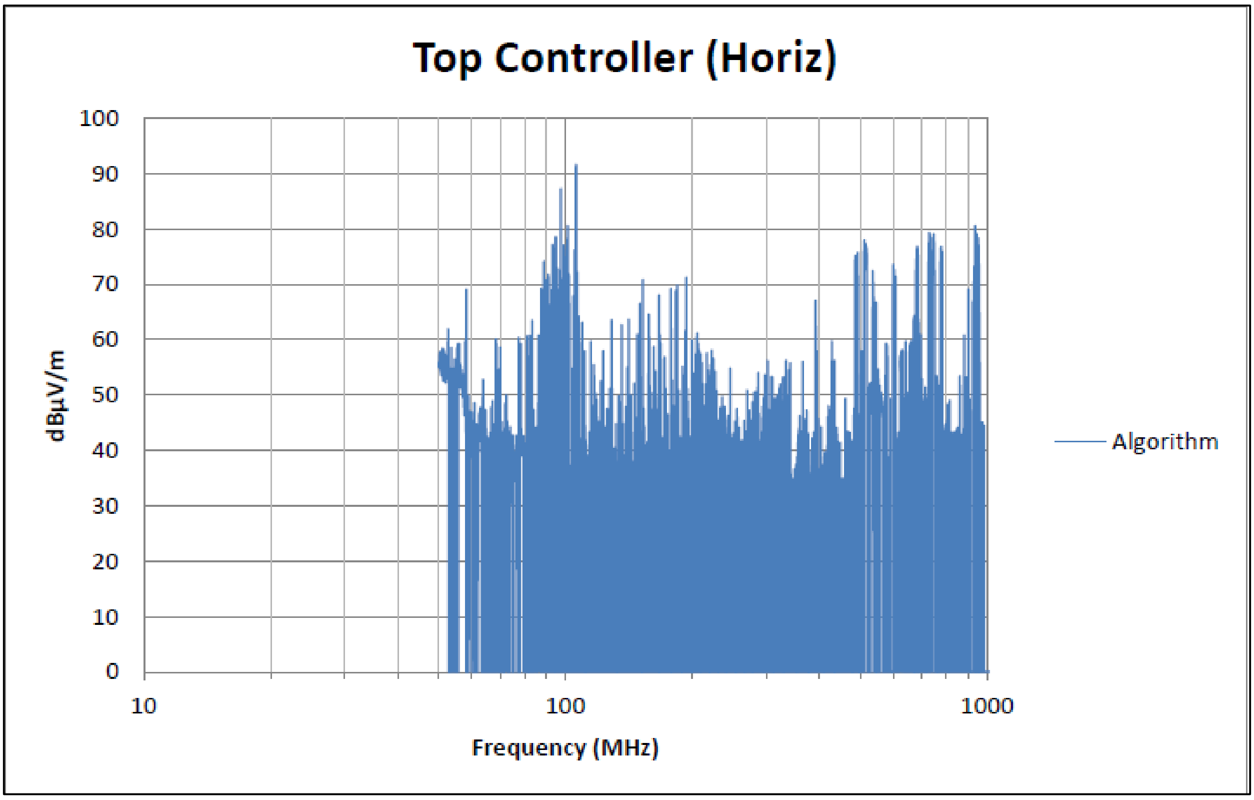
There is a 30dB to 40dB increase in the ambient emissions when the converter is switched on. Although the conducted emissions indicated little emissions above 200MHz, the radiated emission results indicates emissions at frequencies into the GHz range.



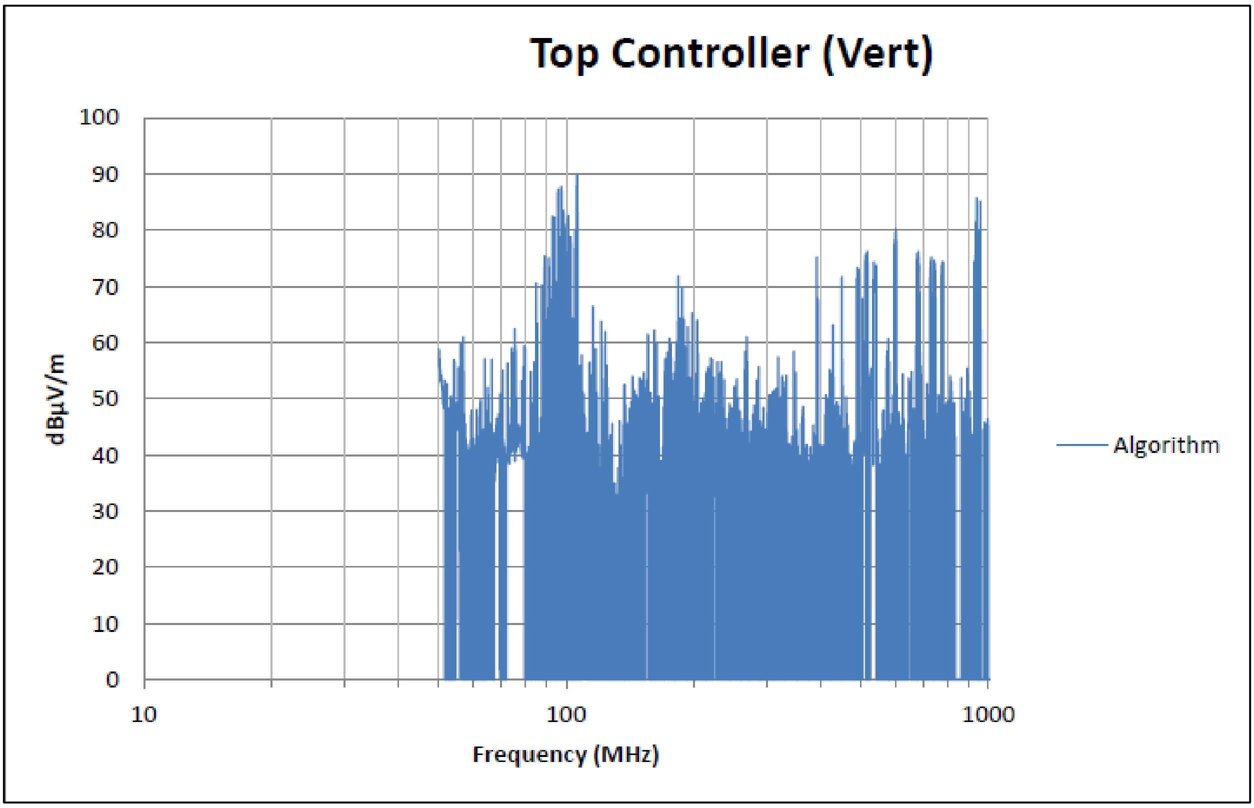
Graph 4: PT0085 Convertor with ambient algorithm (Vertical)

- **Top Controller (Measurement distance = 1m)**

The top control cabinet can be divided in two segments, ie. the power side and the control side. Comparing the results in Report (NIE) 49577REM.001 for the power and control side it is shown that the control side emissions were worst case.



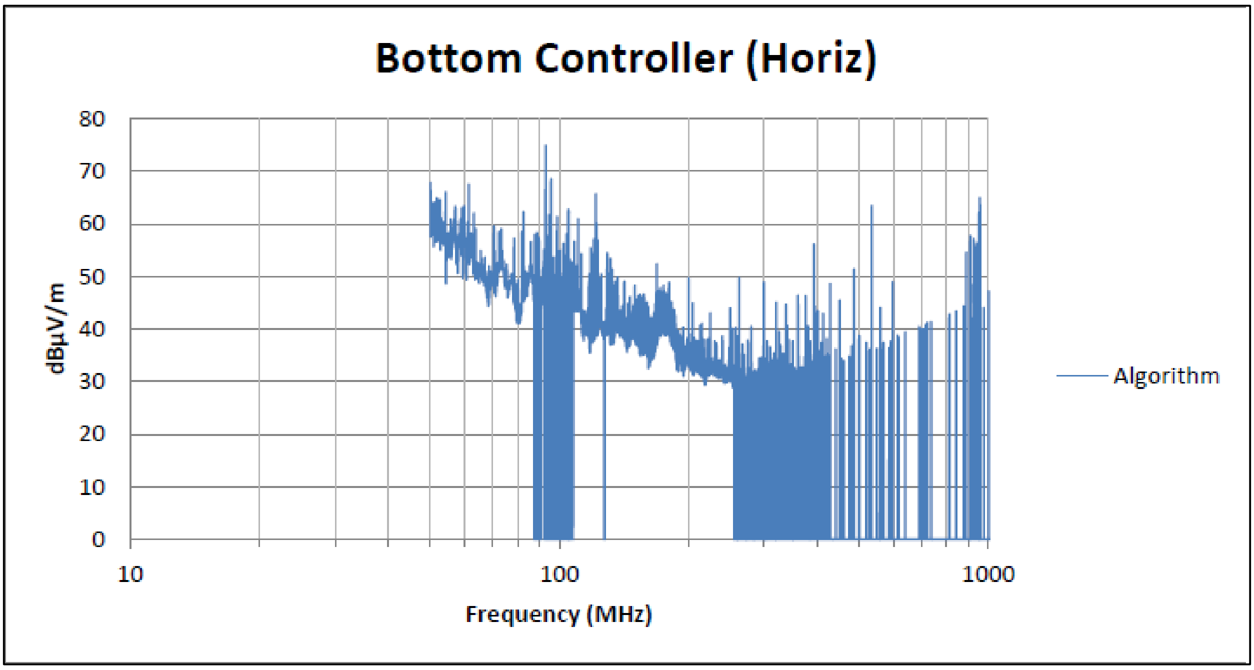
Graph 5: Top Controller (Horizontal @ 1m)



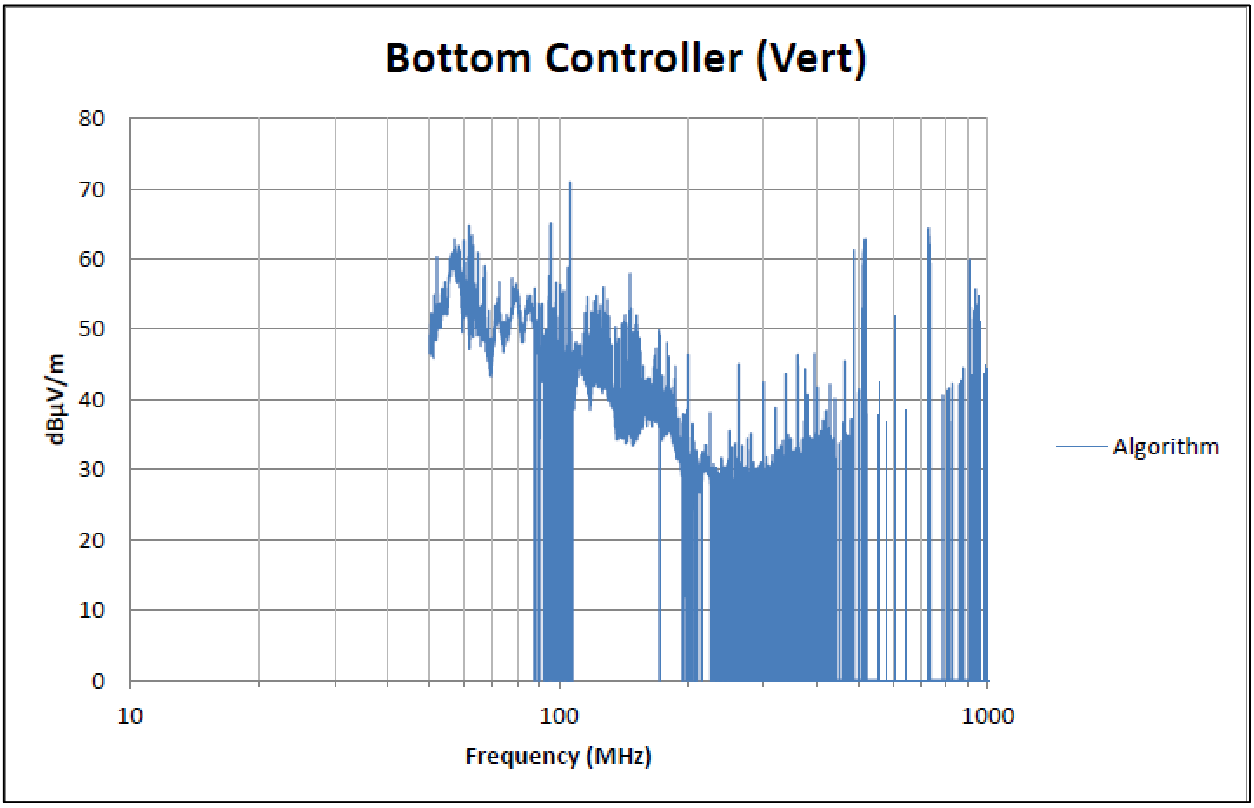
Graph 6: Top Controller (Vertical @ 1m)

- **Bottom Controller (Measurement distance = 1m)**

The Bottom Control Cabinet is an upright configuration and not side by side as the Top Control Cabinet configuration.



Graph 7: Bottom Controller (Horizontal @ 1m)



Graph 8: Bottom Controller (Vertical @ 1m)

8.11.4.2 Conducted Emissions

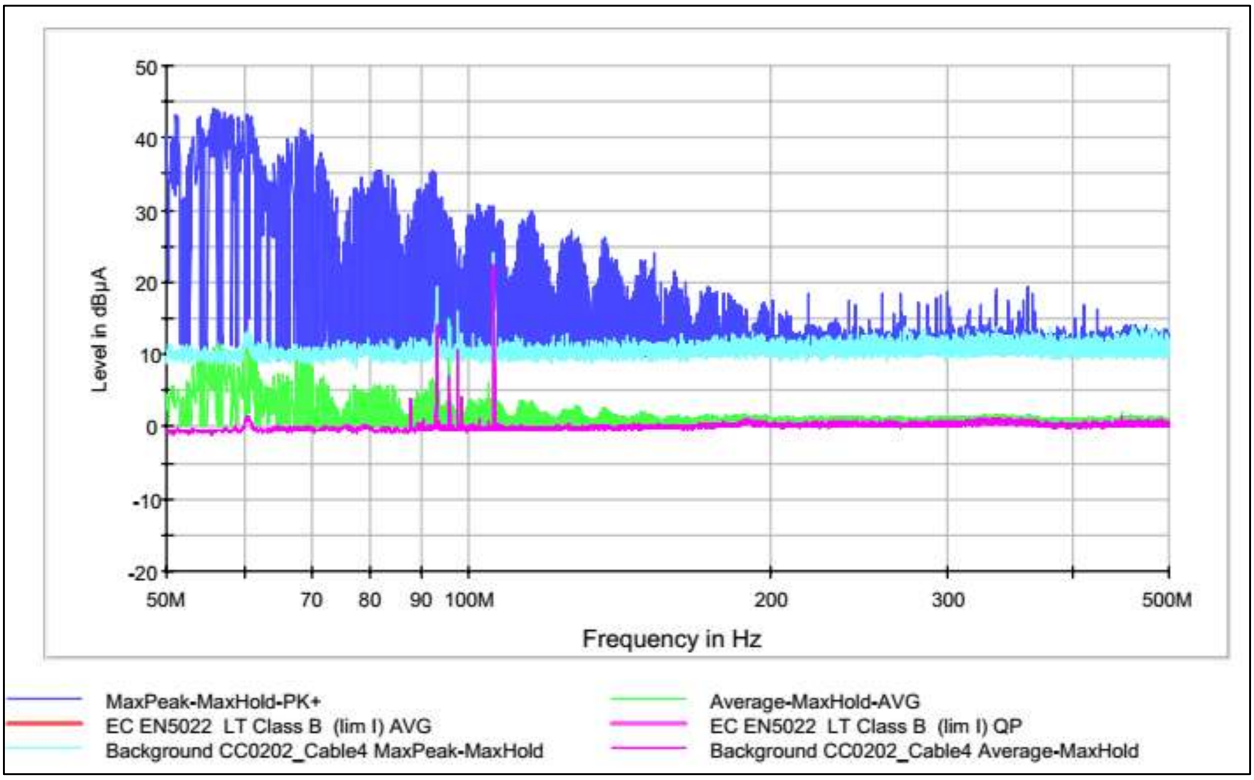
Critical cables were measured in an installation to characterize the emissions and to determine the likelihood of the cable acting as a radiator.

As a rule of thumb, a common mode current value of 14dBµA can potentially cause radiated emissions in excess of 37dBµV/m (CISPR Class B radiated emission limit at 10m distance). This will only be valid for cables in free space and when the cable has resonant properties at a given frequency.

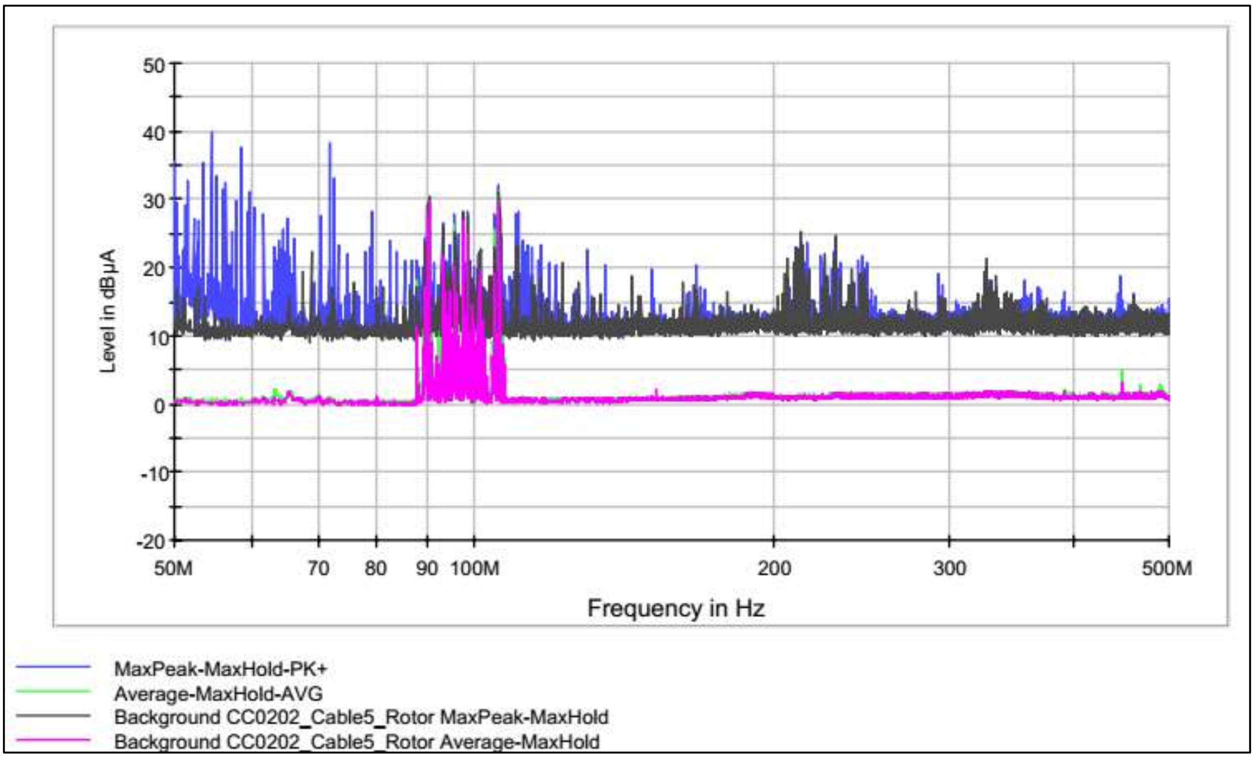
- **Convertor**

The converter was previously identified as a significant risk due to the following:

i. High dV and dI values
ii. Cable connection from converter in the base to the rotor in the nacelle
iii. Unshielded cable used between the converter (base) and rotor (nacelle)



Graph 9: Rotor cable measured in the base between converter in the base and rotor in nacelle

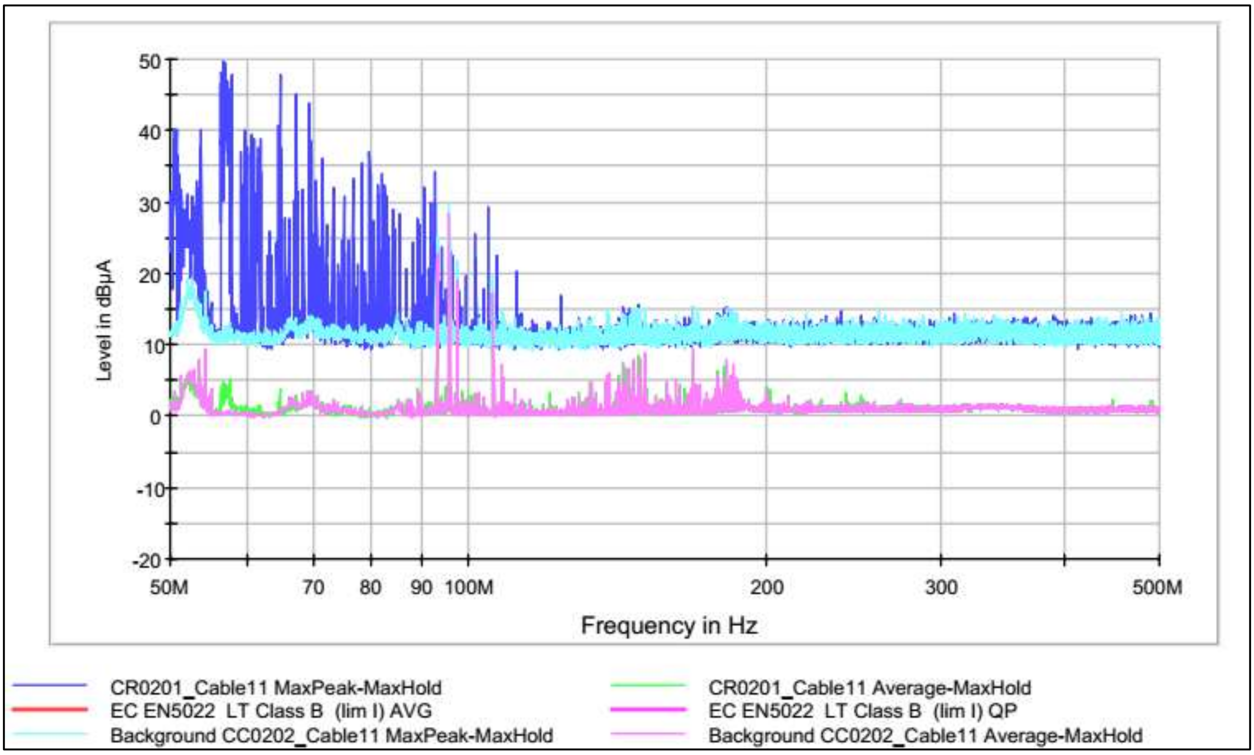


Graph 10: Rotor cable measured in the nacelle between convertor in the base and rotor in nacelle

From **Graph 9** and **Graph 10**, it is evident that the converter to rotor cable emissions is below 15dBµA in the higher frequency range.

When comparing the two graphs, the effect of cable length (inductance) on the signal is clear.

The spectrum envelope in **Graph 9** is typical of a periodic signal. This was expected and is a function of the converter switching frequency of 2.75 kHz and cable properties. The amplitude decay is however more than 40dB/decade, indicating that the rise time of the signal is more than 6.3nS.

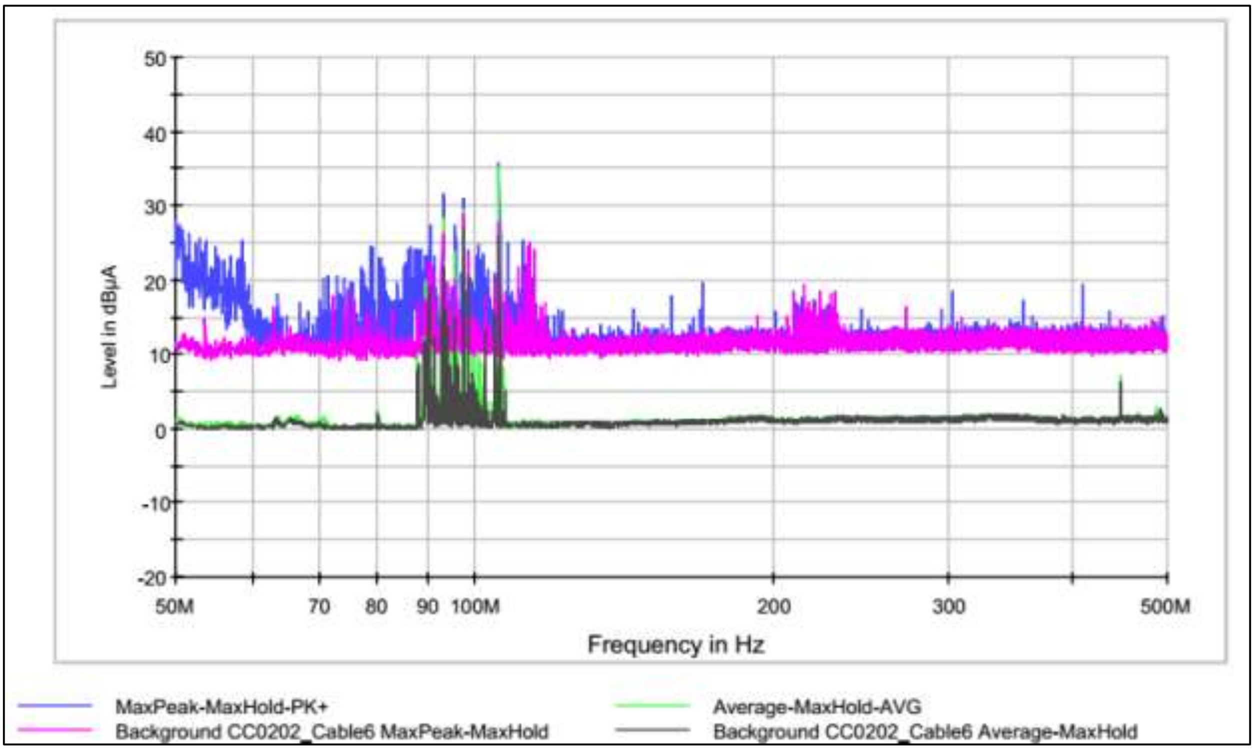


Graph 11: Convertor cable between the convertor and auxiliary transformer measured in base

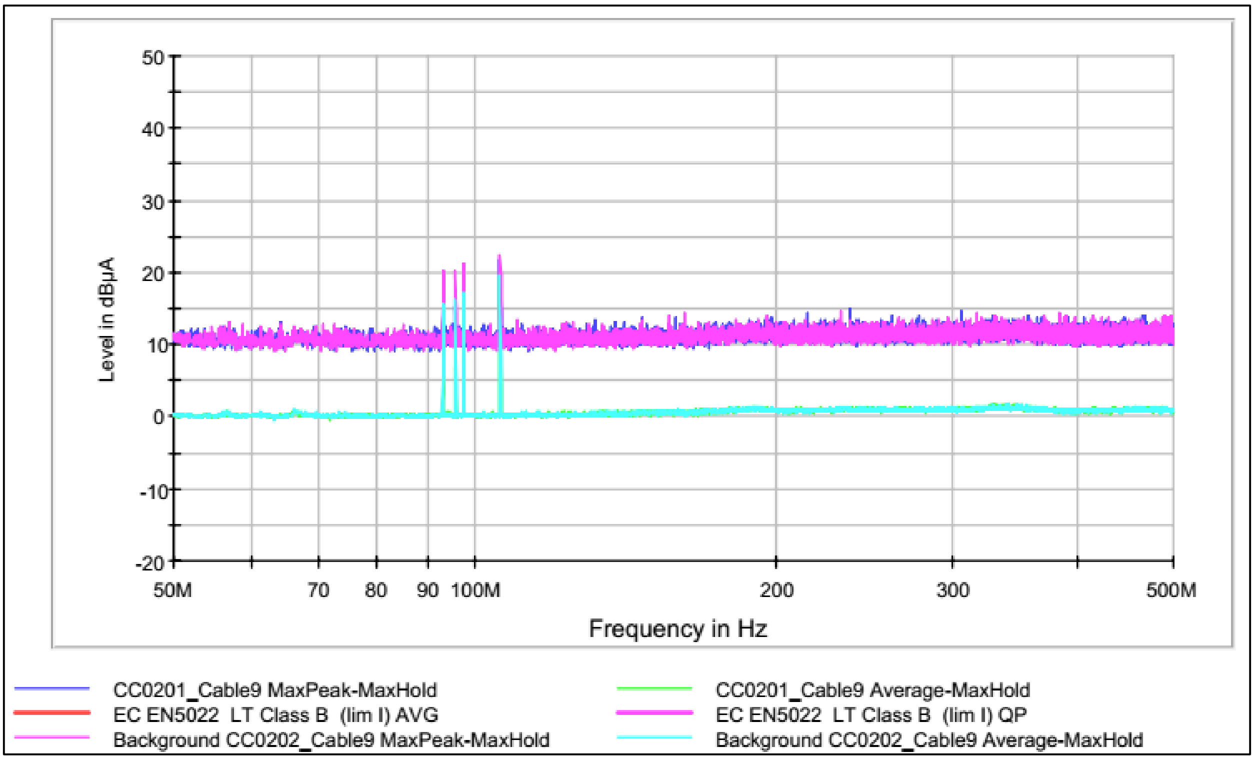
Graph 11 shows emissions on the transformer side of the converter. This confirms that conducted emissions from the converter are relative low in frequency. Although high in amplitude, this cable is inside the base with added path loss due to proximity to the ground.

- **Stator**

The stator cables run from the bottom control cabinet in the base to the stator in the nacelle. The emissions from stator cables in the nacelle (**Graph 12**) are less than the rotor cables (**Graph 10**). The stator cables are currently shielded.



Graph 12: Stator cable in nacelle between bottom control cabinet in base and stator in nacelle

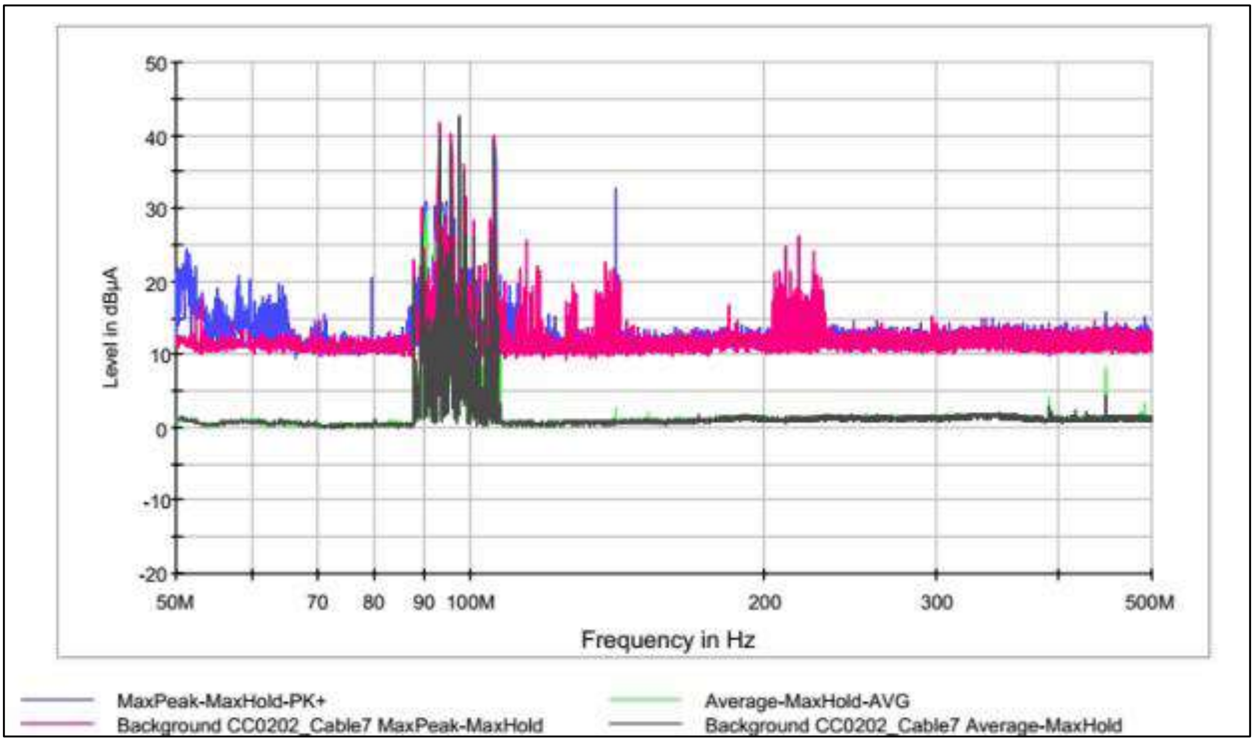


Graph 13: Stator cable in base between bottom control cabinet in base and stator in nacelle

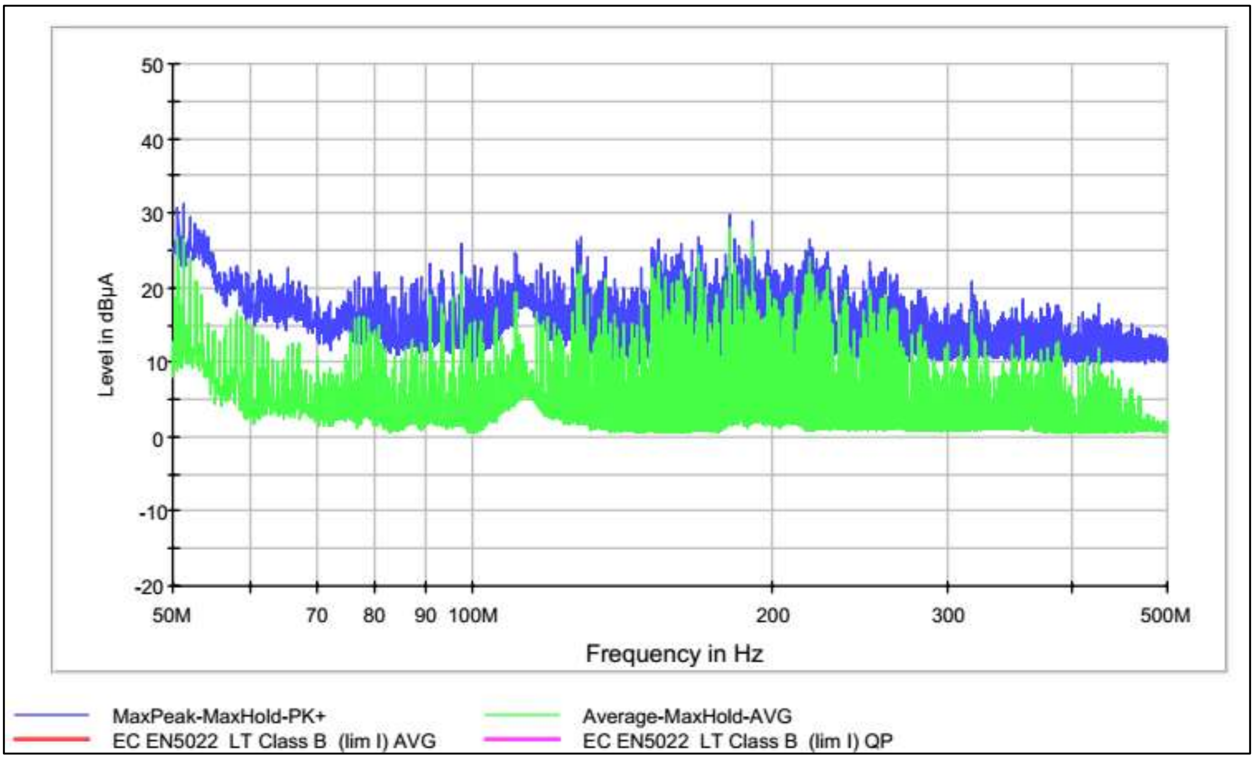
As the signal amplitudes are higher in the nacelle (**Graph 12**) than in the base (**Graph 13**), the conclusion would be that the source of the emissions is in the nacelle.

- **Encoder signal cable**

The encoder signal cable runs between the generator and converter. It is a shielded cable and the common mode currents on the shield were measured.



Graph 14: Encoder cable in the nacelle

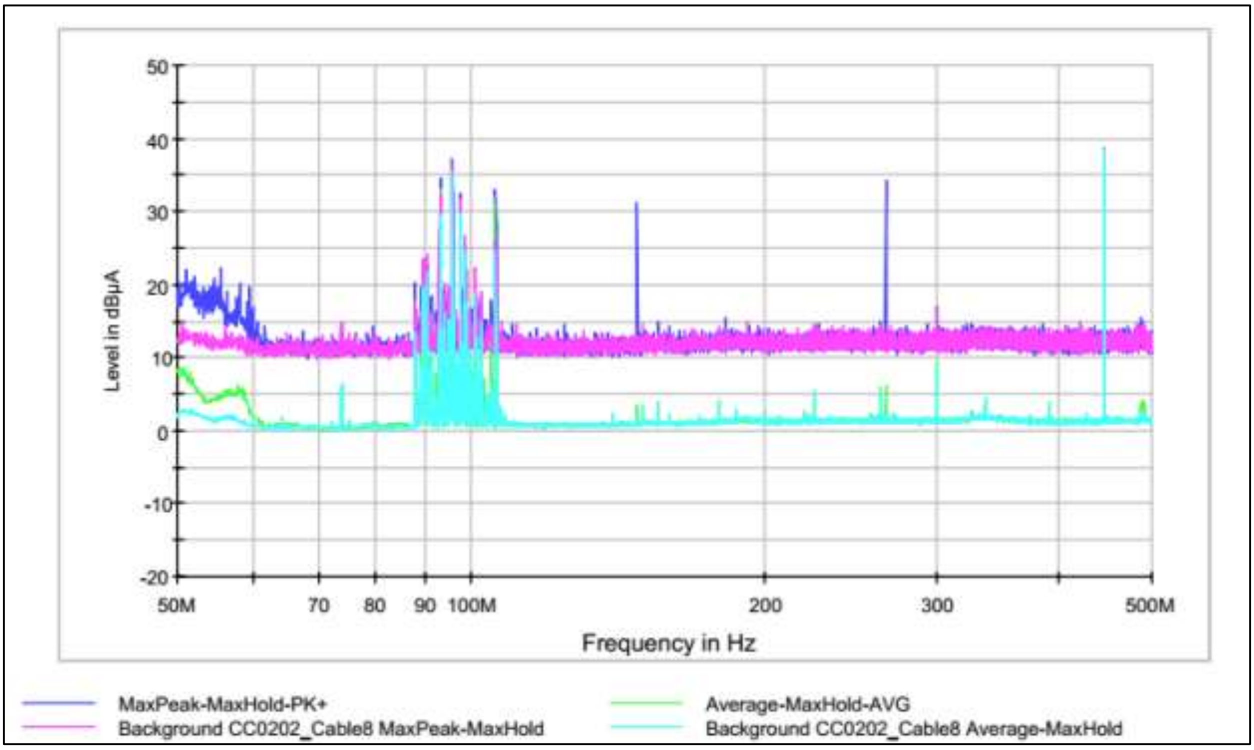


Graph 15: Encoder cable in the base

A significantly denser spectrum was measured in the base (**Graph 15**) than in the nacelle (**Graph 14**). It would therefore be fair to assume that the source is in the converter cabinet in the base.

- **CAN Bus (Nacelle)**

The CAN bus is also a shielded cable and carries the different sensor data, such as the electro valves, pitch position sensor etc. in the nacelle.



Graph 16: CAN Bus in the nacelle

The profile of the emissions below 60MHz is similar to the shielded encoder cable (**Graph 14**) in the nacelle. Site conditions limited the number of tests and investigations that could be done.

8.11.4.3 Tower Shielding Effectiveness

The minimum shielding effectiveness of the tower was found to be 5.2dB at the door. The electrical contact between the door and door frame can be improved to increase this figure, but the 5.85dB of the concrete will still be the limiting factor.

Table 74: Shielding effectiveness - Vertical Polarization

Vertical Polarization						
Frequency (MHz)	**Distance (m)**	**Reference (dBm)**	**Door (dBm)**	**Concrete (dBm)**	**SE Door (dB)**	**SE Concrete (dB)**
80	2.5		-31.51	-32.62	6.28	7.39
110	2.5		-38.52	-33.89	16.77	12.14
300	2.5		-4.69	5.51	16.05	5.85
500	2.5		-27.4	0.99	36.69	8.3
700	2.5		-18.93	-1.24	24.12	6.43
1000	2.5		-40.05	-9.08	41.11	10.14

Table 75: Shielding effectiveness - Horizontal Polarization

Horizontal Polarization						
Frequency (MHz)	**Distance (m)**	**Reference (dBm)**	**Door (dBm)**	**Concrete (dBm)**	**SE Door (dB)**	**SE Concrete (dB)**
700	2.5		-17.24	0.43	23.93	6.26
1000	2.5		-28.09	-8.99	28.48	9.38

The shielding effectiveness values will be used as input to the Risk Matrix.

8.11.5 Conclusions

As mitigation techniques are source and coupling path specific, tests were be done on a current WTG to confirm the suspected noise sources.

The results indicated shielding required at frequencies in the FM Radio band as well as other controlled frequency bands, especially in the nacelle area.

The Aletta WTG 1 was chosen as the transmitter site as at 46.52km from SKA 004 it is the closest to the SKA 1 infrastructure.

- **Convertor Cabinet**

The converter cabinet is in the base of tower. The 6dB to 10dB shielding provided by the concrete tower is currently not included in the results.

Test results obtained at the current installation including a 10dB safety margin shows no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect highlighted a few frequencies that will require additional attenuation. Further analysis of the frequencies above the 0dB line proved that they are ambient frequencies in the FM, TV and cell phone band. The shielding effectiveness of the concrete tower was not taken into account. No additional shielding of the bottom converter cabinet would therefore be required.

- **Bottom Control Cabinet**

Test results obtained at the current installation including a 10dB safety margin shows that no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect, highlighted the frequencies that will require additional attenuation of 12dB maximum excluding the FM radio frequencies. Further analysis of these signals proved that they are ambient signals from intentional transmitters. No additional shielding of the bottom control cabinet would therefore be required.

- **Top Control Cabinet**

When taking cumulative effect into consideration, a significant amount of shielding is required. This is the combined effect of the cables entering and exiting the Top Control Cabinet and equipment mounted in the cabinet.

Further analysis revealed that they can be attributed to FM radio stations, TV and GSM intentional transmitters. However, not all signals that require attenuation could be attributed to intentional transmitters.

Given that the nacelle houses different equipment in a confined space and the difficulty in performing tests in the nacelle while the system is operational mitigation should include shielded cabinets, shielded cable trays and the use of absorptive cable sleeves.

Laboratory tests will be done to narrow down the source possibilities.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 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.

9.1.1 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 77**.

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.

9.1.2 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. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 76: 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 77: 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 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

IMPACT TABLE FORMAT		
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**
	Pre-mitigation impact rating	
Extent	1	4
Probability	1	4
Reversibility	1	4
Irreplaceable loss	1	4
Duration	1	4
Cumulative effect	1	4
Intensity/magnitude	2	2
Significance rating	-12 (low negative)	-48 (medium 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 analysing the significance. These measures will be detailed in the EMPr.*	

The 2014 regulations also specify that alternatives must be compared in terms of impact assessment.

9.2 Environmental Impact Assessment

9.2.1 Biodiversity

- Planning

No impacts are expected during planning.

- Construction

Table 78: Rating of impacts on indigenous natural vegetation

IMPACT TABLE	
Environmental parameter	Indigenous natural vegetation
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of vegetation. The regional terrestrial vegetation type in the broad study area is Bushmanland Basin Shrubland, listed as Least Threatened. Some loss of habitat will occur, but this will be insignificant in comparison to the total area of the vegetation type concerned. The assessment here is for all infrastructure components and

	assumes a significant impact due to the construction of internal access roads.	
Extent	The impact will affect natural vegetation on site and possibly in immediately surrounding areas.	
Probability	The impact will definitely happen.	
Reversibility	Irreversible in human timeframes, since natural successional processes cannot compensate for complete local loss of habitat and diversity. Secondary vegetation will probably never resemble the original vegetation found on site.	
Irreplaceable loss of resources	Significant loss of resources will occur.	
Duration	The impact will be permanent (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.)	
Cumulative effect	Low cumulative impact. Added to existing impacts on natural habitat from mining activities in the general region as well as other proposed alternative energy projects, the current project will cause additional loss of vegetation, the cumulative effect of which will possibly be noticeable.	
Intensity/magnitude	Low. Regional vegetation will continue to function.	
Significance rating	Medium negative impact expected.	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	4	4
Irreplaceable loss	3	3
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-38 (high negative)	-36 (medium negative)
Mitigation measures	It is not possible to avoid impacts on indigenous vegetation for this project. The following mitigation measures would help to limit impacts: ▪ Restrict impact to development footprint only and limit disturbance creeping into surrounding areas. ▪ As far as possible, locate infrastructure within areas that have been previously disturbed or in areas with lower sensitivity scores. ▪ Avoid sensitive features and habitats when locating infrastructure. ▪ Undertake detailed field surveys of the proposed footprint of infrastructure to locate any sensitive species and/or ecological features. If necessary, shift infrastructure to avoid impacts on species or specific features. ▪ Compile a Rehabilitation Plan.	

	▪ Compile an Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. ▪ The footprint of the proposed road infrastructure needs to be assessed again once it is known. Where possible, this should be located along existing farm roads. ▪ Access to sensitive areas should be limited during construction. ▪ Undertake monitoring to evaluate whether further measures would be required to manage impacts.

Table 79: Rating of impacts of loss of individuals of protected plant species

IMPACT TABLE	
Environmental parameter	Protected plants, as per NEM:BA and Northern Cape Nature Conservation Act.
Issue/Impact/Environmental Effect/Nature	Loss of individuals. Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat. There are two species protected according to the National Environmental Management: Biodiversity Act, *Hoodia gordonii* and *Harpagophytum procumbens*, neither of which are considered likely to occur on site. There are a number of species that are protected according to the Northern Cape Nature Conservation Act. A number of these occur on site and there is a high probability that additional species occur there and that one or more of these species will be affected by proposed activities on site.
Extent	The impact will affect local populations or individuals of the affected species.
Probability	Based on the list of species that are protected, the impact will almost certainly happen.
Reversibility	Partly reversible. Individuals can be rescued or else cultivated to replace lost specimens.
Irreplaceable loss of resources	Marginal loss of resources could occur. The species that are likely to occur on site are likely to be relatively common throughout their range.
Duration	The impact will be medium-term.
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.
Intensity/magnitude	Low. Loss of some individuals will be insignificant compared to the number that probably occur in surrounding areas.
Significance rating	Low negative impact expected.

	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-9 (low negative)
Mitigation measures	It is possible to a limited extent to avoid some impacts on protected species for this project. The following mitigation measures would help to avoid and limit impacts: ▪ It is a legal requirement to obtain permits for specimens that will be lost. ▪ A pre-construction walk-through survey will be required during a favourable season to locate any protected plants. This survey must cover the footprint of all proposed infrastructure, including internal access roads. ▪ Plants lost to the development can be rescued and planted in appropriate places in rehabilitation areas. This will reduce the irreplaceable loss of resources as well as the cumulative effect. ▪ A Plant Rescue Plan must be compiled to be approved by the appropriate authorities. ▪ Where large populations of affected species are encountered, consideration should be given to shifting infrastructure to avoid such areas.	

Table 80: Rating of impacts of loss of individuals of protected tree species

IMPACT TABLE	
Environmental parameter	Protected trees, as per National Forests Act.
Issue/Impact/Environmental Effect/Nature	Loss of individuals. There is one protected tree species that occurs on site, Boscia albitrunca. This species is found primarily within the rocky hills, but also as lone individuals in other areas.
Extent	The impact will affect local populations or individuals of the affected species.
Probability	The impact may possibly happen.
Reversibility	Partly reversible. Individuals can be rescued or else cultivated to replace lost specimens, but this is likely to have limited value as a mitigation measure.
Irreplaceable loss of resources	Marginal loss of resources could occur. The species that are likely to occur on site are likely to be relatively common throughout their range.

Duration	The impact will be medium-term.	
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.	
Intensity/magnitude	Low. Loss of some individuals will be insignificant compared to the number that probably occur in surrounding areas.	
Significance rating	Low negative impact expected.	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-9 (low negative)
Mitigation measures	It is possible to some extent to avoid impacts on protected trees for this project. The following mitigation measures would help to avoid and limit impacts: ▪ It is a legal requirement to obtain permits for specimens that will be lost. ▪ A pre-construction walk-through survey will be required to locate any protected trees. ▪ Concentrations of plants can be avoided by shifting infrastructure components, where necessary. This will reduce the irreplaceable loss of resources as well as the cumulative effect. ▪ A Plant Rescue Plan must be compiled to be approved by the appropriate authorities.	

Table 81: Rating of impacts of damange to sensitive habitats

IMPACT TABLE	
Environmental parameter	Drainage areas, pan depressions and rocky hills
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of vegetation. There is one main drainage area, one subsidiary drainage and three small pans occurring on site. The plant species composition within these areas is different to surrounding terrestrial areas, even though the site is within an arid region. The soils within these areas are also deeper and more suitable for burrowing animals. The low, rocky hills are also considered to be of higher sensitivity than surrounding areas due to the higher species richness and higher likelihood of encountering rare and/or protected species, especially geophytes. Some loss of habitat will probably occur within these more sensitive areas.

Extent	The impact may affect drainage areas, pan depressions and rocky hills on site.	
Probability	Based on the proposed location of turbines, the impact will probably happen	
Reversibility	Irreversible in human timeframes, since natural successional processes cannot compensate for complete local loss of habitat and diversity. Secondary vegetation will probably never resemble the original vegetation found on site.	
Irreplaceable loss of resources	Significant loss of resources could occur.	
Duration	The impact will be permanent (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.)	
Cumulative effect	Medium cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of habitat.	
Intensity/magnitude	Medium. Sensitive ecosystems will probably continue to function, but in a modified way.	
Significance rating	Medium negative impact expected.	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	4	2
Reversibility	4	2
Irreplaceable loss	3	2
Duration	4	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-36 (medium negative)	-10 (low negative)
Mitigation measures	It is possible to some extent to avoid impacts on sensitive habitats for this project. The following mitigation measures would help to avoid or limit impacts: ▪ Select alternative sites for infrastructure where features of concern may be affected. ▪ Prevent erosion impacts on drainage systems. ▪ Rehabilitate disturbance as quickly as possible. ▪ Prevent invasion by alien plants. ▪ Undertake monitoring to evaluate whether further measures would be required to manage impacts.	

Table 82: Rating of impacts of mortality of populations of sedentary species

IMPACT TABLE	
Environmental parameter	Littledale's Whistling Rat and the Giant Bullfrog

Issue/Impact/Environmental Effect/Nature	Loss of individuals. There are three animal species of conservation concern that could potentially be affected by the proposed project: 1. Honey badger (NT) 2. Littledale's Whistling Rat (NT) 3. Giant Bullfrog (NT/LC) Two of these species, Littledale's Whistling Rat and the Giant Bullfrog, are relatively sedentary and therefore considered to be potentially vulnerable to habitat loss, as related to this project. The remaining species is highly mobile and will not be affected by some loss of habitat within their overall range.	
Extent	The impact will affect individuals on site and possibly in immediately surrounding areas.	
Probability	The impact may possibly happen.	
Reversibility	Partly reversible. Preventative measures could reduce mortality to below replacement levels.	
Irreplaceable loss of resources	Marginal loss of resources will occur.	
Duration	The impact will be long-term.	
Cumulative effect	Medium cumulative impact. Cumulative effects will be minor.	
Intensity/magnitude	Medium. May impact on population processes.	
Significance rating	Low negative impact expected.	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-11 (low negative)
Mitigation measures	It is possible to some extent to avoid impacts on sensitive habitats for this project. The following mitigation measures would help to avoid or limit impacts: ▪ Continue to observe on site whether either species does or could occur on site or not. ▪ If either species is found to occur on site, the habitat requirements of the species on site needs to be determined. Infrastructure must then avoid sensitive areas or else measures must be put in place to minimise impacts.	

Table 83: Rating of impacts of the displacement of individuals of mobile fauna

<table>
<tr><th colspan="3">IMPACT TABLE</th></tr>
<tr><td>Environmental parameter</td><td colspan="2">Mobile fauna of conservation concern</td></tr>
<tr><td>Issue/Impact/Environmental Effect/Nature</td><td colspan="2">Displacement of individuals. Construction activities, loss of habitat, noise, dust and general activity associated with the construction phase of the project are likely to cause all mobile species to move away from the site. Mobile species of conservation concern (two sedentary species are discussed for the previous impact) that could potentially be affected by the proposed project are as follows:
1. Honey badger (NT)

The Honey Badger is a highly mobile terrestrial species with a large home range and the ability to travel long distances in short periods of time. It may be locally displaced, but this will have little effect on the overall range of the species nor is it expected that any overall impacts will result from local displacement.</td></tr>
<tr><td>Extent</td><td colspan="2">The impact will affect individuals on site and possibly in immediately surrounding areas.</td></tr>
<tr><td>Probability</td><td colspan="2">The impact may possibly happen.</td></tr>
<tr><td>Reversibility</td><td colspan="2">Partly reversible with time.</td></tr>
<tr><td>Irreplaceable loss of resources</td><td colspan="2">No or low loss of resources will occur.</td></tr>
<tr><td>Duration</td><td colspan="2">The impact will be short-term (construction phase).</td></tr>
<tr><td>Cumulative effect</td><td colspan="2">Low cumulative impact. Cumulative effects will be minor.</td></tr>
<tr><td>Intensity/magnitude</td><td colspan="2">Low. May impact on population processes.</td></tr>
<tr><td>Significance rating</td><td colspan="2">Low negative impact expected.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td></td><td>Pre-mitigation impact rating</td><td>Post-mitigation impact rating</td></tr>
<tr><td>Extent</td><td>1</td><td>1</td></tr>
<tr><td>Probability</td><td>2</td><td>2</td></tr>
<tr><td>Reversibility</td><td>2</td><td>2</td></tr>
<tr><td>Irreplaceable loss</td><td>1</td><td>1</td></tr>
<tr><td>Duration</td><td>1</td><td>1</td></tr>
<tr><td>Cumulative effect</td><td>1</td><td>1</td></tr>
<tr><td>Intensity/magnitude</td><td>1</td><td>1</td></tr>
<tr><td>Significance rating</td><td>-8 (low negative)</td><td>-8 (low negative)</td></tr>
<tr><td>Mitigation measures</td><td colspan="2">None required</td></tr>
</table>

- Operation

Table 84: Rating of impacts of the establishment and spread of declared weeds and alien invader plants

IMPACT TABLE		
Environmental parameter	Vegetation and habitat	
Issue/Impact/Environmental Effect/Nature	Loss of habitat due to invasion by alien plants. There is a moderate possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The potential consequences may be of low seriousness for surrounding natural habitats due to the fact that little natural vegetation still remains on site. Control measures could prevent the impact from occurring.	
Extent	The impact will affect habitat on site and possibly in immediately surrounding areas.	
Probability	The impact will probably happen in the absence of control measures.	
Reversibility	Partly reversible in the absence of control measures. Completely reversible if mitigation measures applied. Preventative measures will stop the impact from occurring.	
Irreplaceable loss of resources	Marginal to significant loss of resources will occur. Uncontrolled invasion can affect all nearby natural habitats.	
Duration	The impact will be long-term.	
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.	
Intensity/magnitude	Medium. Severe invasion can alter the functioning of natural ecosystems.	
Significance rating	Low negative impact expected.	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-11 (low negative)
Mitigation measures	It is possible to avoid impacts due to alien plant invasions by undertaking the following mitigation measures: ▪ Undertake a comprehensive alien plant species survey to determine which species occur on site and where they are located.	

	▪ Compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. ▪ Undertake regular monitoring to detect alien invasions early so that they can be controlled. ▪ Implement control measures.

- Decommissioning

It is expected that the project will operate for a minimum of twenty years or more (a typical planned life-span for a project of this nature. Decommissioning will probably require a series of steps resulting in the removal of equipment from the site and rehabilitation of footprint areas. It is possible that the site could be returned to a rural nature, but it is unlikely that natural vegetation would become established at disturbed locations on site for a very long time. The reality is that it is not possible to determine at this stage whether rehabilitation measures will be implemented or not or what the future plans for the site would be nor is it possible at this stage to determine what surrounding land pressures would be. These uncertainties make it impossible to undertake any assessment to determine possible impacts of decommissioning. At best, it is recommended that a rehabilitation and closure plan be compiled and that this would be required to be implemented prior to closure of the project.

9.2.2 Avifauna

- Planning

No impacts are expected during planning.

- Construction

Table 85: Rating of impacts of displacement of priority species due to disturbance during construction phase.

IMPACT TABLE 1	
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.
Probability	Impact will certainly occur (greater than a 75% chance of occurrence) for some species, particularly the larger ones.
Reversibility	Partly 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 the construction activities, most species should re-colonise the areas which have not been

IMPACT TABLE 1		
	transformed by the footprint. However, the indirect effect of habitat fragmentation could result in lower densities of priority species.	
Irreplaceable loss of resources	Marginal loss of resources. The displacement of priority species is likely to be partial.	
Duration	Short term. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, priority species should re-colonise the areas which have not been transformed by the footprint, albeit possibly at a lower density.	
Cumulative effect	Medium cumulative impact. The priority species that occur (or are likely to occur) at the proposed site all have large distribution ranges, the cumulative impact of displacement would therefore be at most locally significant in some instances, rather than regionally or nationally significant (see also Section 9 below).	
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.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	2
Reversibility	2	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-39 (medium negative)	-18 (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. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ Implement a 3km no development buffer zone around the Verreaux's eagle nest at FP2 - 29°52'56.53"S 22°33'19.06"E.	

IMPACT TABLE 1	
	▪ Implement a 300m no development buffer zone around the Southern Pale Chanting Goshawk nest at FP3 - 29°56'34.42"S 22°32'55.35"E.

Table 86: Rating of impacts of displacement of priority species due to habitat destruction during construction phase.

IMPACT TABLE 2		
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	Partly reversible. The footprint of the wind farm is an inevitable result of the development, but it is likely that priority species will still utilise the site, albeit at lower densities.	
Irreplaceable loss of resources	Marginal loss of resources. It is likely that priority species will still utilise the site albeit at lower densities.	
Duration	Long term. The habitat transformation will be permanent	
Cumulative effect	Medium cumulative impact. There are several renewable energy developments planned around Copperton which could result in a significant area of transformed habitat at a local scale, for some species (see also Section 9 below).	
Intensity/magnitude	Medium. It is likely that priority species will still utilise the site albeit at lower densities.	
Significance Rating	Medium significance.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	3
Reversibility	2	2
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-32 (medium negative)	-30 (medium negative)

IMPACT TABLE 2	
Mitigation measures	▪ The recommendations of the specialist ecological study must be strictly adhered to. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as possible.

▪ Operation

Table 87: Rating of impacts of displacement of priority species due to disturbance during the operational phase.

IMPACT TABLE 3		
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	Probable. The impact may occur (between a 50% to 75% chance of occurrence).	
Reversibility	Partly reversible. The operational activities could cause displacement of some priority species, but the impact is likely to be much less than during the construction phase.	
Irreplaceable loss of resources	Marginal loss of resources. Habituation is likely for some species after the construction phase, especially smaller species.	
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, the cumulative impact of displacement would therefore be locally significant at most, rather than regional or national (see also Section 9 below).	
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.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2

IMPACT TABLE 3		
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-26 (low negative)	-24 (low negative)
Mitigation measures	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. Post-construction monitoring should be implemented to make comparisons with baseline conditions possible. If densities of key priority species are proven to be significantly reduced due to the operation of the wind farm, the management of the wind farm must be engaged to devise ways of reducing the impact on these species.	
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Collisions of priority species with the turbines in the operational phase	
Extent	The impact will affect the local area or district	
Probability	Definite. More than 75% chance of occurrence.	
Reversibility	Partly reversible. Mitigation measures could reduce the risk of collisions.	
Irreplaceable loss of resources	Significant loss of resources.	
Duration	Long term. The risk of collision will be present for the life-time of the development.	
Cumulative effect	Moderate cumulative impact. The cumulative impact will depend largely on which species are killed. If Verreaux's Eagles or Martial Eagles are killed, the regional impact could be significant (see also Section 9 below).	
Intensity/magnitude	Medium. The wind turbines could cause mortality of some priority species.	
Significance Rating	High significance.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	2
Reversibility	2	2
Irreplaceable loss	3	3
Duration	3	3
Cumulative effect	3	3

IMPACT TABLE 3		
Intensity/magnitude	3	2
Significance rating	-51 (high negative)	-30 (medium negative)
Mitigation measures	▪ 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 significant mortality levels at specific turbines, curtailment of these turbines should be implemented. ▪ A 200m no turbine zone is recommended around all water points. ▪ A 3km no development buffer zone is recommended around the Verreaux's Eagle nest at FP2 - 29°52'56.53"S 22°33'19.06"E. ▪ A 300m no development buffer zone is recommended around the Southern Pale Chanting Goshawk nest at FP3 - 29°56'34.42"S 22°32'55.35"E.	

- Decommissioning

The avifaunal impacts anticipated during the decommissioning phase are expected to be similar to those during the construction phase.

9.2.3 Bats

- Planning

No impacts are expected during planning.

- Construction

Table 88: Rating of Impact of the Destruction of bat roosts due to earthworks and blasting

IMPACT TABLE	
Environmental Parameter	Bat populations will be impacted upon through earthworks and blasting close to bat roosts.
Issue/Impact/Environmental Effect/Nature	Earthworks and blasting close to bat roosts will negatively affect bat populations by direct mortality and via roost destruction.
Extent	If bat roosts are found to be within the site, blasting will have a negative effect on the bat populations in the local area.
Probability	There is a reasonable probability of the impact occurring.
Reversibility	Blasting occurring at bat roosts will cause damage to the bat population in the area. Recovery of the bat population

	is possible over a longer time period, such as several generations of bat reproduction. However, loss of the physical roost will be irreversible.
Irreplaceable loss of resources	If blasting and earthworks occurs close to a bat roost, it will be destroyed and lost.
Duration	The impact will be of short duration, as blasting and earthworks will only occur during construction phase.
Cumulative effect	Moderate to high effect, as the destruction of the bat roosts impact the population numbers within a large area which in effect will impact the insect numbers.
Intensity/magnitude	Blasting of bat roosts will cause mortality to the bats inhabiting the roosts, and will negatively impact the population and ecosystem.
Significance Rating	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	4	2
Irreplaceable loss	4	2
Duration	1	1
Cumulative effect	3	1
Intensity/magnitude	4	2
Significance rating	- 68 (high negative)	- 16 (low negative)
Mitigation measures	Adhere to the sensitivity map during turbine placement and do not carry out blasting works within a delineated bat sensitivity area or buffer zone. Blasting should be minimised and used only when necessary.	

Table 89: Rating of Impact of Loss of Foraging Habitat

IMPACT TABLE	
Environmental Parameter	Loss of foraging habitat within the site boundaries.
Issue/Impact/Environmental Effect/Nature	Small areas of foraging habitat will be permanently lost by construction of turbines and access roads. Temporary foraging habitat loss will also occur during construction for storage areas and movement of heavy vehicles.
Extent	Loss of foraging habitat will be contained within the boundaries of the development site.
Probability	Definite probability

Reversibility	Depending on the degree of habitat loss, it will be partly reversed with some mitigation measures, especially in more sensitive areas. Minimal foraging habitat will be permanently lost.	
Irreplaceable loss of resources	In areas where vegetation is removed for roads and turbines, there will be a loss of habitat resources, but the scale is small.	
Duration	The impact will be of a long duration, past the operation of the development.	
Cumulative effect	Low effect, as the removal of habitat will cause a decrease in the number of bat numbers and insect numbers within the immediate area.	
Intensity/magnitude	Blasting of bat roosts will cause mortality to the bats inhabiting the roosts, and will negatively impact the population and system.	
Significance Rating	The anticipated impact will have moderate negative effects and will require mitigation measures.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	3	1
Irreplaceable loss	3	2
Duration	3	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 30 (medium negative)	- 8 (low negative)
Mitigation measures	Adhere to the sensitivity map. Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles. Keep to designated roads with all construction vehicles. Damaged areas not in use after construction should be rehabilitated by an experienced vegetation succession specialist.	

- Operation

Table 90: Rating of Impact on Bat mortalities due to direct turbine blade impact or barotrauma during foraging activities (not migration)

IMPACT TABLE	
Environmental Parameter	Impact on bat population numbers via mortalities due to direct turbine blade collision or barotrauma during foraging activities.

Issue/Impact/Environmental Effect/Nature	Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration). The concerns of foraging bats in relation to wind turbines is discussed in **Section 2.2** of the Bat Specialist Report. If the impact is too severe (e.g. in the case of no mitigation) local bat populations may not recover from mortalities.
Extent	The impact will be contained within the boundaries of the development site.
Probability	There is a definite chance of the impact occurring.
Reversibility	The impact will occur throughout the lifespan of the wind facility. Population numbers may take very long to recover. Population and diversity genetics may be permanently altered.
Irreplaceable loss of resources	Bat population numbers will decrease in the area; will take several generations to restore the population if the impact is removed.
Duration	The impact will be of long duration, past the operational phase of the development. It will take some time for the population to achieve its previous numbers after the impact.
Cumulative effect	High effect, as the decrease in bat numbers will in effect cause an increase in the number of insects in the area which changes the ecosystem of the area.
Intensity/magnitude	Very high intensity impact on the bat population numbers in the area.
Significance Rating	The anticipated impact will have highly significant effects and precise mitigations will be required to be developed over time as the wind farm operates and further data is collected.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	2
Reversibility	4	2
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	4	3
Intensity/magnitude	4	2
Significance rating	- 76 (very high negative)	- 26 (low negative)
Mitigation measures	Adhere to the sensitivity maps, avoid areas of bat sensitivity and their associated buffers. Adhere to operational mitigation measures that may be deemed necessary during the operational monitoring assessment.	

Table 91: Rating of Impact of Artificial Lighting

IMPACT TABLE		
Environmental Parameter	Impact on bat populations, foraging behaviour and diversity.	
Issue/Impact/Environmental Effect/Nature	During operation, strong artificial lights that may be used at the turbine base or immediate surrounding infrastructure, the light will attract insects and thus bats. This will significantly increase the likelihood of blade collision and barotrauma to bats foraging around such lights. Additionally, only certain species of bats will readily forage around strong lights, whereas others avoid such lights even if there is insect prey available, which can draw insect prey away from other natural areas and thereby artificially favor only certain species.	
Extent	Artificial lighting will be contained within the boundaries of the development site.	
Probability	There is a probable chance of the impact occurring.	
Reversibility	Yes, the impact is reversible.	
Irreplaceable loss of resources	No	
Duration	The impact will be of a long-term duration, the lifespan of the development. It will take some time to reverse the impact.	
Cumulative effect	During operational phase strong artificial lights used at the work environment during night time will attract insects and thereby also bats. However only certain species of bats will readily forage around strong lights, whereas others avoid such lights even if there is insect prey available. This can draw insect prey away from other natural areas and thereby artificially favour certain species, affecting bat diversity in the area.	
Intensity/magnitude	Artificial lighting in the area will change the diversity of the bat species in the area. This will negatively affect the system.	
Significance Rating	The anticipated impact will have moderate negative effects and will require mitigation measures.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	3	2

Intensity/magnitude	2	1
Significance rating	- 30 (medium negative)	- 8 (low negative)
Mitigation measures	Utilise lights with wavelengths that attract less insects (low thermal/infrared signature). If not required for safety or security purposes, lights should be switched off when not in use or equipped with passive motion sensors.	

Table 92: Rating of cumulative impact on cumulative bat mortalities due to direct blade collision or barotrauma during foraging (resident and migrating bats affected).

IMPACT TABLE	
Environmental Parameter	Bat population numbers and diversity.
Issue/Impact/Environmental Effect/Nature	Cumulative bat mortalities due to direct blade collision or barotrauma during foraging – cumulative impact (resident and migrating bats affected). Mortalities of bats due to wind turbines during foraging and migration can have significant ecological consequences as the bat species at risk are insectivorous and thereby contribute significantly to the control of nocturnal flying insects. On a wind farm specific level insect numbers in a certain habitat can increase if significant numbers of bats are killed off. But if such an impact is present on multiple wind farms in close vicinity of each other, insect numbers can increase regionally and possibly cause outbreaks of colonies of certain insect species. There is also the risk of complete loss of certain bat species from the area (namely *Tadarida aegyptiaca* and *Neoromicia capensis*).
Extent	Regional (3)
Probability	Definite (4)
Reversibility	Partly reversible (2). The impact will occur throughout the lifespan of the wind energy facility as well as other facilities in the area, therefore bat population numbers may take very long to recover. There is a higher probability for population and diversity genetics to be permanently altered in cumulative impacts.
Irreplaceable loss of resources	Significant loss of resources (3). Bat population numbers will decrease across the region, species may be lost regionally.
Duration	Long term (3). The impact will be of long duration, over the operational life span of the wind farm. It will take a significant time period for the population to achieve its previous numbers after the removal of the impact.
Cumulative effect	High cumulative impact (4). Mortalities of bats due to wind turbine collision or barotrauma during foraging and/or migration can have significant ecological consequences as the bat species at risk are insectivorous, and thereby contribute significantly to the control of nocturnal flying insects.

IMPACT TABLE		
	If large numbers of a population of a resident species are lost to this impact, it will most likely lead to destabilization of the species population and ultimately possible extinction from the area. If migrating bats are killed off it can have detrimental effects on the ecology of the caves that the specific colonies utilise. This is since bat guano is the primary form of energy input into a cave ecosystem, and no sunshine which is needed for photosynthesis exists in cave ecosystems.	
Intensity/magnitude	High (3).	
Significance Rating	The anticipated impact will have highly significant.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	3	3
Probability	4	2
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	4	3
Intensity/magnitude	3	2
Significance rating	- 57 (High negative)	- 30 (Medium negative)
Mitigation measures	Drainage areas can serve as commuting corridors for bats in the larger area, potentially lowering the cumulative effects of several WEF's in an area if the drainage areas are avoided during turbine placement and are well buffered. Also, adhere to recommended mitigation measures for this project during the operational phase study, and it is essential that project specific mitigations be applied and adhered to for each project. Adhere to the sensitivity map during any further turbine layout revisions, and avoid placement of turbines in bat sensitive areas and their buffers.	

- Decommissioning

No significant impacts have been identified for the decommissioning phase.

9.2.4 *Surface Water*

- Planning / Pre-construction

Table 93: Rating of Impacts associated with the Construction Lay-down Area directly in or in close proximity to Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Impacts associated with the construction lay-down area directly in or within close proximity to surface water resources	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Low cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the potential impact can be reduced greatly.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 22 (low negative)	- 6 (low negative)
Mitigation measures	**Location of the Lay-down Area** – The location of the lay-down area must not be within 50m of any of the identified surface water resources. Therefore, the location of the construction lay-down area must not be within any of the associated buffer zones by implication. Additionally, the storage of materials and machinery must also not be within 50m of any of the identified surface water resources. **Preventing Fire Risks** – Operational fire extinguishers are to be available in the case of a fire emergency. Given the dry seasons that the region experiences, it is recommended that a fire management and emergency	

	plan compiled by a suitably qualified health and safety officer be compiled and implemented for the proposed development.

- Construction

Table 94: Rating of Impacts for Construction Vehicle and Machinery Degradation Impacts to Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Vehicle and machinery degradation to surface water resources	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	- 26 (low negative)	- 6 (low negative)
Mitigation measures	**Preventing Physical Degradation of Surface Water Resources** – Surface water resources are to be designated as "highly sensitive areas". Vehicle access is not to be allowed in the highly sensitive areas. Internal access roads are not to be routed in any surface water resources. Should this be required, environmental authorisation and a water use license will be required before construction takes place and all mitigation measures are to be implemented accordingly.	

	Limiting Damage to Surface Water Resources – Ideally, to minimise any impact to surface water resources, the proposed development (including buildings, wind turbines and all associated infrastructure) should seek to avoid all surface water resources as far as possible. Where this is not possible a single access route or “Right of Way” (RoW) is to be established through or in the desired construction area in the surface water resource(s). The environmentally authorized and license permitted construction area is to be demarcated and made visible. The establishment of the RoW likewise must be demarcated and made visible. The width of the RoW must be limited to the width of the vehicles required to enter the surface water resource. An area around the locations of the proposed development buildings, wind turbines and any other associated infrastructure will be required in order for construction vehicles and machinery to operate/maneuver, only where required. This too must be limited to the smallest possible area and made visible by means of demarcation. Construction workers are only allowed in the designated construction areas of the proposed development and not into the surrounding surface water resources. Highly sensitive areas are to be clearly demarcated prior to the commencement of construction and no access beyond these areas is to be allowed unless in RoW areas. **Preventing Soil Contamination** – No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. Should there be any oil, fuel or any other fluid leaks, vehicles are not to be allowed into surface water resources. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas. Sufficient spill contingency measures must be available throughout the construction process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage

	areas must be bunded to prevent oil or fuel contamination of the ground and/or nearby surface water resources.

Table 95: Rating of Impacts for Human Degradation of Flora and Fauna associated with Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Human degradation to fauna and flora associated with surface water resources	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Short term*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Low*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	- 10 (low negative)	- 6 (low negative)
Mitigation measures	**Minimising Human Physical Degradation of Sensitive Areas** – Construction workers are only allowed in designated construction and RoW areas. The highly sensitive areas are to be clearly demarcated no access into these areas are to be allowed unless authorised. No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed Environmental Control Officer is to be contacted should removal of any fauna be required during the construction phase. Should dangerous/venomous snakes	

	be found, all staff must be provided with the appropriate snake handling and removal training and the necessary permits must obtained from the relevant conservation authority before any are trapped and removed from the site. No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from any surface water resource(s) where required. Temporary chemical sanitation facilities must be placed over a bunded or a sealed surface area and adequately maintained to prevent pollution impacts. No water is to be extracted unless a water use license is granted for specific quantities for a specific water resource. No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive areas. Appropriate safety measures as stipulated above must be implemented. No cement mixing is to take place in a surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the highly sensitive areas.

Table 96: Rating of Impacts for Degradation and Removal of Vegetation and Soils associated with Surface Water Resources

IMPACT TABLE	
Environmental Parameter	Surface water resources
Issue/Impact/Environmental Effect/Nature	Degradation and removal of soils and vegetation associated with surface water resources
Extent	*Site*
Probability	*Possible*
Reversibility	*Barely reversible*
Irreplaceable loss of resources	*Marginal loss of resources*

Duration	*Long term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be further reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	3	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	- 42 (medium negative)	- 6 (low negative)
Mitigation measures	**Strategic Positioning of Wind Turbines, Buildings and other Linear Infrastructure** – Preferably all wind turbines, buildings and infrastructure should be placed at least 50m from any surface water resource as far as practically possible. This will significantly reduce the potential impact on surface water resources. Where this is not possible, more intense mitigation measures will be required as stipulated below. **Obtaining Relevant Authorisations and Licenses** – Before any construction or removal of soils and vegetation in any delineated surface water resources is undertaken, the relevant water use license and environmental authorisation is to be obtained and conditions adhered to. **Limiting Damage to Surface Water Resources** – Construction must be limited to the authorized RoW areas where applicable. **Limiting Removal of Excavated Soils** – Should the necessary authorisations (water use license, environmental authorisation etc.) be obtained for the proposed development to be placed in surface water resources, excavated topsoils should be stockpiled separately from subsoils so that it can be replaced in the correct order for rehabilitation purposes post-construction. Soils removed from surface water resources must only be removed if absolutely required. Furthermore, any removed soils and vegetation that are not required should be taken	

	to a registered landfill site that has sufficient capacity to assimilate the spoil. The topsoil is to be used for rehabilitation purposes and should not be removed unless there is surplus that cannot be utilised. It is important that when the soils are re-instated, the subsoils are to be backfilled first followed by the topsoil. The topsoil contains the natural seedbank from which the affected surface water resources or the associated buffer zone can naturally rehabilitate. Where the soils are excavated from the sensitive areas, it is preferable for them to be stockpiled adjacent to the excavation pit to limit vehicle and any other movement activities around the excavation areas. **Preventing Pollution Impacts** – Any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground of the surface water resource. Importantly, no mixing of cement directly on the surface is allowed in the construction and RoW areas in surface water resources. **Protection of Stockpiled Soils** – Stockpiled soils will need to be protected from wind and water erosion. Stockpiled soils are not to exceed a 3m height and are to be bunded by suitable materials. Stacked bricks surrounding the stockpiled soils can be adopted. Alternatively, wooden planks pegged around the stockpiled soils can be used. **Rehabilitation of RoW Areas** – Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed from the surface water resource(s), and the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion until vegetation can re-establish where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped.

Table 97: Rating of Impacts for Increased Storm Water Run-off, Erosion and Sedimentation Impacts

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Increased storm water run-off, erosion and increased sedimentation impacting on surface water resources	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	- 39 (medium negative)	- 6 (low negative)
Mitigation measures	**Preventing Increased Run-off and Sedimentation Impacts** – Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future. An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas. In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the wind turbine hard stand	

	areas and building structure footprints can also be used to reduce run-off and onset of erosion. Where required more permanent structures such as attenuation ponds and gabions can be constructed if needs be, however this is unlikely given the study area. All impacted areas are to be adequately sloped to prevent the onset of erosion.

- Operation

Table 98: Rating of Impacts of Vehicle Damage to Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Vehicle damage to surface water resources	
Extent	*Local*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low negative impact.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	- 42 (medium negative)	- 8 (low negative)
Mitigation measures	**Minimising Vehicle Damage to the Surface Water Resources** – Potential impacts can be avoided by the planning and routing of access / service roads outside of and away from surface water resources. Where access through surface water resources are unavoidable and are absolutely required, it is recommended that any road plan and associated structures (such as stormwater flow pipes, culverts, culvert	

	bridges etc.) be submitted to the relevant environmental and water departments for approval prior to construction. Internal access and services roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every month. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified. Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified wetland/surface water specialist must be obtained in this respect should this be required.

Table 99: Rating of Storm-water Run-off Impacts to Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Impermeable and hardened surfaces creating accelerated run-off, consequent erosion and sedimentation	
Extent	Site	
Probability	Probable	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Marginal loss of resource	
Duration	Long term	
Cumulative effect	Medium cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3

Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (low negative)	-11 (low negative)
Mitigation measures	Any hardstand area or building within 50m proximity to a surface water resource must have energy dissipating structures in an appropriate location to prevent increased run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering adjacent areas or surface water resources.	

- Decommissioning

Should the proposed development need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Similar impacts are therefore expected to occur and the stipulated mitigation measures where relevant and appropriate must be employed as appropriate to minimise impacts.

9.2.5 Soils and Agricultural Potential

- Planning

No impacts are expected during planning.

- Construction and Operation

Table 100: Rating of impact on the loss of Agricultural Potential

IMPACT TABLE	
Environmental Parameter	*Soil resource*
Impact	*Loss of agriculturally productive land*
Extent (E)	*Site*
Probability (P)	*Possible*
Reversibility (R)	*Completely reversible*
Irreplaceable loss of resources (I)	*Marginal*

IMPACT TABLE		
Duration (D)	*Medium term*	
Cumulative effect (C)	*Low*	
Intensity/magnitude (M)	*Medium, mainly due to low prevailing agricultural potential of area*	
Significance Rating	*(E+P+R+I+D+C) x M*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-20 (low negative)	-20 (low negative)
Mitigation measures	*These would include: ensuring that the minimum area possible is set aside for the project infrastructure, so that the natural vegetation is undisturbed and grazing of livestock can continue on site post-construction.*	

Table 101: Rating of impact on wind erosion potential

IMPACT TABLE		
Environmental Parameter	*Soil resource*	
Impact	*Increased erosion of topsoil by wind*	
Extent (E)	*Local area*	
Probability (P)	*Probable*	
Reversibility (R)	*Partly reversible*	
Irreplaceable loss of resources (I)	*Marginal*	
Duration (D)	*Medium term*	
Cumulative effect (C)	*Medium, as wind-blown sediments can travel long distances*	
Intensity/magnitude (M)	*Potentially high, due to the dry climate and sandy nature of many of the topsoils in the area*	
Significance Rating	*(E+P+R+I+D+C) × M*	
	Pre-mitigation impact rating	Post mitigation impact rating

IMPACT TABLE		
Extent	2	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 45 (medium negative)	-18 (low negative)
Mitigation measures	*Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed. If bare topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilize the site until vegetation can re-establish.*	

Table 102: Rating of cumulative impacts on increased erosion of topsoil by wind

IMPACT TABLE		
Environmental Parameter	Soil resource	
Cumulative Impact	Increased erosion of topsoil by wind	
Extent (E)	Local area	
Probability (P)	Probable	
Reversibility (R)	Partly reversible	
Irreplaceable loss of resources (I)	Marginal	
Duration (D)	Medium term	
Cumulative effect (C)	Medium, as wind-blown sediments can travel long distances	
Intensity/magnitude (M)	Potentially high, due to the dry climate and sandy nature of many of the topsoils in the area	
Significance Rating	(E+P+R+I+D+C) x M	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-45 (medium negative)	-18 (low negative)

IMPACT TABLE	
Mitigation measures	Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed. If bare topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilize the site until vegetation can re-establish. In addition, regular communication between responsible officials at all sites in the vicinity is essential. Regular monitoring (at least monthly during any construction phase and approximately six-monthly thereafter is strongly recommended to pick up any potential problems before they arise.

- Decommissioning

Agricultural impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.6 Noise

- Planning

No impacts are expected during planning.

- Construction

Table 103: Rating of impact of temporary loss of "quiet" low residual noise level during construction for the residential area within the WEF boundaries

IMPACT TABLE	
Environmental Parameter	Noise
Issue/Impact/Environmental Effect/Nature	Temporary loss of “quiet” low residual noise level during construction phase for residential area within the WEF boundaries.
Extent	The impact will only affect residences on site.
Probability	Impact will likely occur.
Reversibility	Completely reversible. Construction noise ceases once infrastructure is in place.
Irreplaceable loss of resources	Marginal loss of “quiet” environment.
Duration	Short term. Construction noise ceases once infrastructure is in place.
Cumulative effect	Low cumulative impact. Construction noise ceases once infrastructure is in place.
Intensity/magnitude	High. Construction noise would intrude on residential activities during daytime.

IMPACT TABLE		
Significance Rating	Low significance.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	3	1
Significance rating	-27 (low negative)	-7 (low negative)
Mitigation measures	▪ Construct access roads to avoid vehicle movements near the farm residences. ▪ Where possible vehicles with noise reduction packages should be used ▪ Restrict the construction activities to daytime.	

- Operation

Table 104: Rating of impact on site residences during the operational life of the wind farm

IMPACT TABLE		
Environmental Parameter	Noise	
Issue/Impact/Environmental Effect/Nature	Loss of "quiet" low residual noise level for residences within the WEF boundaries for the operational life of the wind farm.	
Extent	The impact will affect residences on site.	
Probability	Impact will definitely occur.	
Reversibility	Completely reversible after decommissioning.	
Irreplaceable loss of resources	Significant loss of "quiet" environment.	
Duration	Long term. Operation noise will last for the operational life of the wind farm.	
Cumulative effect	High cumulative impact. Impact will have a significant effect on the residents.	
Intensity/magnitude	High. Operational noise would intrude on residential activities particularly during sensitive night-time.	
Significance Rating	Medium significance.	
	Pre-mitigation impact rating	Post mitigation impact rating

IMPACT TABLE		
Extent	1	1
Probability	4	2
Reversibility	1	1
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	3	1
Significance rating	-39 (medium negative)	-10 (low negative)
Mitigation measures	▪ If possible turbines should be relocated such that the distance between residences and nearest turbine is at least 3 000 m.	

It should be noted that although a 3 000 m buffer around the onsite residence could not be achieved the developer has set the turbines back 1.4km from the onsite residence in order to reduce the impact of noise. Refer to **Figure 217** for a map showing the preferred site layout and 1.4km buffer around the onsite residence.

Table 105: Rating of impacts on neighbouring residences during the operational life of the wind farm

IMPACT TABLE		
Environmental Parameter	Noise	
Issue/Impact/Environmental Effect/Nature	Disturbance of low residual noise level for the operational life of the wind farm.	
Extent	Local.	
Probability	Possible.	
Reversibility	Completely reversible after decommissioning.	
Irreplaceable loss of resources	Marginal loss of “quiet” environment.	
Duration	Long term. Operation noise will last for the operational life of the wind farm.	
Cumulative effect	Negligible	
Intensity/magnitude	Low. Operational noise might intrude on residential activities during sensitive night-time.	
Significance Rating	Medium significance.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	3	3

IMPACT TABLE		
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-22 (low negative)	-9 (low negative)
Mitigation measures	▪ If possible, relocation of turbines such that the distance between residences and nearest turbine is at least 3 000 m.	

Table 106: Rating of impacts on land adjacent to site boundaries for the operational life of the wind farm

IMPACT TABLE		
Environmental Parameter	Noise	
Issue/Impact/Environmental Effect/Nature	Loss of "quiet" low residual noise level on land beyond the WEF boundaries for the operational life of the wind farm.	
Extent	Local up to 3 500 m beyond WEF boundaries.	
Probability	Impact will definitely occur.	
Reversibility	Completely reversible after decommissioning.	
Irreplaceable loss of resources	Marginal to Significant loss of "quiet" environment.	
Duration	Long term. Operation noise will last for the operational life of the wind farm.	
Cumulative effect	High cumulative impact. Impact will have a significant effect on adjacent land.	
Intensity/magnitude	Low to High. Operational noise would intrude on adjacent land.	
Significance Rating	Low to high significance.	
	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	1	1
Intensity/magnitude	3	1
Significance rating	-42 (medium negative)	-11 (low negative)
Mitigation measures	▪ If possible relocate turbines such that distance to nearest boundary is at least 3 000 m. ▪ However, as this would prevent the development from proceeding, it is recommended that a written application for exemption of provisions of the NCR be made to the	

IMPACT TABLE	
	local authority with the due consideration and approval by all affected parties.

- Decommissioning

Noise impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.7 Visual

- Planning

No visual impacts are expected during planning.

- Construction

Table 107: Rating of visual impacts of the proposed 140MW Aletta Wind Energy Facility during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed site on gravel access roads are also expected to increase dust emissions. The increased traffic on gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. In addition, temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.
Extent	Local / District (2)
Probability	Probable (3)
Reversibility	Completely reversible (1)

Irreplaceable loss of resources	Marginal loss (2)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	Prior to mitigation measures: Low negative impact After mitigation measures: Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-24 (low negative)	-22 (low negative)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Vegetation clearing should take place in a phased manner. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads, where possible. ▪ Limit the number of vehicles and trucks travelling to and from the proposed site, where possible. ▪ Ensure that dust suppression techniques are implemented on all gravel access roads utilised during construction. ▪ Ensure that dust suppression is implemented in all areas where vegetation clearing has taken place. ▪ Ensure that dust suppression techniques are implemented on all soil stockpiles.Temporarily fence-off the construction site (for the duration of the construction period).	

** Please note in the context of the visual environment ‘resources’ are defined as scenic / natural views that are almost impossible to replace.*

Table 108: Rating of visual impacts of the infrastructure associated with the proposed 140MW Aletta Wind Energy Facility during construction

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction of the underground cables, overhead power lines (if required), on-site 132kV substation, access roads and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed site on gravel access roads are also expected to increase dust emissions. The increased traffic on the gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. In addition, temporarily stockpiling soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	
Extent	Local/district (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2

Significance rating	-22 (low negative)	-20 (low negative)
Mitigation measures	▪ Where possible all reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid, where possible. ▪ Carefully plan to reduce the construction period. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads utilised during construction.	

* Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.

- Operation

Table 109: Rating of visual impacts of the proposed 140MW Aletta Wind Energy Facility during operation

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	The proposed Aletta Wind Energy Facility could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations, such as the Nelspoortjie Karoo Guest Farm (VR 2) and the Boesmansberg Guest Farm (VR 1), to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the wind energy facility via gravel access roads and are expected to increase dust emissions in doing so. The increased traffic on the gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Security and operational lighting at the proposed wind energy facility could result in light pollution and glare, which could be an annoyance to surrounding viewers
Extent	Local/district (2)
Probability	Definite (4)
Reversibility	Irreversible (4)
Irreplaceable loss of resources	Significant (3)

Duration	Long term (3)	
Cumulative effect	High cumulative effects (4)	
Intensity/magnitude	Medium (2)	
Significance Rating	Prior to mitigation measures: Medium negative impact After mitigation measures: Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	4	3
Intensity/magnitude	2	2
Significance rating	-40 (medium negative)	-36 (medium negative)
Mitigation measures	▪ Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity. ▪ Light fittings for security at night should reflect the light toward the ground (except for aviation lighting) and prevent light spill. ▪ Turbines should be painted plain white, as this is a less industrial colour (Vissering, 2011). Bright colours or obvious logos should not be permitted. ▪ Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011). ▪ If required, turbines should be replaced with the same model, or one of equal height and scale. Repeating elements of the same height, scale and form can result in unity and lessen the visual impact that would typically be experienced in a chaotic landscapes made up of diverse colours, textures and patterns (Vissering, 2011). ▪ As far as possible, limit the number of maintenance vehicles, which are allowed to access the site. ▪ Ensure that dust suppression techniques are implemented on all access roads, utilised during operation.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

Table 110: Rating of visual impacts of the infrastructure associated with the proposed 140MW Aletta Wind Energy Facility during operation

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	The proposed underground cables, overhead power lines (if required), on-site 132kV substation, access roads and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptors to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the infrastructure associated with the wind energy facility via gravel access roads and are expected to increase dust emissions in doing so. The increased traffic on the gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Security and operational lighting at the associated infrastructure could result in light pollution and glare, which could be an annoyance to surrounding viewers	
Extent	Local / District (2)	
Probability	Probable (3)	
Reversibility	Irreversible (4)	
Irreplaceable loss of resources	Marginal loss (2)	
Duration	Long term (3)	
Cumulative effect	Medium cumulative effect (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	4	4
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-34(medium negative)	-28 (low negative)

Mitigation measures	▪ Light fittings for security at the on-site 132kV substation at night should reflect the light toward the ground and prevent light spill. ▪ The operations and maintenance buildings should not be illuminated at night, if possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads, utilised during operation. ▪ Select the alternatives that will have the least impact on visual receptors (refer to **Section 5** of the Visual Specialist Report).

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

- Decommissioning

It is imperative that once the wind energy facility is no longer operational, that the turbines and other associated infrastructure be removed, and the site be reclaimed and rehabilitated. The visual impacts anticipated during the decommissioning phase are potentially similar to those during the construction phase.

9.2.8 Heritage and Palaeontology

It is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some heritage sites.

The impact assessment conducted for heritage sites assumes the possibility of finding heritage resources during the project life and has been conducted as such.

- Planning

No impacts are expected during planning.

- Construction

Table 111: Rating of impacts – Palaeontology

IMPACT TABLE	
Environmental Parameter	Palaeontological sensitive rock formations

Issue/Impact/Environmental Effect/Nature	The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group. The allocation of a Moderate sensitivity for Palaeontological Heritage to the entire study area except the two historic spring sites indicates that the EAP must be aware of the Very High point sources of Groundwater Heritage and it is recommended for practical reasons that the layout of the distribution of the wind generators be moved away from the five spring sites with a "No-Go" zone of at least 500m from each of the sites. Although the Uitdraai Formation can provide new information on micro-fossils of Mokolian age, these fossils are very difficult to identify and are more of academic interest. Both the Dwyka Group and Gordonia Formations are however known for some very significant fossil finds and although scarce, the fossils can contribute significantly to our understanding of depositional environments during the Carboniferous, Permain and Quaternary ages in South Africa. It is recommended that the EAP and the ECO be informed of these fossils assemblages known from these groups of rocks and to be aware of the possible presence of the fossils during exposure of rock during the construction phase of this project.	
Extent	Localised to deep excavations into bedrock	
Probability	A possibility of encountering fossils exist	
Reversibility	Fossils are none renewable.	
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	The loss of the fossil record will be permanent	
Cumulative effect	Medium cumulative impact over the site	
Intensity/magnitude	Magnitude of the impact pre-mitigation is rated as High negative however the implementation of the recommended mitigation measures changes this to a Low magnitude of impact.	
Significance Rating	High negative before mitigation and low negative after mitigation for both the expanded and the constrained layout.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	3
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4

Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	-51 (high negative)	-15 (low negative)
Mitigation measures	▪ The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged. ▪ The two historic spring sites indicated on the Palaeontological sensitivity map and database is of extreme importance as Geological Heritage appoints and these points must for at least 500m around them be declared "No-Go" zones. ▪ The recommendations must be included in the EMPr of the project.	

Table 112: Rating of Impacts – Archaeological resources

IMPACT TABLE	
Environmental Parameter	*Stone Age find spots and Sites*
Issue/Impact/Environmental Effect/Nature	*Two types of archaeological finds have been identified during the fieldwork. Find spots that were rated as having low archaeological significance and archaeological sites rated as having medium to high archaeological significance.* *All the identified find spots could be impacted by construction activities however the impact is seen as negligible. None of the archaeological site identified will be impacted directly by any of the proposed layouts except for ALE3, which is of a low impact. It must be noted however, that this entire farm is abundant with stone age remains and in the time allocated it was not possible to locate all of them. A medium impact rating is given with the implementation of a precautionary mitigation measures.*
Extent	*Localised*
Probability	*Probable*
Reversibility	*Non- renewable.*

Irreplaceable loss of resources	*Archaeological sites are irreplaceable*	
Duration	*Permanent*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Negative medium impact before mitigation and low negative after mitigation.*	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	3	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-40 (Negative Medium Impact	-16 (Low negative
Mitigation measures	▪ *A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be.* ▪ *Sites Ale 4 and Ale 36 must be monitored during construction, as they are close to turbine construction activities.* ▪ *Monitor find spot areas if construction is going to take place through them.* ▪ *A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase.*	

Table 113: Rating of impacts – Historical / Recent history

IMPACT TABLE	
Environmental Parameter	*Historical structures and cemeteries*
Issue/Impact/Environmental Effect/Nature	*The historical sites and cemeteries are mostly localised in the southwestern part of the study area away from the proposed development. With the exception of ALE38 which is in the northern corner.*
Extent	*Localised*
Probability	*Possible*

Reversibility	*Non- renewable.*	
Irreplaceable loss of resources	*Archaeological sites are irreplaceable*	
Duration	*Permanent*	
Cumulative effect	*Low*	
Intensity/magnitude	*Medium*	
Significance Rating	*Negative medium impact before mitigation and low negative after mitigation.*	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-34 (Negative medium impact)	-16 (Low negative)
Mitigation measures	▪ *Demarcate sites as no-go areas.* ▪ *Demarcate and fence during construction if construction activities area to happened within 100 meters from a site.* ▪ *Monitor find spot areas if construction is going to take place through them.* ▪ *A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.* ▪ *Adjust the development layout (where possible) and demarcate the gravesites with at least a 5-10-meter buffer.* ▪ *In the event that the sites cannot be excluded from the development footprint a grave relocation process as described in Appendix A of this reports needs to be implemented.*	

Table 114: Rating of impacts - Chance finds

IMPACT TABLE	
Environmental Parameter	*Unidentified heritage structures*
Issue/Impact/Environmental Effect/Nature	*Due to the size of the area assessed and the design process requiring fieldwork before identification of the layout. The possibility of encountering heritage features in unsurveyed areas does exist.*
Extent	*Localised and in most cases no more than 1000m^2*

Probability	*Probable*	
Reversibility	*Heritage resources are non-renewable.*	
Irreplaceable loss of resources	*A brief description of the degree in which irreplaceable resources are likely to be lost*	
Duration	*Permanent*	
Cumulative effect	*Medium*	
Intensity/magnitude	*Medium*	
Significance Rating	*Medium negative before mitigation and low negative after mitigation for both the expanded and the constrained layout.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	2	1
Significance rating	-34 (Medium negative)	-17 (Low negative)
	Post mitigation impact rating	
Mitigation measures	▪ *A walk down of the final approved layout will be required before construction commence;* ▪ *Any heritage features of significance identified during this walk down will require formal mitigation, permits if required or where possible a slight change in design could accommodate such resources.* ▪ *A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.*	

- Operation

Table 115: Rating of impacts - Cumulative

IMPACT TABLE	
Environmental Parameter	Heritage Resources
Issue/Impact/Environmental Effect/Nature	The extent that the addition of this project will have on the overall impact of developments in the region on heritage resources
Extent	Regional

Probability	Possible
Reversibility	Non- renewable.
Irreplaceable loss of resources	The nature of heritage resources are that they are non-renewable. The proper mitigation and documentation of these resources can however preserve the data for research
Duration	Permanent
Cumulative effect	It is my considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.
Intensity/magnitude	Medium
Significance Rating	Negative medium impact before mitigation and low negative after mitigation.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-38 (Negative medium impact)	-18 (Low negative)
Mitigation measures	It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "S*AHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area*."	

- Decommissioning

Heritage impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.9 Socio-economic

- Planning

No impacts are expected during planning.

- Construction

Table 116: Rating of impacts of loss of agricultural land during construction

IMPACT TABLE		
Environmental Parameter	Loss of land which is currently used for grazing.	
Issue/Impact/Environmental Effect/Nature	The physical space required for the wind turbines will lead to a permanent loss of grazing land.	
Extent	The impact is only expected to affect the site.	
Probability	Land loss will definitely occur to accommodate the wind turbine. (greater than 75% chance).	
Reversibility	The impact is expected to be partly reversible following decommissioning and rehabilitation.	
Irreplaceable loss of resources	There will be a marginal loss of resources, that is, the loss of grazing land a part of the facility's footprint and no other land loss beyond that.	
Duration	The landowners will not be able to uses the land on which the towers will be erected for the duration of the construction (24 months) and operation (20-25 years) phases. The impact will therefore, be long-term.	
Cumulative effect	The cumulative effect associated with loss of agricultural land will be notable considering the approved development of other renewable energy projects, particularly solar PV.	
Intensity/magnitude	The intensity will be low as only a small portion of the grazing land will be lost to the wind farm.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-13	-13
Mitigation measures	▪ The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure. ▪ Consultation with the directly affected and adjacent land owners must be on-going to limit the effect on productive agricultural land.	

Table 117: Rating of impacts of disruption of farming activities due to construction related activities

IMPACT TABLE		
Environmental Parameter	Farming activities my need to be halted on the directly affected farm portions during construction.	
Issue/Impact/Environmental Effect/Nature	The activities associated with the construction phase such as establishment of road infrastructure, movement of heavy vehicles and preparation of foundations for the wind facility and power lines will disrupt the farming activities.	
Extent	The impact is only expected to occur at site level.	
Probability	The impact will probably occur (between 50% to 75% chance).	
Reversibility	The impact is completely reversible with minor mitigation required.	
Irreplaceable loss of resources	There will be no production losses experienced by the affected farmers.	
Duration	The interruption will be experienced during the construction phase; therefore, the impact will be short-term.	
Cumulative effect	Although there are numerous renewable energy projects already approved for the area, the development of these projects I likely to be taking place at different time than the proposed project. This suggests that the cumulative effect on operations of the local agricultural activities will be limited.	
Intensity/magnitude	Although some sections of the farms will be affected, grazing activities will be able to continue unabated. The intensity will be low.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-8	-8
Mitigation measures	▪ The footprint associated with construction related activities facility and all associated infrastructure must be minimised. ▪ Construction vehicles should only access the construction site via demarcated access roads and should not be allowed to cut across farms or vacant (agricultural) land. ▪ The project developers and affected land owners should discuss and agree on appropriate construction procedures, which will minimise disruption of current faming activities.	

Table 118: Rating of impacts of temporary employment creation during construction

IMPACT TABLE		
Environmental Parameter	Creation of temporary employment opportunities.	
Issue/Impact/Environmental Effect/Nature	The project will create approximately 128 job opportunities at peak construction. 40% (about 51 positions) of the available employment opportunities will be made available to the local community.	
Extent	Employment will be created at all levels depending on availability of required skills, but will largely create benefits at the local level.	
Probability	The impact will probably occur (between 50% and 75% chance of occurrence).	
Reversibility	Once construction is over the jobs created will cease, therefore the impact is completely reversible	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Short-term – the impact and its effects will disappear once the construction period is over.	
Cumulative effect	The impact could contribute towards a significant cumulative effect since temporary job opportunities on offer will increase and be available over longer time periods as the construction of the various facilities will not be taking place at the same time.	
Intensity/magnitude	There will be 51 job opportunities available to the local community during the construction phase. Given the size of the local community the intensity will be low.	
Significance rating	Prior to mitigation measures: Positive low After mitigation measures: Positive low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	4	4
Intensity/magnitude	1	1
Significance rating	12	12
Mitigation measures	▪ Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted community. ▪ Where feasible, training and skills development programmes targeted at the locals should be initiated prior to commencement of the construction phase. ▪ Establish if a skills database exists within the local area; if so, it should be made available to contractors - information sharing will ensure that the proposed development is understood, enabling those individuals with fitting skills, if any,	

	to make their services and/or knowledge available to the project proponent. ▪ If no database exists, set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community which will assist in recruiting local labour during both construction and operation. ▪ The recruitment process should promote gender equality.

Table 119: Rating of impact of loss of farm labour to the construction phase

IMPACT TABLE		
Environmental Parameter	Recruitment of farm labourers for construction work.	
Issue/Impact/Environmental Effect/Nature	Farm workers may be tempted to resign from their permanent positions on the farms in favour of the short-term (more highly paid) employment created by the construction phase.	
Extent	The impact will affect the local area and will not be limited only to the site	
Probability	The impact could possibly occur (between 25% and 50% chance of occurrence).	
Reversibility	The impact is partly reversible – some workers could be re-employed by farmers once construction is over.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Short-term – the impact and its effects will disappear once the construction period is over.	
Cumulative effect	The proposed establishment of a number of renewable energy projects could lead to notable losses in farm labour in the area and potentially impact the agricultural activities within the area.	
Intensity/magnitude	Low intensity considering the number of farm employees within the vicinity of the project.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	1	1
Significance rating	-11	-10
Mitigation measures	▪ When hiring, the EPC contractor should enquire about current or previous employment and avoid employing farm workers, where feasible. ▪ When hiring, the EPC contractor should inform all potential job seekers and candidates that construction work will be	

	temporary and also warned of the potential negative consequences, e.g. loss of permanent employment. ▪ Liaison between the EPC contractor and farmers is necessary to prevent losses in farm labour and to identify the severity of the impact of farm operations.

Table 120: Rating of impacts on skills development and training during construction

IMPACT TABLE		
Environmental Parameter	Skills development: employment creation gives way to a host of skills transfer and development opportunities in terms of honing an existing skill or acquiring a new skill.	
Issue/Impact/Environmental Effect/Nature	Employed individuals will benefit from on-the-job training and experience.	
Extent	The impact will affect the local community.	
Probability	The impact may occur (between 25% and 50% chance of occurrence), as one cannot be certain that people gaining employment during the construction phase will be able to develop or acquire new skills.	
Reversibility	The effect of the impact (increased experience and knowledge) is unlikely to be reversed.	
Irreplaceable loss of resources	The impact will not result in any loss of resources	
Duration	Permanent – knowledge and experience cannot be considered to stop over a certain period, the effect of the impact will continue indefinitely.	
Cumulative effect	A significant cumulative effect could result since temporary job opportunities on offer will increase and be available over longer time periods as the construction of the various facilities will not be taking place at the same time. Individuals will work and gain experience for longer periods, or more local community members will gain employment.	
Intensity/magnitude	Medium impact on local employees' skills - 11.5% of the adult population in the Siyathemba LM had no education at all, while 64% have primary or secondary education and only 5.5% have higher educational qualifications.	
Significance rating	Prior to mitigation measures: Positive medium After mitigation measures: Positive medium	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	3
Reversibility	3	3
Irreplaceable loss	1	1
Duration	4	4
Cumulative effect	4	4
Intensity/magnitude	2	2
Significance rating	32	34

Mitigation measures	Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted community. Knowledge sharing and on-the-job training should be promoted by the developer among the appointed contractors and, where feasible, viewed as a prerequisite for securing contracts related to the project.

Table 121: Rating of impacts on health during construction

IMPACT TABLE		
Environmental Parameter	Health impacts associated with influx of workers and job-seekers during construction.	
Issue/Impact/Environmental Effect/Nature	The adverse impacts on community health associated with the proposed project.	
Extent	The impact will affect the local community	
Probability	The impact will possibly occur (between 25% and 50% chance of occurrence).	
Reversibility	This impact is barely reversible. The spread of STDs, effects of domestic violence, and unwanted pregnancies will have a lasting negative impact on the community.	
Irreplaceable loss of resources	The impact will not affect resources.	
Duration	The health impacts related to the construction phase are expected to occur over the short-term. Some of the effects however, could be long-lasting, e.g. in the case of HIV/AIDS.	
Cumulative effect	The cumulative effect associated with the adverse health impacts, which could be created by the other related projects is notable.	
Intensity/magnitude	The intensity will be low. The impact is not expected to be wide-spread given the small-scale of these additional activities; however, the negative effects could be significant and long lasting.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	3	2
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-12	-11
Mitigation measures	▪ Raising awareness among construction workers on health issues, including HIV/AIDS. ▪ Make condoms available to employees and all contractor workers for free.	

	▪ Developing a Code of Conduct for all employees related to the project, which includes no tolerance of activities such as alcohol and drug abuse. ▪ A Monitoring Forum (MF) should be created between the parties of interest who are directly and indirectly impacted by the project.

Table 122: Rating of impacts on social relations during construction

IMPACT TABLE		
Environmental Parameter	Conflicts may result between job seekers/construction workers and the local community, as well as develop between private landowners and the project proponent.	
Issue/Impact/Environmental Effect/Nature	Conflict situations that can delay the project and prolong the duration of impacts.	
Extent	The impact will affect the local community.	
Probability	The impact could possibly occur (between 25% and 50% chance of occurrence).	
Reversibility	The conflicts, which might ensue are for most parts completely reversible if they can be resolved.	
Irreplaceable loss of resources	The impact will not result in loss of resources.	
Duration	Conflict situations for the most part will be limited to the construction phase.	
Cumulative effect	Although conflict situations relating to one project might be insignificant, issues might persist or be intensified with the development of other renewable projects such that the local community as a whole can start resenting such activities.	
Intensity/magnitude	The impacts will be for most part of medium intensity.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	1
Reversibility	2	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-22	-18
Mitigation measures	▪ Locals should be informed upfront about employment opportunities so that there are no unrealistic expectations on the part of the community. ▪ The project proponent should attempt to resolve issues and concerns, which they are made aware of immediately. If this is not possible, this should be communicated to the landowner	

	along with a plan on how and when the problem will be addressed. ▪ The Code of Conduct should be used as a set of regulations to be followed to reduce the risk of conflict.

Table 123: Rating of impact on safety and security during construction

IMPACT TABLE		
Environmental Parameter	Increased safety and security risk to farmers, their properties, guests and local residents.	
Issue/Impact/Environmental Effect/Nature	Potential risk to the safety and security of farm workers and residents, guests of local tourism facilities, and personal property of farmers posed by the presence of construction workers on site and job seekers.	
Extent	The impact will affect the local area or district.	
Probability	The impact will likely occur (between 50% and 75% chance of occurrence)	
Reversibility	The impact is partly reversible – farmers can be compensated for losses or damage.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources.	
Duration	The impact might continue even after the construction phase as job seekers might stay on.	
Cumulative effect	The development of at least four projects preceding the proposed Aletta Wind Facility is likely to create high expectations among job seekers from all parts of the country and intensify the influx of people and, as a result, increase the risks to personal safety and security.	
Intensity/magnitude	The impacts will be for most parts of medium intensity.	
Significance rating	Prior to mitigation measures: Negative medium After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	2	1
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-28	-22
Mitigation measures	▪ Ensure clear communication of the project information and effective public participation processes to minimise the influx of migrant job seekers. ▪ Movement of construction workers on and off site must be closely monitored and managed. ▪ Prior construction, rules and regulations regarding presence of construction workers on site need to be devised in	

	consultation with the land owners of directly affected and adjacent properties. ▪ During construction the rules and regulations must be clearly communicated to all workers, personal property must be respected and avoided. ▪ Manage workers to ensure that they are only on site during the reasonable working hours.

Table 124: Rating of impacts of the temporary increase in production and Gross Domestic Product during construction

IMPACT TABLE		
Environmental Parameter	Temporary increase in production. Economic production can be defined as an activity that uses inputs of varied nature to produce goods and services.	
Issue/Impact/Environmental Effect/Nature	The impact takes place due to the investment on the project that will be spent in the country. Besides the direct impact, it involves the indirect and induced effects that are also created. It is expected that approximately R2.6 billion of CAPEX will be spent in South Africa.	
Extent	Considering the specialised nature of most of the goods and services required it is likely that a large portion of this will be sourced from outside the local community and the province in general. Therefore, the impact will affect the entire country.	
Probability	The impact will probably occur (50% to 75% chance of occurrence).	
Reversibility	The impact is completely reversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources	
Duration	Short term: the impact will continue for the duration of the construction period.	
Cumulative effect	The impact could result in a significant cumulative impact. The national economy will be stimulated by the various investments. At the same time, the local economy may be able to achieve the economies of scale required for the development of a local support industry, increasing the benefit to the local economy.	
Intensity/magnitude	High, the investment value is considerably high.	
Significance rating	Prior to mitigation measures: Positive medium After mitigation measures: Positive medium	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	4	4
Intensity/magnitude	3	3

Significance rating	42	42
Mitigation measures	▪ Where possible and feasible, local procurement of labour, goods, and services must be practiced to maximise the benefit to the local economy.	

Table 125: Rating of impact of temporarily increased traffic and the impact on road infrastructure during construction

IMPACT TABLE		
Environmental Parameter	Impact of movement of heavy vehicles during construction on road infrastructure and road safety.	
Issue/Impact/Environmental Effect/Nature	Potential noise, dust, safety and road quality risks associated with the movement of heavy vehicles during construction.	
Extent	The impact will affect the local area/district.	
Probability	The impact is likely to occur.	
Reversibility	The impact is partly reversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	The impact will last for the duration of the construction period.	
Cumulative effect	The impact will result in significant cumulative effects.	
Intensity/magnitude	The quality and use of roads will be slightly modified and affected hence the impact will be of medium intensity.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	4	4
Intensity/magnitude	2	1
Significance rating	-26	-12
Mitigation measures	▪ Damage caused to local farm roads by construction related activities must be repaired by the project proponent. ▪ Dust suppression measures must be implemented. ▪ Appropriate signage must be put up for traffic control and road safety. ▪ Engage with local municipality to discuss the potential impact on local road quality and the possible mitigation measures.	

Table 126: Increased demand for social facilities during construction

IMPACT TABLE	
Environmental Parameter	Increased pressure on existing social infrastructure.
Issue/Impact/Environmental Effect/Nature	If unmanaged, expectations about job opportunities during the construction of the proposed project may attract numerous

	migrant workers. The result will be increased pressure on the local social facilities.	
Extent	The impact will affect the local area.	
Probability	The impact will likely occur (between 50% and 75% chance of occurrence).	
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Medium term, the effect may last slightly longer than the construction phase since some migrant job seekers could linger in the area.	
Cumulative effect	The impact could result in a significant cumulative impact. As more projects are approved, the job creation during construction of the projects will increase. At the same time, the construction is not likely to all take place at the same time, increasing the length of the impact by acting as motivation for migrants to remain in the area longer in hopes of finding employment.	
Intensity/magnitude	Rated as medium, considering that there are no significant existing challenges experienced by the area.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	4	4
Intensity/magnitude	2	1
Significance rating	-28	-13
Mitigation measures	▪ Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities, local authorities and local land owners. ▪ Ongoing consultation with the municipality to prepare local authorities for the activity and the increase demands for public services and affordable housing that may result from this.	

Table 127: Rating of impact on service delivery during construction

IMPACT TABLE	
Environmental Parameter	Increased demand for basic services and affordable accommodation.
Issue/Impact/Environmental Effect/Nature	If unmanaged, expectations about job opportunities during the construction of the proposed project may attract numerous migrant workers. The result will be increased pressure on the local authorities' ability to adequately provide basic services.

Extent	The impact will affect the local area.	
Probability	The impact will likely occur (between 50% and 75% chance of occurrence).	
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Medium term, the effect may last slightly longer than the construction phase since some migrant job seekers could linger in the area.	
Cumulative effect	The impact could result in a significant cumulative impact. As more projects are approved, the job creation during construction of the projects will increase. At the same time, the construction is not likely to all take place at the same time, increasing the length of the impact by acting as motivation for migrants to remain in the area longer in hopes of finding employment.	
Intensity/magnitude	Rated as medium, considering that there are no significant existing challenges experienced by the area.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	4	4
Intensity/magnitude	2	1
Significance rating	-28	-13
Mitigation measures	▪ Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities and local authorities. ▪ Ongoing consultation with the municipality to prepare local authorities for the activity and the increase demands that may result from this. ▪ Establish a health facility for the duration of the construction period to provide services to the construction crew and alleviate pressure on the local facilities.	

Table 128: Rating of impacts of the temporary increase in household disposable income during construction

IMPACT TABLE	
Environmental Parameter	Temporary increase in the household income of members employed during the construction phase.
Issue/Impact/Environmental Effect/Nature	The impact takes place during construction as a result of jobs created through direct, indirect and induced impacts.

Extent	An estimated minimum of 51 households in the Siyathemba LM may temporarily benefit from an increase in disposable income directly as a result of the proposed development. About 77 of the employment opportunities will be filled by people from outside the local area, and even the province. It follows that an increase in household income will take place along the same geographical boundaries as employment creation.	
Probability	The impact will most likely occur (between 50% and 75% chance of occurrence).	
Reversibility	The impact is completely reversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Short term, the increased disposable income will disappear once the construction is completed.	
Cumulative effect	The impact could result in a significant cumulative impact. As more projects are approved, the job creation during construction of the projects will increase. At the same time, the construction is not likely to all take place at the same time, increasing the length of the impact. The benefitting households will benefit for longer or more households will benefit.	
Intensity/magnitude	Considering the total income to be earned by individuals and consequently households directly benefitting from the construction phase project, i.e. about R41 million, the impact is considered to be of medium intensity.	
Significance rating	Prior to mitigation measures: Positive low After mitigation measures: Positive low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	4	4
Intensity/magnitude	2	2
Significance rating	28	28
Mitigation measures	▪ Where possible, local labour should be used during the construction activities. ▪ When feasible local procurement of goods and services should be implemented to further increase the benefit to the local community.	

Table 129: Rating of impact of a temporary increase in tax revenue for government during construction

IMPACT TABLE	
Environmental Parameter	Increase in government revenue.
Issue/Impact/Environmental Effect/Nature	The project proponent will have to pay taxes such as income taxes and payroll taxes. It cannot be said with certainty how this income

	will be distributed and spent; however, the government will no doubt utilise it to better service provision somewhere in South Africa.	
Extent	The impact will affect the entire country	
Probability	The impact will most likely occur (between 50% and 75% chance of occurrence).	
Reversibility	The impact is completely reversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Short term, the increase in government revenue linked to the construction of the facility will cease once construction is completed.	
Cumulative effect	The impact could result in a significant cumulative impact.	
Intensity/magnitude	The project will make a small contribution to the national revenue, hence the intensity rating is low.	
Significance rating	Prior to mitigation measures: Positive low After mitigation measures: Positive low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	13	13
Mitigation measures	No mitigation measures exist.	

- Operation

Table 130: Rating of impact of loss of agricultural land during operations

IMPACT TABLE	
Environmental Parameter	Loss of land which is currently used for grazing.
Issue/Impact/Environmental Effect/Nature	The physical space required for the wind turbines will lead to a permanent loss of grazing land.
Extent	The impact is only expected to affect the site.
Probability	Land loss will definitely occur to accommodate the wind turbine. (greater than 75% chance).
Reversibility	The impact is expected to be partly reversible following decommissioning and rehabilitation.
Irreplaceable loss of resources	There will be a marginal loss of resources, that is, the loss of grazing land a part of the facility's footprint and no other land loss beyond that.
Duration	The landowners will not be able to uses the land on which the towers will be erected for the duration of the construction (24

	months) and operation (20-25 years) phases. The impact will therefore, be long-term.	
Cumulative effect	The cumulative effect associated with loss of agricultural land will be notable considering the approved development of other renewable energy projects, particularly solar PV.	
Intensity/magnitude	The intensity will be low as only a small portion of the grazing land will be lost to the wind farm.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-13	-13
Mitigation measures	▪ The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure. ▪ Consultation with the directly affected and adjacent land owners must be on-going to limit the effect on productive agricultural land.	

Table 131: Rating of impact of sustainable employment during operation

IMPACT TABLE	
Environmental Parameter	Creation of long-term employment opportunities.
Issue/Impact/Environmental Effect/Nature	The project will create approximately 39 new job opportunities during its operational period. Approximately 60% (about 23 positions) of the available employment opportunities will be made available to the local community.
Extent	Employment will be created at all levels depending on availability of required skills.
Probability	The impact will probably occur (between 50% and 75% chance of occurrence).
Reversibility	The impact is completely reversible.
Irreplaceable loss of resources	The impact will not result in any loss of resources.
Duration	This impact is considered long-term since it will last for at least the lifespan of the project.
Cumulative effect	There are a number of planned renewable energy developments in the area, which will start operations in different periods. In the context of the local economy, where the unemployment rate measures at 24.7%, the envisaged 39 permanent employment opportunities together with permanent jobs created at other

	facilities (solar PV and wind) could create a notable cumulative effect, as they will increase the intensity of the impact.	
Intensity/magnitude	There will be 39 sustainable employment opportunities available to during operations - the intensity will therefore be low.	
Significance rating	Prior to mitigation measures: Positive low After mitigation measures: Positive low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	13	13
Mitigation measures	▪ Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted community. ▪ Continuous skills and development training will equip low-skilled labourers with experience and advanced skills to work on other future renewable energy projects within the area, thus creating long-term employment for the foreseeable future.	

Table 132: Rating of impact on skills development and training during operations

IMPACT TABLE	
Environmental Parameter	Skills development: employment creation gives way to a host of skills transfer and development opportunities in terms of honing an existing skill or acquiring a new skill.
Issue/Impact/Environmental Effect/Nature	Permanently employed individuals (39) will benefit from on-the-job training and experience. No certainty exists at this stage, but the project proponent could initiate skills development as a part of the Enterprise Development and Social Development requirement.
Extent	It is envisaged that the benefits will be limited to the local area.
Probability	The impact could possibly occur – one cannot be certain that people gaining employment during the operational phase will be able to develop or acquire new skills (between 25% and 50% chance of occurrence).
Reversibility	The effect of the impact (increased experience and knowledge) is unlikely to be reversed.
Irreplaceable loss of resources	The impact will not result in any loss of resources
Duration	Permanent – knowledge and experience cannot be considered to stop over a certain period, the effect of the impact will continue indefinitely.

Cumulative effect	The impact could contribute towards a notable cumulative effects due to the approval of another four renewable energy projects in the area.	
Intensity/magnitude	An impact is rated as being of low intensity due to the fact that the number of permeant jobs created is limited and that it is doubtful at this stage that the envisaged number of locals will benefit from the employment opportunities and subsequently skills development.	
Significance rating	Prior to mitigation measures: Positive low After mitigation measures: Positive low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	16	17
Mitigation measures	▪ Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted community. ▪ Research should be undertaken to determine the viability of a skills development programme as a part of the Enterprise Development and Social Development initiatives that will have to be implemented by the project proponent.	

Table 133: Rating of impact on change in the sense of place

IMPACT TABLE	
Environmental Parameter	Negative impact on sense of place in the area.
Issue/Impact/Environmental Effect/Nature	The impact on sense of place could be experienced by residents, workers, the R2257 road users, and tourists visiting the area who will not value the change to the area.
Extent	The impact will affect the local area or district.
Probability	The impact will definitely occur.
Reversibility	This impact would be completely reversible when the plant is decommissioned.
Irreplaceable loss of resources	The impact will result in marginal loss of resources.
Duration	The impact will last for the entire project life; hence it will be long term.
Cumulative effect	The cumulative impact on the sense of place could be significant, since at least four other renewable energy projects will be built in the area by the time the proposed Wind Facility is constructed.
Intensity/magnitude	The intensity will be low – none of the farmers interviewed pointed out that the project would create negative impacts on their sense

	of place. There is no significant tourist activity currently taking place.	
Significance rating	Prior to mitigation measures: Negative low After mitigation measures: Negative low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	4	4
Intensity/magnitude	1	1
Significance rating	-16	-16
Mitigation measures	▪ Adhere to the mitigation measures recommended by the visual, noise, and air quality specialists; this will limit the negative impact on sense of place of the directly and indirectly affected community members.	

Table 134: Rating of impacts of the temporary increase in production and Gross Domestic Product during operation

IMPACT TABLES		
Environmental Parameter	Sustainable increase in production. Economic production can be defined as an activity that uses inputs of varied nature to produce goods and services.	
Issue/Impact/Environmental Effect/Nature	The impact results from operation of the proposed facility, as well as procurement of goods and services required for its sustainable operations and creation of sustainable employment opportunities through direct and indirect effects.	
Extent	The national economy will experience an increase in production.	
Probability	The impact will probably occur (50% to 75% chance of occurrence).	
Reversibility	The impact is irreversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources	
Duration	This impact is rated as long-term since it will be experienced over the entire operational life of the project.	
Cumulative effect	The impact could result in a significant cumulative impact. The national economy will be stimulated by the various investments.	
Intensity/magnitude	The direct impact associated with the project will lead to the change in the local economy's structure; therefore, resulting in a medium intensity.	
Significance rating	Prior to mitigation measures: Positive medium After mitigation measures: Positive medium	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3

Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	4	4
Intensity/magnitude	2	2
Significance rating	34	34
Mitigation measures	▪ Where possible and feasible, local procurement of labour, goods, and services must be practiced to maximise the benefit to the local economy.	

Table 135: Rating of impact of a sustainable increase in household disposable income during operations

IMPACT TABLE		
Environmental Parameter	Sustainable increase in the household income of individuals involved in the activities associated with the operational phase of the facility.	
Issue/Impact/Environmental Effect/Nature	It is expected that the households benefitting will experience an increase in income as a result of the sustainable jobs created through the operation of the wind farm directly and its multiplier effects.	
Extent	Local, since the jobs will be created locally.	
Probability	The impact will most likely occur (between 50% and 75% chance of occurrence).	
Reversibility	The impact is irreversible – income received during operations cannot be undone.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	This impact is rated as long-term since it will be experienced over the entire operational life of the project.	
Cumulative effect	The impact could result in a significant cumulative impact. As more projects are approved, the job creation during operations of the projects will increase. At the same time, the developments are unlikely to become fully operational at the same time, increasing the length of the impact. The benefitting households will benefit for longer or more households will benefit.	
Intensity/magnitude	Considering the total income to be earned by individuals and consequently households directly benefitting from the operation phase project, i.e. ~R9.6 million per annum, the impact is considered to be of medium intensity.	
Significance rating	Prior to mitigation measures: Positive medium After mitigation measures: Positive medium	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3

Cumulative effect	4	4
Intensity/magnitude	2	2
Significance rating	34	34
Mitigation measures	▪ Where possible, local labour should be used during the construction activities. ▪ When feasible local procurement of goods and services should be implemented to further increase the benefit to the local community.	

Table 136: Rating of impact on property values and desirability of property

IMPACT TABLE		
Environmental Parameter	Property prices and the desirability of property in the project vicinity.	
Issue/Impact/Environmental Effect/Nature	Establishment of the facility could increase the demand for real estate and positively impact on the property values in the area.	
Extent	The impact on property prices resulting from the operation of the wind energy facility will occur at the local level.	
Probability	The impact could possibly occur (between 25% and 50% chance of occurrence).	
Reversibility	Reversible.	
Irreplaceable loss of resources	The impact will not result in loss of resources.	
Duration	Medium-term, the impact is likely to last longer than construction influenced by developments in the area.	
Cumulative effect	The impact could result in a notable cumulative impact given the number of similar facilities planned in the area.	
Intensity/magnitude	The intensity could reach medium levels.	
Significance rating	Prior to mitigation measures: Positive low After mitigation measures: Positive low	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	11	11
Mitigation measures	▪ It is recommended that in order to curb the increase in property prices in the area, proper planning concerning accommodation of the construction crew is done. ▪ Aim to hire as many people from the local community as possible to limit the increase in demand for accommodation.	

Table 137: Rating of impact of an increase in tax revenue for government durng operations

IMPACT TABLE		
Environmental Parameter	Increase in government revenue.	
Issue/Impact/Environmental Effect/Nature	The project proponent will have to pay taxes such as local taxes and rates, and income taxes and payroll taxes. Local taxes and rates will increase the revenue of the local government, while the income taxes and payroll taxes will become part of the national fiscus. It cannot be said with certainty how this income will be applied; however, the government will no doubt utilise it to better service provision somewhere in South Africa.	
Extent	The impact will affect the entire country	
Probability	The impact will most likely occur (between 50% and 75% chance of occurrence).	
Reversibility	The impact is reversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Long term, the impact and its effects will last and continue for the operational span of the project.	
Cumulative effect	The impact could result in a significant cumulative impact.	
Intensity/magnitude	The project will make a notable contribution to the national revenue, hence the intensity rating is moderate.	
Significance rating	Prior to mitigation measures: Positive medium After mitigation measures: Positive medium	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	30	30
Mitigation measures	No mitigation measures exist.	

- Decommissioning

Socio-economic impacts stimulated during the decommissioning phase are expected to be similar to those that take place during the construction phase.

9.2.10 Traffic

- Planning

No impacts are expected during planning.

- Construction

Table 138: Rating of impact of long distance route

IMPACT TABLE		
Environmental Parameter	A wind energy facility is to be constructed in the Northern Cape Province. This will have an impact on the haulage routes to site as well as the local traffic and the community.	
Issue/Impact/Environmental Effect/Nature	The trips generated by the delivery of wind turbine components to site are insignificant when compared to the ADT of the immediate road network as it does not affect and/or change the current Level of Service provided that the abnormal vehicle create passing opportunities on a regular basis.	
Extent	Province / region (3)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Low cumulative effect (2)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	3	1
Probability	3	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-22 (low negative)	-6 (low negative)
Mitigation measures	The majority of the haulage routes are single carriage ways which may result in light vehicles not able to pass the abnormal load vehicles. Mitigation measures to be put in place will be for	

	the trucks to stop at regular intervals to allow queuing vehicles to pass.

Table 139: Rating of impacts on intersections

IMPACT TABLE		
Environmental Parameter	A wind energy facility is to be constructed in the Northern Cape Province. This will have an impact on the haulage routes to site as well as the local traffic and the community.	
Issue/Impact/Environmental Effect/Nature	The intersections will be temporary blocked, but will be of short duration and will not affect the LOS in any significant way. Traffic will be allowed to pass the abnormal load vehicle to minimize the queuing lengths.	
Extent	Local / district (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Low cumulative effect (2)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-20 (low negative)	-6 (low negative)
Mitigation measures	Traffic at intersections along the chosen haulage route will be affected, but only for a short duration. To accommodate for this, once the abnormal load vehicle has turned, traffic will be allowed to pass and subsequently reducing queuing lengths.	

Table 140: Rating of impacts on local traffic

IMPACT TABLE		
Environmental Parameter	A wind energy facility is to be constructed in the Northern Cape Province. This will have an impact on the haulage routes to site as well as the local traffic and the community.	
Issue/Impact/Environmental Effect/Nature	The chances of local traffic being adversely affected by the construction traffic are considered extremely low.	
Extent	Site (1)	
Probability	Possible (2)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Negligible cumulative effect (1)	
Intensity/magnitude	Low (1)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-7 (low negative)	-6 (low negative)
Mitigation measures	Since the abnormal load vehicles will avoid towns along the chosen haulage route, the effect on local traffic is negligible and no mitigation measures are needed.	

Table 141: Rating of impacts on the community

IMPACT TABLE	
Environmental Parameter	A wind energy facility is to be constructed in the Northern Cape Province. This will have an impact on the haulage routes to site as well as the local traffic and the community.
Issue/Impact/Environmental Effect/Nature	The construction of the wind energy facility will have a definite positive impact on the communities in the surrounding areas of the site.
Extent	Local / district (2)

Probability	Definite (4)	
Reversibility	Partly reversible (2)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	High cumulative effect (4)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low positive impact **After mitigation measures:** N/A	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	N/A
Probability	4	N/A
Reversibility	2	N/A
Irreplaceable loss	1	N/A
Duration	1	N/A
Cumulative effect	4	N/A
Intensity/magnitude	2	N/A
Significance rating	+28 (low positive)	N/A
Mitigation measures	Mitigation measures are not applicable	

- Operation

The noise impacts associated with the operational phase are not considered to be significant enough to warrant an impact rating.

- Decommissioning

Noise impacts associated with the decommissioning phase are expected to be similar to those that take place during the construction phase.

10 SPECIALIST RECOMMENDATIONS AND MITIGATION MEASURES

10.1 Mitigation Measures

10.1.1 Biodiversity

Mitigation measures

- **Rehabilitation Programme**

A Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.

- **Restrict access to sensitive areas**

Impacts should be restricted to within the development footprint and disturbance of surrounding areas should be avoided or minimised. Sensitive habitats in close proximity to construction activities / sites should be fenced off or marked to indicate that they are No-Go areas.

- **Locate internal roads judiciously to avoid sensitivities**

No internal road layout plan has been provided for assessment. It is assumed that this will be planned once the final location of turbines has been determined. If possible, roads should be located as close as possible to existing farm roads to minimise disturbance of natural areas. They should not cross sensitive habitats, if possible, or do this as little as possible.

- **Botanical walk-through survey**

This is a requirement only to ensure legal compliance. A pre-activity walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. If possible, areas of concentrations of species of concern should be avoided, i.e. if such concentrations are identified in the field, infrastructure components should be shifted to accommodate them.

- **Obtain permits for protected plants**

It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants.

- **Search and rescue**

Search and rescue operation of all listed species within the activity footprint. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held GPS device. The plants must be planted into a container to be housed within a temporary nursery on site or immediately planted into the target habitat. If planted into natural habitat, the position must be marked to aid in future monitoring of that plant. Rescued plants housed in temporary nursery may be used in one of two ways: (1) transplanted into suitable natural habitats near to where they were rescued, or (2) used for replanting in rehabilitation areas. Receiver sites must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.

- **Alien plant management plan**

It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures.

- **Undertake regular monitoring**

Monitoring should be undertaken to evaluate the success of mitigation measures.

10.1.2 Avifauna

- Restrict the construction activities to the construction footprint area.
- Do not allow any access to the remainder of the property during the construction period.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Implement a 3km no development buffer zone around the Verreaux’s eagle nest at FP2 - 29°52'56.53"S 22°33'19.06"E.
- Implement a 300m no development buffer zone around the Southern Pale Chanting Goshawk nest at FP3 - 29°56'34.42"S 22°32'55.35"E.
- The recommendations of the specialist ecological study must be strictly adhered to.
- 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.
- Post-construction monitoring should be implemented to make comparisons with baseline conditions possible.
- If densities of key priority species are proven to be significantly reduced due to the operation of the wind farm, the management of the wind farm must be engaged to devise ways of reducing the impact on these species.
- 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 significant mortality levels at specific turbines, curtailment of these turbines should be implemented.
- A 200m no turbine zone is recommended around all water points.

10.1.3 Bats

- The bat sensitivity map should be used as a pre-construction mitigation in terms of improving turbine placement with regards to bat preferred habitats on site.
- Adhere to the sensitivity map during turbine placement and do not carry out blasting works within a delineated bat sensitivity area or buffer zone.
- Blasting should be minimised and used only when necessary.
- Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles.
- Keep to designated roads with all construction vehicles.
- Damaged areas not in use after construction should be rehabilitated by an experienced vegetation succession specialist.
- Avoid areas of bat sensitivity and their associated buffers.
- Turbines within or close to the moderate bat sensitivity areas must acquire priority (not excluding all other turbines) during pre/post-construction studies.
- The high bat sensitivity areas should be classified as 'no-go' areas and turbines must not be placed in these areas and their buffers.
- In the case of a migratory event, a mitigation schedule will be drawn up specifically for the event.
- Valley areas can serve as commuting corridors for bats in the larger area, potentially lowering the cumulative effects of several WEF's in an area if the valley areas are avoided during turbine placement and are well buffered.
- Utilise lights with wavelengths that attract less insects (low thermal/infrared signature). If not required for safety or security purposes, lights should be switched off when not in use or equipped with passive motion sensors.
- The correct placement of wind farms and of individual turbines can significantly lessen the impacts on bat fauna in an area, and should be considered as the preferred option for mitigation.
- If found to be required, mitigation should be applied during the peak activity periods and times, and when the advised wind speed and temperature ranges are prevailing simultaneously (considering conditions in which 80% of bat activity occurred).
- Where mitigation by location is not possible, other options that may be utilised include curtailment, blade feathering, blade lock, acoustic deterrents or light lures.

Curtailment:

Curtailment is defined as the act of limiting the supply of electricity to the grid during conditions when it would normally be supplied. This is usually accomplished by locking or feathering the turbine blades.

Cut-in speed:

The cut-in speed is the wind speed at which the generator is connected to the grid and producing electricity. For some turbines, their blades will spin at full or partial RPMs below cut-in speed when no electricity is being produced.

Feathering or Feathered:

Adjusting the angle of the rotor blade parallel to the wind, or turning the whole unit out of the wind, to slow or stop blade rotation. Normally operating turbine blades are angled almost perpendicular to the wind at all times.

Free-wheeling:

Free-wheeling occurs when the blades are allowed to rotate below the cut-in speed or even when fully feathered and parallel to the wind. In contrast, blades can be “locked” and cannot rotate, which is a mandatory situation when turbines are being accessed by operations personnel.

Increasing cut-in speed:

The turbine’s computer system (referred to as the Supervisory Control and Data Acquisitions or SCADA system) is programmed to a cut-in speed higher than the manufacturer’s set speed, and turbines are programmed to stay locked or feathered at 90° until the increased cut-in speed is reached over some average number of minutes (usually 5 – 10 min), thus triggering the turbine blades to pitch back “into the wind” and begin to spin normally and produce power.

Blade locking or feathering that renders blades motionless below the manufacturers cut in speed, and don’t allow free rotation without the gearbox engaged, is more desirable for the conservation of bats than allowing free rotation below the manufacturer’s cut in speed. This is because bats can still collide with rotating blades even when no electricity is being produced.

Acoustic deterrents:

Are a developing technology and will need further investigation closer to time of wind farm operation, opportunities to test such devices may be available during operation of the facility.

Light lures:

Refer to the concept where strong lights are placed on the periphery (or only a few sides) of the wind farm to lure insects and therefore bats away from the turbines. However, the long term effects on bat populations and local ecology of this method is unknown.

Habitat modification:

With the aim of augmenting bat habitat around the wind farm in an effort to lure bats away from turbines, is not recommended. Such a method can be adversely intrusive on other fauna and flora and the ecology of the areas being modified. Additionally, it is unknown whether such a method may actually increase the bat numbers of the broader area, causing them to move into the wind farm site due to resource pressure.
Currently the most effective method of mitigation, after correct turbine placement, is alteration of blade speeds and cut-in speeds under environmental conditions favourable to bats.

A basic "6 levels of mitigation" (by blade manipulation or curtailment), from light to aggressive mitigation is structured as follows:

1. No curtailment (free-wheeling is unhindered below manufacturer’s cut in speed so all momentum is retained, thus normal operation).
2. Partial feathering (45-degree angle) of blades below manufacturer’s cut-in speed in order to allow the free-wheeling blades half the speed it would have had without feathering (some momentum is retained below the cut in speed).
3. Ninety degree feathering of blades below manufacturer’s cut-in speed so it is exactly parallel to the wind direction as to minimize free-wheeling blade rotation as much as possible without locking the blades.

4. Ninety degree feathering of blades below manufacturer's cut-in speed, with partial feathering (45-degree angle) between the manufacturer's cut-in speed and mitigation cut-in conditions.
5. Ninety degree feathering of blades below mitigation cut in conditions.
6. Ninety degree feathering throughout the entire night.

- The blades of all turbines of the Aletta WEF must be feathered below manufacturers cut in speed as to not allow for free-wheeling from 1 November to 31 March.
- If elevated bat mortalities are found during the operational monitoring, mitigation measures may need to be implemented as outlined in **Table 142**. The affected turbines to which such mitigation may apply are 18, 28, 33, 34, 38, 41, 48 and 49.
- Actual impacts on bats will be monitored during the operational phase monitoring, and the recommended mitigation measures and levels of curtailment will be adjusted according to the results of the operational monitoring.

Additional Mitigation Measures for Cumulative Impacts

The final pre-construction bat monitoring reports of Copperton WEF and Garop WEF call for curtailment to mitigate bat mortalities during an ecological phenomenon that was identified to cause large increases in bat activity. Peak annual rainfall usually occurs within the months of November to March, which stimulates a mass emergence of insects which in turn causes an influx of insectivorous bats into the area. This phenomenon is generally initiated by the first instance of 7.5mm rain per week.

The blades of all turbines of the Aletta WEF must be feathered below manufacturers cut in speed as to not allow for free-wheeling from 1 November to 31 March. Bat activity is markedly higher over low wind speed periods. Preventing free-wheeling should not affect energy production significantly and will be a significant bat conservation mitigation measure.

Based on accepted threshold levels effective at the time of decision making during the operational phase, and only if elevated bat mortalities are found during the operational monitoring, the following **Table 142** serves as a guideline of mitigation measures that may need to be implemented in such a case. The affected turbines to which such mitigation may apply are 18, 28, 33, 34, 38, 41, 48 and 49.

Table 142: A guideline to the times of implementation of mitigation measures that may be required if found to be necessary during operational monitoring (considering more than 80% bat activity, normalised data).

Terms of mitigation implementation	
Peak activity (times to implement curtailment/ mitigation)	15 October – 30 November (or after the first instance of 7.5mm rain per week), over the time of sunset – 02:00
Environmental conditions in which to implement curtailment/ mitigation	Wind speed below 7.5m/s *And simultaneously* Temperature above 16°C

Autumn peak activity (times to implement curtailment/ mitigation)	01 – 31 January (or after the first instance of 7.5mm rain per week), over the time of sunset – 03:00
Environmental conditions in which to implement curtailment/ mitigation	Wind speed below 9.0m/s *And simultaneously* Temperature above 17.5°C

If found to be required, the mitigation must be applied during the peak activity periods and times, and when the advised wind speed and temperature ranges are prevailing simultaneously (considering conditions in which 80% of bat activity occurred). Bat activity at 80m height were used, with wind speed data at 79.6 m and temperature data at 4.5 meters.

10.1.4 Surface Water

- **Location of the Lay-down Area –** The location of the lay-down area must not be within 50m of any of the identified surface water resources. Therefore, the location of the construction lay-down area must not be within any of the associated buffer zones by implication. Additionally, the storage of materials and machinery must also not be within 50m of any of the identified surface water resources.

- **Preventing Fire Risks –** Operational fire extinguishers are to be available in the case of a fire emergency. Given the dry seasons that the region experiences, it is recommended that a fire management and emergency plan compiled by a suitably qualified health and safety officer be compiled and implemented for the proposed development.

- **Preventing Physical Degradation of Surface Water Resources –** Surface water resources are to be designated as "highly sensitive areas". Vehicle access is not to be allowed in the highly sensitive areas. Internal access roads are not to be routed in any surface water resources. Should this be required, environmental authorisation and a water use license will be required before construction takes place and all mitigation measures are to be implemented accordingly.

- **Limiting Damage to Surface Water Resources –** Ideally, to minimise any impact to surface water resources, the proposed development (including buildings, wind turbines and all associated infrastructure) should seek to avoid all surface water resources as far as possible. Where this is not possible a single access route or "Right of Way" (RoW) is to be established through or in the desired construction area in the surface water resource(s). The environmentally authorized and license permitted construction area is to be demarcated and made visible. The establishment of the RoW likewise must be demarcated and made visible. The width of the RoW must be limited to the width of the vehicles required to enter the surface water resource. An area around the locations of the proposed development buildings, wind turbines and any other associated infrastructure will be required in order for construction vehicles and machinery to operate/maneuver, only where required. This too must be limited to the smallest possible area and made visible by means of demarcation.

  Construction workers are only allowed in the designated construction areas of the proposed development and not into the surrounding surface water resources. Highly sensitive areas are to be clearly demarcated prior to the commencement of construction and no access beyond these areas is to be allowed unless in RoW areas.

- **Preventing Soil Contamination –** No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. Should there be any oil, fuel or any other fluid leaks, vehicles are not to be allowed into surface water resources.

  All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas.

  Sufficient spill contingency measures must be available throughout the construction process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage areas must be bunded to prevent oil or fuel contamination of the ground and/or nearby surface water resources.

- **Minimising Human Physical Degradation of Sensitive Areas** – Construction workers are only allowed in designated construction and RoW areas. The highly sensitive areas are to be clearly demarcated no access into these areas are to be allowed unless authorised.

  No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed Environmental Control Officer is to be contacted should removal of any fauna be required during the construction phase. Should dangerous/venomous snakes be found, all staff must be provided with the appropriate snake handling and removal training and the necessary permits must obtained from the relevant conservation authority before any are trapped and removed from the site.

  No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from any surface water resource(s) where required. Temporary chemical sanitation facilities must be placed over a bunded or a sealed surface area and adequately maintained to prevent pollution impacts.

  No water is to be extracted unless a water use license is granted for specific quantities for a specific water resource.

  No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive areas. Appropriate safety measures as stipulated above must be implemented.

  No cement mixing is to take place in a surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the highly sensitive areas.

- **Strategic Positioning of Wind Turbines, Buildings and other Linear Infrastructure** – Preferably all wind turbines, buildings and infrastructure should be placed at least 50m from any surface water resource as far as practically possible. This will significantly reduce the potential impact on surface water resources. Where this is not possible, more intense mitigation measures will be required as stipulated below.

- **Obtaining Relevant Authorisations and Licenses** – Before any construction or removal of soils and vegetation in any delineated surface water resources is undertaken, the relevant water use license and environmental authorisation is to be obtained and conditions adhered to.

- **Limiting Damage to Surface Water Resources** – Construction must be limited to the authorized RoW areas where applicable.

- **Limiting Removal of Excavated Soils** – Should the necessary authorisations (water use license, environmental authorisation etc.) be obtained for the proposed development to be placed in surface water resources, excavated topsoils should be stockpiled separately from subsoils so that it can be replaced in the correct order for rehabilitation purposes post-construction. Soils removed from surface water resources must only be removed if absolutely required. Furthermore, any removed soils and vegetation that are not required should be taken to a registered landfill site that has sufficient capacity to assimilate the spoil. The topsoil is to be used for rehabilitation purposes and should not be removed unless there is surplus that cannot be utilised. It is important that when the soils are re-instated, the subsoils are to be backfilled first followed by the topsoil. The topsoil contains the natural seedbank from which the affected surface water resources or the associated buffer zone can naturally rehabilitate.

  Where the soils are excavated from the sensitive areas, it is preferable for them to be stockpiled adjacent to the excavation pit to limit vehicle and any other movement activities around the excavation areas.

- **Preventing Pollution Impacts** – Any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground of the surface water resource. Importantly, no mixing of cement directly on the surface is allowed in the construction and RoW areas in surface water resources.

- **Protection of Stockpiled Soils** – Stockpiled soils will need to be protected from wind and water erosion. Stockpiled soils are not to exceed a 3m height and are to be bunded by suitable materials. Stacked bricks surrounding the stockpiled soils can be adopted. Alternatively, wooden planks pegged around the stockpiled soils can be used.

- **Rehabilitation of RoW Areas** – Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed from the surface water resource(s), and the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion until vegetation can re-establish where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped.

- **Preventing Increased Run-off and Sedimentation Impacts** – Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future.

  An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.

  In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian “sausage” nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the wind turbine hard stand areas and building structure footprints can also be used to reduce run-off and onset of erosion. Where required more permanent structures such as attenuation ponds and gabions can be constructed if needs be, however this is unlikely given the study area. All impacted areas are to be adequately sloped to prevent the onset of erosion.

- **Minimising Vehicle Damage to the Surface Water Resources** – Potential impacts can be avoided by the planning and routing of access / service roads outside of and away from surface water resources.

  Where access through surface water resources are unavoidable and are absolutely required, it is recommended that any road plan and associated structures (such as stormwater flow pipes, culverts, culvert bridges etc.) be submitted to the relevant environmental and water departments for approval prior to construction.

  Internal access and services roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every month. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified.

  Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified wetland/surface water specialist must be obtained in this respect should this be required.

- Any hardstand area or building within 50m proximity to a surface water resource must have energy dissipating structures in an appropriate location to prevent increased run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example).

  Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering adjacent areas or surface water resources.

- Other recommendations include the following:
  - All surface water resources and buffer zones must be avoided as far as practically possible;

- Where it is not possible to avoid impacting on the identified surface water resources, the relevant environmental authorisation and water use license must be applied for.

10.1.5 Soils and Agricultural Potential

- Ensure that the minimum area possible is set aside for the project infrastructure, so that the natural vegetation is undisturbed and grazing of livestock can continue on site post-construction.
- Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed.
- If bare topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilise the site until vegetation can re-establish.
- Regular communication between responsible officials at all sites in the vicinity is essential.
- Regular monitoring (at least monthly during any construction phase and approximately six-monthly thereafter is strongly recommended to pick up any potential problems before they arise.

10.1.6 Noise

- Construct access roads to avoid vehicle movements near the farm residences.
- Where possible, vehicles with noise reduction packages should be used.
- Restrict the construction activities to daytime.
- The only practical means of mitigating the noise impact would be to increase the separation distance between wind energy turbines and the WEF boundaries and between the turbines and noise sensitive receptors.
- In order to reduce the intensity of noise impact on the farm residences within the WEF boundaries to Low would require a minimum distance of 3 000 m between the residences and any turbine.
- Construction of a new road and site works should take place at least 1 000 m from the residences.
- No mitigation would be required for the identified neighbouring residences at locations L3 and L4. However, in order to reduce the intensity of noise impact on adjacent land to Low would require a setback distance of at least 3 000 m between turbines and boundary.
- In order to legally comply with the NCR the wind turbines would need to be relocated with a minimum distance of 2 600 m from any boundary. However, as this would prevent the development from proceeding, it is recommended that a written application for exemption of provisions of the NCR be made to the local authority with the due consideration and approval by all affected parties.

10.1.7 Visual

- Carefully plan to reduce the construction period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Vegetation clearing should take place in a phased manner.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.
- Limit the number of vehicles and trucks travelling to and from the proposed site, where possible.
- Ensure that dust suppression techniques are implemented on all gravel access roads.
- Ensure that dust suppression is implemented in all areas where vegetation clearing has taken place.

- Ensure that dust suppression techniques are implemented on all soil stockpiles.
- Where possible, re-vegetate all reinstated cable trenches with the same vegetation that existed prior to the cable being laid.
- Temporarily fence-off the construction site (for the duration of the construction period).
- Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity.
- Light fittings for security at night should reflect the light toward the ground (except for aviation lighting) and prevent light spill.
- As far as possible, limit the amount of security and operational lighting present on site.
- Turbines should be painted plain white, as this is a less industrial colour (vissering, 2011). Bright colours or obvious logos should not be permitted.
- Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011).
- If required, turbines should be replaced with the same model, or one of equal height and scale. Repeating elements of the same height, scale and form can result in unity and lessen the visual impact that would typically be experienced in a chaotic landscape made up of diverse colours, textures and patterns (Vissering, 2011).
- As far as possible, limit the number of maintenance vehicles, which are allowed to access the site.
- Ensure that dust suppression techniques are implemented on all access roads utilised during operation.
- The operations and maintenance (O&M) buildings should not be illuminated at night.
- Light fittings for security at the on-site 132kV substation at night should reflect the light toward the ground and prevent light spill.
- Bury cables under the ground where possible.
- The O&M buildings should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.
- Select the alternatives that will have the least impact on visual receptors

10.1.8 Heritage and Palaeontology

Pre-Construction

- A detailed walk down of the final approved layout will be required before construction commence;
- Any heritage features of significance identified during this walk down will require formal mitigation, permits if required or where possible a slight change in design could accommodate such resources.
- A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.
- Archaeology

Palaeontology

- The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged.

- The two historic spring sites indicated on the Palaeontological sensitivity map is of extreme importance as Geological Heritage points and these points must for at least 500m around them be declared "No-Go" zones.
- The recommendations must be included in the EMPr of the project.

Archaeological Sites

- A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be.
- Sites Ale 4 and Ale 36 must be monitored during construction, as they are close to turbine construction activities.
- Demarcate and fence during construction if construction activities are within 100 meters from a site.
- Monitor find spot areas if construction is going to take place through them.
- A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase.

Historical Sites

- Demarcate sites as no-go areas
- Demarcate and fence during construction if construction activities area to happened within 100 meters from a site.
- A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

Grace Sites and Cemeteries

- Adjust the development layout (where possible) and demarcate the grave sites with at least a 5-10-meter buffer.
- In the event that the sites cannot be excluded from the development footprint a grave relocation process as described in Appendix A of this reports needs to be implemented

Cumulative Impact

- It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.

10.1.9 Socio-economic

- The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure.
- Consultation with the directly affected and adjacent land owners must be on-going to limit the effect on productive agricultural land.
- The footprint associated with construction related activities facility and all associated infrastructure must be minimised.

- Construction vehicles should only access the construction site via demarcated access roads and should not be allowed to cut across farms or vacant (agricultural) land.
- The project developers and affected land owners should discuss and agree on appropriate construction procedures, which will minimise disruption of current faming activities.
- Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted community.
- Where feasible, training and skills development programmes targeted at the locals should be initiated prior to commencement of the construction phase.
- Establish if a skills database exists within the local area; if so, it should be made available to contractors - information sharing will ensure that the proposed development is understood, enabling those individuals with fitting skills, if any, to make their services and/or knowledge available to the project proponent.
- If no database exists, set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community which will assist in recruiting local labour during both construction and operation.
- The recruitment process should promote gender equality.
- When hiring, the EPC contractor should enquire about current or previous employment and avoid employing farm workers, where feasible.
- When hiring, the ECP contractor should inform all potential job seekers and candidates that construction work will be temporary and also warned of the potential negative consequences, e.g. loss of permanent employment.
- Liaison between the EPC contractor and farmers is necessary to prevent losses in farm labour and to identify the severity of the impact on operations.
- Continuous skills and development training will equip low-skilled labourers with experience and advanced skills to work on other future renewable energy projects within the area, thus creating long-term employment if the foreseeable future.
- Knowledge sharing and on-the-job training should be promoted by the developer among the appointed contractors and, where feasible, viewed as a prerequisite for securing contracts related to the project.
- Research should be undertaken to determine the viability of a skills development programme as a part of the Enterprise Development and Social Development initiatives that will have to be implemented by the project proponent.
- Raising awareness among construction workers on health issues, including HIV/AIDS.
- Make condoms available to employees and all contractor workers for free.
- Developing a Code of Conduct for all employees related to the project, which includes no tolerance of activities such as alcohol and drug abuse.
- A Monitoring Forum (MF) should be created between the parties of interest who are directly and indirectly impacted by the project.
- Locals should be informed upfront about employment opportunities so that there are no unrealistic expectations on the part of the community.
- The project proponent should attempt to resolve issues and concerns, which they are made aware of immediately. If this is not possible, this should be communicated to the landowner along with a plan on how and when the problem will be addressed.
- The Code of Conduct should be used as a set of regulations to be followed to reduce the risk of conflict.
- Ensure clear communication of the project information and effective public participation processes to minimise the influx of migrant job seekers.
- Movement of construction workers on and off site must be closely monitored and managed.

- Prior construction, rules and regulations regarding presence of construction workers on site need to be devised in consultation with the land owners of directly affected and adjacent properties.
- During construction the rules and regulations must be clearly communicated to all workers, personal property must be respected and avoided.
- Manage workers to ensure that they are only on site during the reasonable working hours.
- Adhere to the mitigation measures recommended by the visual, noise, and air quality specialists; this will limit the negative impact on sense of place of the directly and indirectly affected community members.
- Where possible and feasible, local procurement of labour, goods, and services must be practiced to maximise the benefit to the local economy.
- Damage caused to local farm roads by construction related activities must be repaired by the project proponent.
- Dust suppression measures must be implemented.
- Appropriate signage must be put up for traffic control and road safety.
- Engage with local municipality to discuss the potential impact on local road quality and the possible mitigation measures.
- Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities, local authorities and local land owners.
- Ongoing consultation with the municipality to prepare local authorities for the activity and the increase demands for public services and affordable housing that may result from this.
- Establish a health facility for the duration of the construction period to provide services to the construction crew and alleviate pressure on the local facilities.
- Where possible, local labour should be used during the construction activities.
- When feasible local procurement of goods and services should be implemented to further increase the benefit to the local community.
- It is recommended that in order to curb the increase in property prices in the area, proper planning concerning accommodation of the construction crew is done.
- Aim to hire as many people from the local community as possible to limit the increase in demand for accommodation.

10.1.10 Traffic

- The transport route must be cleared prior to the transport activities taking place.
- All relevant permits must be obtained prior to the transport activities taking place.
- Queuing vehicles must be allowed to pass the abnormal load vehicles at regular intervals as needed.
- The abnormal load vehicles should under no circumstances travel in groups of two or more trucks.
- Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period as well as on the National Road N10.
- The existing gravel track off the R357 which will be used to access the site will need to be upgraded and extended and suitably maintained.
- Re-gravel the site access road as a maintenance measure, from time to time, throughout the operational life of the plant.
- Should damage be caused by the transport vehicles along the site access road, it should be assessed and mitigating maintenance should be initiated.

10.1.11 Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)

The mitigation principles are shown in **Table 143** below:

Table 143: Mitigation Principles

Principle	Solution	Comment
Cable emissions (DM)	Shield wires	Can be implemented by using metal wiring ducts with duct cover (Par 13.1 of the Electromagnetic Interference Path Loss and Risk Assessment Specialist Report). Although not designed for shielding, the shielding effectiveness could be enough for this application. Shielded flexible conduits can be used to terminate onto duct end covers for cable exits and onto the receiving end. (Par 13.2 of the Electromagnetic Interference Path Loss and Risk Assessment Report (Including Emission Control Plan)
	Control loop areas	By using the closed metal wiring duct and bonding them to earth, the loop area between cables and ground plane is reduced.
Cable emissions (CM)	Ferrites and absorbers	Ferrite loaded sleeve to convert common mode currents to heat
	Control loop areas	By using the closed metal wiring duct and bonding them to earth, the loop area between cables and ground plane is reduced
Enclosure Radiation	Improve shielding • EMC Gaskets • Conductive viewing aperture • Cooling aperture shield	

<u>Shielding of Base to Nacelle Cables</u>

- Aluminium (fixed) and copper (flexible) rotor cables will be replaced by shielding cables.
- Shields connected to earth.
- Termination on gland plate.

<u>Absorption of Common Mode Currents</u>

- Absorption of common mode currents.

- Ferrites will be installed in the cables going out from the Top controller cabinet and from the ground controller. The number and location to be defined in further updates of the control plan on completion of the controller cabinet tests.

Nacelle Cable Installation

- Ethernet cable will be replaced by CAT7 cables.
- All cable trays will be metallic and of a closed type.
- The rest of the cables will be shielded and the shield will be correctly connected to earth.

Top Controller Enclosure

- The top controller cabinet will be redesigned. The current design does not have an EMI gasket and does not provide contact surfaces to retrofit with a conductive gasket. The emissions from the top controller cabinet will be mitigated according to a mitigation Action Plan. The objective is to reduce the emissions from the current configuration with 40dB. The new shielded enclosure will be tested using the IEEE 299 as guideline. The current top controller will be tested in an accredited EMC Test laboratory to confirm the extent of mitigation required. Mitigation measures will then be applied and the effectiveness will be confirmed in the laboratory.

Lighting

- Fluorescent lights in the tower and nacelle will be replace by LED. By implementing the suggested mitigation measures, the impact on the SKA project will be reduced. Where possible, the mitigation measures will be verified by means of laboratory tests.
- To prevent an impact on the SKA Project, Biotherm Energy has reviewed the facility lay-out to increase the distance from the closest turbine to the closest SKA infrastructure from 20km to 25km. The number of turbines has also been reduced from the initial 125 turbines to 60 turbines.

Tests at the New Site

- To verify overall windfarm emissions, ambient measurements should be done at the new site before construction starts. Tests points should be carefully selected based on test equipment sensitivity with the objective to observe the increase in ambient emissions as construction progresses.

Final Site Tests

- Final site tests will be done on completion of the project and results should be compared to results in Par 11 of the Electromagnetic Interference Path Loss and Risk Assessment Report to prove the effectiveness of the mitigation techniques applied to the turbine.
- Although not anticipated, proper mitigation measures on identified emitters will be studied and implemented if final test shows emissions exceeding the SKA threshold.

11 CUMULATIVE IMPACTS

The area has seen a notable interest from developers of various renewable energy projects, which could be associated with the wind and solar energy resource potential found in the region, proximity to the existing sub-station and its evacuation capacity, as well as other factors. Such developments, whether already approved or only proposed, need to be considered as they have the potential to create numerous cumulative impacts, whether positive or negative, if implemented. **Table 144** lists the projects that will need to be considered when examining the cumulative impacts; their location relative to the project under review is illustrated in **Figure 209**. The specialists have identified specific cumulative impacts and these are outlined below.

As requested by the DEA a literature review of other specialist assessments / studies on the neighbouring adjacent properties was also undertaken in order to ascertain any additional cumulative impacts that should be taken into consideration. Some of the project sites are at a very advanced stage, and the initial studies were undertaken in 2012 which are not currently publically available to download. Nonetheless, a fair amount of information was available. The information (including specialist studies, EIA / Scoping and EMPr Reports) that could be obtained for the surrounding renewable energy sites planned that were taken into account by the various specialists is elaborated on below.

Table 144: Renewable energy developments planned in close proximity to the proposed 140MW Aletta Wind Energy Facility

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
The Badudex Solar Project	14/12/16/3/3/2/546	EIA underway	Budadex (Pty) Ltd	74 MW	Portion 1 of the Farm Volgelstruis Bult No 104
The Moiblox Solar Project	14/12/16/3/3/2/547	EIA underway	Moiblox (Pty) Ltd	75 MW	Remainder of the Farm Bosjesmansberg
Garob Wind Energy Facility Project	14/12/16/3/3/2/279	Awarded Preferred Bidder Status.	Garob Wind Farm (Pty) Ltd	140 MW	Portion 5 of the Farm Nelspoortje No. 103
Humansrus Solar PV Energy Facility 1 and 2	14/12/16/3/3/2/707 14/12/16/3/3/2/708	Authorised	Humansrus Solar PV Energy Facility 1 (Pty) Ltd	75 MW	Remainder the Farm Humansrus No. 147
Humansrus Solar PV Energy Facility 2 and 3	14/12/16/3/3/2/888 14/12/16/3/3/2/887	EIA underway	Humansrus Solar PV Energy Facility 3/4 (Pty) Ltd	75 MW	Remainder the Farm Humansrus No. 147
Mierdam Solar Photovoltaic Facility	12/12/20/2320/2	Authorised	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75 MW	Portion 1 of the Farm Kaffirs Kolk No. 118
Platsjambok East and West Solar Photovoltaic Facility	12/12/20/2320/4 12/12/20/2320/5	Authorised	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75 MW	Remainder of the Farm Platsjambok 102
Helena Solar 1, 2, and 3 PV energy facility	14/12/16/3/3/2/765 14/12/16/3/3/2/766 14/12/16/3/3/2/767	EIA underway	BioTherm Energy (Pty) Ltd	75 MW	Portion 3 of the Farm Klipgats Pan No. 117
Renewable Energy Farm near Prieska	14/12/16/3/3/2/608 14/12/16/3/3/2/609	EIA underway	NK Energie (Pty) Ltd	UNKNOWN	▪ Portion 3 of the Farm Hedley Plains No. 64 and

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
					▪ Portion 5 of the Farm Doonies Pan No. 106
Photovoltaic Power Generation Facility near Prieska	12/12/20/1722	Awarded Preferred Bidder Status in REIPPP Window 1.	Mulilo Renewable Energy Solar PV Prieska (RF) (Pty) Ltd	19.9 MW	Portion 1 of the Farm Volgelstruis Bult No 104
PV Energy Plant near Copperton	12/12/20/2502	Authorised	Mulilo Renewable Energy (Pty) Ltd	100 MW	Portion 1 of the Farm Volgelstruis Bult No 104
Mulilo Sonnedix Prieska PV	12/12/20/2503	Awarded Preferred Bidder Status in REIPPP Window 3. Currently being constructed.	Mulilo Sonnedix Solar Enterprises (Pty) Ltd	75 MW	Remainder of the Farm Hoekplaas No. 146
Mulilo Prieska PV	12/12/20/2501	Awarded Preferred Bidder Status in REIPPP Window 3. Currently being constructed.	Mulilo Prieska PV (Pty) Ltd	75 MW	Portion 4 of the Farm Klipgats Pan No. 117
PV 2, PV 3, PV 4, PV 5 and PV 7 Energy Plants on the Farm Klipgats Pan	14/12/16/3/3/2/486 14/12/16/3/3/2/487 14/12/16/3/3/2/488 14/12/16/3/3/2/489 14/12/16/3/3/2/491	EIA underway	Mulilo Renewable Energy (Pty) Ltd	75 MW	Portion 4 of the Farm Klipgats Pan No. 117
PV 2, PV 3, PV 4, PV 6, PV 7, PV 11	14/12/16/3/3/2/493 14/12/16/3/3/2/494 14/12/16/3/3/2/495	EIA underway	Mulilo Renewable	75 MW	Remainder of the Farm Hoekplaas No. 146

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
and PV 12 Solar Energy Plants on the Farm Hoekplaas	12/12/16/3/3/2/497 14/12/16/3/3/2/498 14/12/16/3/3/2/502 14/12/16/3/3/2/503		Energy (Pty) Ltd		

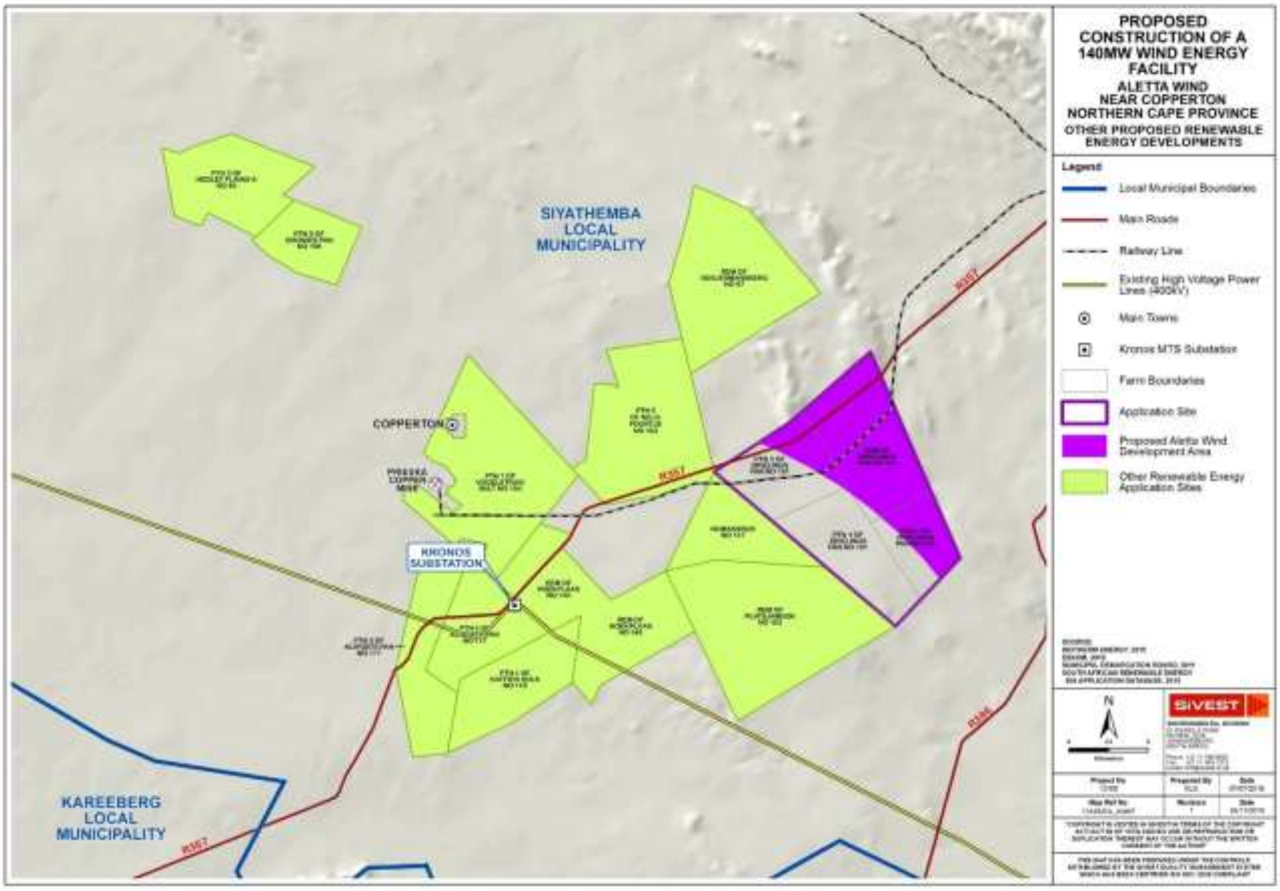


Figure 209: Location of the renewable energy developments planned within close proximity to the proposed 140MW Aletta Wind Energy Facility

11.1 Biodiversity Impacts

- **Cumulative impacts on indigenous natural vegetation**

The regional terrestrial vegetation types in the broad study area are listed as Least Threatened. This is the same vegetation types that will be affected by any other projects that would take place in the area. Loss of habitat will definitely occur, but this will be a small area in comparison to the total area of the vegetation types concerned. Bushmanland Arid Grassland occupies an area in excess of 34 000 km^2, of which less than 1% has been altered and Bushmanland Basin Shrubland occupies an area in excess of 45 000 km^2, of which less than 1% has been altered. The total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. However, the area lost in total will be small compared to the total area of the vegetation types and will not result in a change in the conservation status of the vegetation type. The cumulative effect at a regional level will therefore be low. At a more local scale, the loss of habitat in the area around Copperton will be more significant, but it is still considered to be low.

- **Cumulative impacts on protected plant species**

There are two nationally protected plant species and a whole list of Provincially protected plant species that may occur in the study area, all of which are relatively widespread. An increased number of projects increases the likelihood of individuals being affected, but unless large numbers of individuals are directly affected, there is little cumulative effect.

- **Cumulative impacts on protected trees**

There is one protected tree species that could occur on site, Boscia albitrunca. With each additional project that is constructed there will be an increasing likelihood of individuals being affected and the number of individuals affected will increase. There is therefore a cumulative effect. The significance of this effect is, however, likely to be low due to the high number of individuals of each of these species that occurs over the entire geographical range of the species and the low number that are likely to be affected by any single project. This is especially true if all projects take measures to avoid impacts on protected trees, which is considered likely, given the environmental authorisation process that needs to be undertaken for each project.

- **Cumulative impacts on sensitive habitats**

The sensitive habitats identified for the current project include drainage areas, pans and low, rocky hills. The rocky hills are in the eastern part of the group of projects and the Aletta project is the main one to potentially affect such habitat. The cumulative impact on this habitat will therefore be low. Drainage areas and pans are found throughout the area so the potential impact due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. However, drainage areas and pans are protected according to the National Water Act and there is a high likelihood that all projects will be obliged to avoid these habitats as much as possible. The cumulative impact of all the projects is therefore likely to be low, due primarily to legislative protection of the habitat concerned.

- **Cumulative impacts on populations of sedentary fauna**

There are two species of sedentary fauna that could potentially be impacted by the current project, Littledale's Whistling Rat and the Giant Bullfrog. All have a relatively wide geographical distribution and loss of some habitat in part of their range will have a minimal effect on the species. The combination of a number of projects will have a cumulative effect, but this is likely to be of low significance.

- **Cumulative impacts on mobile fauna**

Construction activities, loss of habitat, noise, dust and general activity associated with the construction phase of the project are likely to cause all mobile species to move away from the site. This effect will be increased if there are a number of projects being constructed at the same time or in quick succession, so the effect is likely to be cumulative. However, the geographical ranges of the species of concern is wide and it is considered that the significance of the effect will be low.

- **Cumulative impacts due to spread of declared weeds and alien invader plants**

There is a moderate possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The greater the number of projects, the more likely this effect will happen, therefore the effect is cumulative. For the current site, the impact is predicted to be low due to existing impacts on site and the high ability to control any additional impact. The significance will therefore be low, especially if control measures are implemented.

There is generally a requirement to control aliens and, as long as this is implemented for all projects, the cumulative impact could be low to neutral.

11.2 Avifauna Impacts

Currently there is no agreed method for determining significant adverse cumulative impacts on ornithological receptors. The Scottish Natural Heritage (2005) recommends a five-stage process to aid in the ornithological assessment:

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

- **Species to be considered**

The potential cumulative impacts on the priority species listed in **Table 6-1** of the Avifauna Specialist Report were considered.

- **Area considered in the cumulative assessment**

The Kronos MTS forms the hub of a proposed renewable energy node. Within this 35km radius, the habitat and land-use is very uniform.

Table 145 below lists the renewable energy applications which is currently (2d quarter 2016) registered with the Department of Environmental Affairs (DEA) within a 35km radius around Kronos MTS.

Table 145: Other renewable energy developments within a 35km radius

Project	DEA reference	Type	MW	EIA status	Approximate footprint (ha)[1]	Bird impact assessment study	Recommendations
Helena (Klipgatspan)	14/12/16/3/3/2/767	PV	75	Unknown	430ha	Yes	▪ Construction activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ Monitoring should be implemented to search the ground between arrays of solar panels on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. Searches should be done on foot. Searches should be conducted randomly or at systematically selected arrays of solar panels to the extent that equals 33% or more of the project area. Detection trials should be integrated into the searches.

							▪ The EMP should provide for the on-going inputs of an avifaunal specialist to oversee the operational phase monitoring and assist with the on-going management of bird impacts that may emerge as the operational phase monitoring programme progresses. ▪ The exact protocol to be followed for the operational phase monitoring should be compiled by the avifaunal specialist in consultation with the plant operator and Environmental Control Officer before the commencement of operations. The exact scope and nature of the operational phase monitoring will be informed on an ongoing basis by the result of the monitoring and the EMP will be updated accordingly. ▪ Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, including minor modifications of panel and mirror design to reduce the illusory characteristics of solar panels. What is considered to be significant will have to be established on a species specific basis by the avifaunal specialist.

Mierdam	2/12/20/2320/2	PV	40	EA issued	450ha	No, part of biodiversity assessment	▪ A formal monitoring and reporting strategy/protocol should be developed for monitoring the impact on the vegetation and biodiversity in general in the area during construction.
Platsjambok West	12/12/20/2320/5	PV	75	EA issued	450ha		▪ Both alternative sites for the eastern PV component on the Platsjambok Farm are located in very close proximity to the sensitive quartzite ridges, and would present a physical barrier between thus area and the other part of the site where a number of grassy pans are located which is also considered important from an avifaunal perspective. The presence of the PV arrays in this location could create an important barrier and disturbance impact in a currently very un-impacted part of the site that may disrupt important linkages between these two habitats. For this reason, although the eastern PV component on the Platsjambok site is not considered a fatal flaw, it is strongly recommended that the eastern PV component be shifted to the south of the current alternatives, away from a 'movement corridor' between the quartzite ridges and the pans, thus not being located in close proximity to the most sensitive areas on the site.
Platsjambok East	2/12/20/2320/4	PV	75	EA issued	450ha		▪ Both alternative sites for the eastern PV component on the Platsjambok Farm are located in very close proximity to the sensitive quartzite

							ridges, and would present a physical barrier between thus area and the other part of the site where a number of grassy pans are located which is also considered important from an avifaunal perspective. The presence of the PV arrays in this location could create an important barrier and disturbance impact in a currently very un-impacted part of the site that may disrupt important linkages between these two habitats. For this reason, although the eastern PV component on the Platsjambok site is not considered a fatal flaw, it is ▪ strongly recommended that the eastern PV component be shifted to the south of the current alternatives, away from a 'movement corridor' between the quartzite ridges and the pans, thus not being located in close proximity to the most sensitive areas on the site.
Hoekplaas	14/12/16/3/3/2/708	PV	75	EA issued	140ha	Yes	▪ The construction footprint shall be kept to the minimum size required for development. ▪ Construction timeframes shall be reduced as much as possible. ▪ To protect the Martial Eagle nest site located on the western edge of Hoekplaas, it shall be necessary to relocate the nest site to a more distant, less disturbed area (e.g. Jenkins et al. 2007, 2013). The extent and distribution of other renewable energy developments planned for the immediate vicinity probably precludes a short-

							range relocation, and a dedicated structure, strategically situated off the power line network aggregated around the Kronos substation, may be the best option. The requirements of such an undertaking shall be further investigated during future visits to the site as part of the pre-construction monitoring programme. ▪ Development shall be excluded from areas/microhabitats identified during the bird monitoring programme as being of particular value to threatened/priority species (e.g. Red Lark, Sclater's Lark). ▪ Noise and disturbances associated with maintenance activities at the facility shall be kept to a minimum once it becomes operational. ▪ The minimum area shall be used for fencing, given that these may present a collision risk for collision-prone birds. ▪ A comprehensive impact monitoring programme shall be implemented of which the results shall be used to inform and refine a dynamic approach to mitigation. ▪ Should the results from the monitoring programme show that the cumulative impacts from the multiple renewable energy projects in the Copperton area are causing high negative impacts on bird species on a local and regional scale (i.e. beyond a radius of 10km from Hoekplaas), DEA shall be contacted

							to discuss the implementation of an integrated mitigation approach by all renewable energy facilities contributing to the cumulative negative impact on avifauna. ▪ Specialist advice shall be sought in devising effective avian deterrents to minimise associated damage should conflict arise with local bird populations due to fouling of critical components, etc. ▪ Decommissioning timeframes shall be reduced as much as possible. ▪ Noise and disturbances associated with decommissioning activities shall be kept to the minimum.
Humansrus	14/12/16/3/3/2/708	PV	75	EA issued	220ha	No, part of biodiversity study	▪ Any raptor or other species of conservation concern which may be nesting within or in the immediate vicinity of the facility should be identified before construction commences. This can occur during the preconstruction walk-through of the facility for other fauna and flora related issues. If any significant finds are made, then some adjustment of the timing or location of certain activities may be required to allow breeding to be completed. ▪ Precautions should be taken to ensure that staff do not wander from the construction site and do not disturb any nesting species in the vicinity of the site.

							▪ There should also be environmental induction required for all construction staff to ensure that avifauna are not harmed during construction and that species such as owls are not persecuted out of superstition or other reason. ▪ All litter generated at the site should be handled in an environmentally sensitive manner to ensure that there is not organic litter at the site which might attract avifauna and that plastic and ▪ other materials are not allowed to blow about the site, as some types of litter such as string can become entangled around birds legs.
Garob (Nelspoortje)	14/12/16/3/3/2/279/ AM2	Win d	140	EA issued	5 520ha	Yes	▪ Micro-siting of turbines to avoid sensitive areas ▪ Strict control of machinery and staff to prevent unnecessary damage to vegetation. ▪ Curtailment of turbines if needed.
Vogelstruisbult	14/12/16/3/3/2/708	PV	75	EA issued	450ha?	Unknown	
Bosjesmansberg	14/12/16/3/3/2/547	PV	300	Unknown	800ha	Unknown	
Doonies Pan	14/12/16/3/3/2/609	PV	75	Unknown	450ha?	Unknown	
Hedley Plains	14/12/16/3/3/2/608	PV	75	Unknown	450ha?	Unknown	
Copperton Wind Energy Facility	12/12/20/2099		Up to 200M W	EA issued	3 219ha	Yes	▪ On-site demarcation of ‘no-go’ areas identified during pre-construction monitoring (see below) to minimise disturbance impacts associated with the construction of the facility. ▪ Minimising the disturbance impacts associated with the operation of the facility by scheduling maintenance activities to avoid disturbances in

							sensitive areas (identified through operational monitoring). ▪ Ensuring that any lighting on the turbines is kept to a minimum, and is coloured (red or green) and intermittent, rather than permanent and white, to reduce confusion effects for nocturnal migrants. ▪ Painting one blade of each turbine black to maximize conspicuousness to oncoming birds. The evidence for this as an effective mitigation measure is not conclusive, but it is suggestive. It might be best to adopt an experimental approach to blade marking, identifying a sample of pairs of potentially high risk turbines in pre-construction monitoring, and marking the blades on one of each pair. Post-construction monitoring should allow empirical testing of efficacy, which would inform subsequent decisions about the need to mark blades more widely in this and other wind farms. ▪ Carefully monitoring the local avifauna pre- and post-construction (see below), and implementing appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in this report, or when collision or electrocution mortalities are recorded for any of the priority species listed in this report. An essential weakness of the EIA process here is the dearth of knowledge about the actual

							movements of key species (bustards, eagles, other raptors) through the impact area. Such knowledge must be generated as quickly and as accurately as possible in order for this and other wind energy proposals in the area to proceed in an environmentally sustainable way. ▪ Ensuring that the results of pre-construction monitoring are applied to project specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of any other wind energy projects proposed for this area, including the Mainstream facility proposed for an area nearby. Viewed in isolation, the present project may pose only a limited threat to the avifauna of the area. However, in combination with a larger, neighbouring facility, it may contribute to the formation of a significant barrier to energy efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become a substantial array of many 100s of turbines (Masden et al. 2010). ▪ Additional mitigation might include re-scheduling construction or maintenance activities on site, shutting down problem turbines either permanently or at certain times of year or in certain conditions. The requirement for these measures

							would need to be determined after pre- and post-construction monitoring.

- **Current impacts**

Below is a summary of the typical threats currently facing avifauna in the Karoo environment (Marnewick et al. 2015):

  - *Overgrazing*

    This results in a depletion of palatable plant species, erosion, and encroachment by Karoo shrubs. The result is loss of suitable habitat and a decrease in the availability of food for large terrestrial birds. Centre-pivot irrigated croplands using underground water are increasing and agriculture is intensifying.

  - *Poisoning*

    Strychnine poison was used extensively in the past to control damage-causing predators, such as Black-backed Jackal *Canis mesomelas* and Caracal *Caracal caracal*, and reduced scavenging raptor populations. The use of poison may be continuing, and the potential impacts on threatened raptor species has not been confirmed or quantified. Outbreaks of brown locust are controlled by means of spraying to prevent damage to crops, resulting in the poisoning of birds that eat the dead locusts.

  - *Road-kills*

    Many birds are commonly killed on roads, especially nocturnal species such as Spotted Eagle-Owl.

  - *Renewable energy developments*

    Several wind and solar developments have been approved for development within a 35km radius around Kronos MTS (**Figure 209**). This has implications for several priority species, both in terms of collision mortality for some species, especially raptors, and displacement due to permanent habitat transformation (especially solar developments), which affects all the priority species to some degree.

  - *Power lines*

    Numerous existing and new power lines are significant threats to some priority species. Power lines kill substantial numbers of all large terrestrial bird species in the Karoo, including threatened species (Jenkins *et al*. 2010; Shaw, J. 2013). There is currently no completely effective mitigation method to prevent collisions.

  - *Climate change*

    Climate change scenarios for the region predict slightly higher summer rainfall by 2050, and increased rainfall variability. Droughts are expected to become more severe. The climate change is predicted to have both positive and negative consequences for priority species. Increased summer rainfall could improve survival, and conversely drought years can lower long-term average survival. Large, mainly resident species dependent on rainfall are also more vulnerable to climate change. This would include the slow-breeding Verreauxs' Eagle, Tawny Eagle and Martial Eagle, which also exhibit extended parental care. Severe hailstorms kill many priority species and could become more frequent.

- *Shale gas fracking*

  There is a potential threat of shale gas fracking throughout the Karoo. Populations of bird species may be locally reduced through disturbance caused by lights, vibration, vehicles and dust, and may be affected by pollutants in ponds containing contaminated water produced by returned fracking fluids.

- *Persecution*

  Although it is difficult to prove, the direct persecution of raptors such as Verreaux's Eagle and Martial Eagle for stock predation is still taking place (R. Visagie pers. comm).

The cumulative impact of the proposed WEF was assessed individually for each priority species (see **Table 146** below).

The factors considered in assessing the potential species-specific impacts are:

- Level of current impact on priority species in study area (all impacts);
- Susceptibility to WEF impacts i.e. collisions with turbines and displacement through habitat transformation;
- The percentage of habitat which is likely to be impacted by the proposed WEF.

Table 146 below sets out the criteria applied to rank potential cumulative impacts:

Table 146: Framework for assessing significance of cumulative effects

Significance	Effect
Severe	Effects that the decision-maker must take into account because the receptor/resource is irretrievably compromised, resulting in a fatal flaw.
Major	Effects that may become a key decision-making issue, potential fatal-flaw.
Moderate	Effects that are unlikely to affect the viability of the project, but mitigation might be required.
Minor	Effects which might be locally/site significant, but probably insignificant for the greater study area.
Not Significant	Effects that are within the ability of the resource to absorb such change both at local/site level and within the greater study area.

See **Table 147** below for a systematic exposition of the expected cumulative impacts of the proposed Aletta WEF on priority species.

Table 147: The expected cumulative impact of the Aletta WEF on priority species within the 35km development node

Priority species	Taxonomic name	Level of current and future impacts on species	Susceptibility to WEF impacts	Preferred habitat in the development node	Approximate size of preferred habitat in development node (ha)	Existing renewable energy applications: Extent of habitat in development node potentially	Aletta WEF: extent of habitat in the development node potentially affected (ha)	Expected cumulative impact of Aletta WEF: Pre-mitigation	Expected cumulative impact of Aletta WEF: Post-mitigation
Karoo Korhaan	*Eupodotis vigorsii*	Low: Powerlines, solar, overgrazing, climate change	Low	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Minor	Not significant
Northern Black Korhaan	*Afrotis afraoides*	Low: Powerlines, solar, overgrazing, climate change	Low	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Moderate	Minor
Kori Bustard	*Ardeatis kori*	High: Powerlines,solar, overgrazing, climate change	Low	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Moderate	Minor
Lanner Falcon	*Falco biarmicus*	Low: Powerlines, poisoning, road kills, solar, WEF	Medium?	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Moderate	Minor
Ludwig's Bustard	*Neotis ludwigii*	High: Powerlines, solar, overgrazing, climate change	Low	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Moderate	Minor
Martial Eagle	*Polemaetus bellicosus*	High: Powerlines, persecution, solar, overgrazing, WEFs, climate change	Medium?	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Minor	Not significant
Secretarybird	*Sagittarius serpentarius*	High: Powerlines, solar , overgrazing, WEFs, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Moderate	Minor

Verreaux's Eagle	*Aquila verreauxii*	High: Powerlines, persecution, WEFs, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Major	Not significant
Booted Eagle	*Aquila pennatus*	Medium: Solar, overgrazing, WEFs, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Minor	Not significant
Sclater's Lark	*Spizocorys sclateri*	Low: Powerlines, solar, overgrazing, climate change	Low	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Not significant	Not significant
Black-chested Snake-Eagle	*Circaetus pectoralis*	Medium: Solar, overgrazing, WEFs, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 264	13 029 (3.35%)	5 600 (1.44%)	Minor	Minor
Southern Pale Chanting Goshawk	*Melierax canorus*	Low: Powerlines, solar, overgrazing, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 265	13 029 (3.35%)	5 600 (1.44%)	Moderate	Minor
Greater Kestrel	*Falco rupicoloides*	Low: Solar, overgrazing, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 266	13 029 (3.35%)	5 600 (1.44%)	Minor	Minor
Spotted Eagle-Owl	*Bubo africanus*	Medium: Powerlines, solar, overgrazing, WEFs, climate change, road kills	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 267	13 029 (3.35%)	5 600 (1.44%)	Minor	Minor
Jackal Buzzard	*Buteo rufofuscus*	Medium: Solar, overgrazing, WEFs, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 268	13 029 (3.35%)	5 600 (1.44%)	Minor	Minor
Lappet-faced Vulture	*Torgos tracheliotis*	High: Powerlines, persecution, solar, overgrazing, WEFs, climate change	High	Bushmanland Basin Shrubland and Bushmanland Arid	388 269	13 029 (3.35%)	5 600 (1.44%)	Minor	Minor
Burchell's Courser	*Cursorius rufus*	Medium: Solar, overgrazing, WEFs, climate change	Low?	Bushmanland Basin Shrubland and Bushmanland Arid	388 270	13 029 (3.35%)	5 600 (1.44%)	Not significant	Not significant
Double-banded Courser	*Rhinoptilus africanus*	Medium: Solar, overgrazing, WEFs, climate change	Low?	Bushmanland Basin Shrubland and Bushmanland Arid	388 271	13 029 (3.35%)	5 600 (1.44%)	Not significant	Not significant

The cumulative impact of the proposed Aletta WEF on priority avifauna, after appropriate mitigation has been implemented, will range from minor to insignificant.

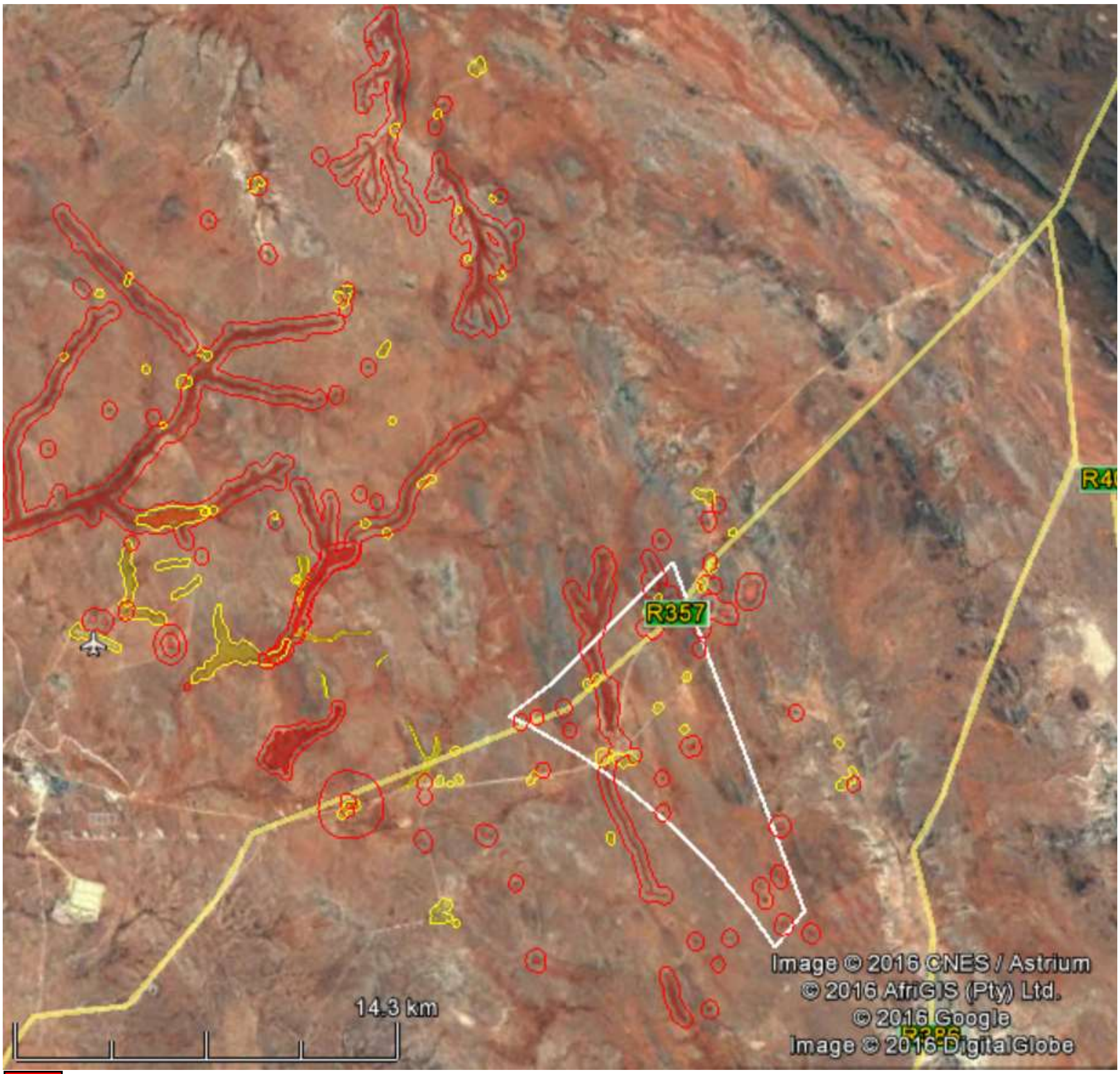
11.3 Bat Impacts

The bat sensitivity assessment reports could not be obtained for all of the neighbouring renewable energy developments, of which most are PV Solar energy applications. The final pre-construction bat sensitivity reports for the authorised Copperton WEF and Garob WEF were used where applicable.

11.3.1 Bat Sensitivy Map

Figure 210 below displays bat sensitivity maps of several wind farms neighbouring the Aletta WEF (namely the Copperton WEF, Garob WEF). The bat sensitivity maps were inspected for congruency of sensitive areas and similarities in their buffer distances. The sensitivity map of the Aletta WEF is sufficient when assessed with neighbouring site sensitivity maps.

The sensitivity maps were also used to assess whether the Aletta WEF turbine layout intersects interlinking bat sensitivity habitats between the different sites i.e. valley areas, rivers and streams, mountain ridges. The topography and habitats across the larger area is generally flat, homogenous and relatively low in bat sensitive features. Thus, the Aletta WEF turbine layout does not traverse large scale ecological corridors or ecological areas of connectivity. The existing bat sensitivity map is sufficient in this regard.



High bat sensitivity area | High bat sensitivity buffer
Moderate bat sensitivity area | Moderate bat sensitivity buffer

Figure 210: Bat sensitivity maps of wind farm areas neighbouring Aletta WEF (white boundary)

11.3.2 Cumulative Impact Assessment Rating

The main impact on bats that raises concern from a cumulative impact assessment point of view is the bat mortalities due to direct turbine blade collision or barotrauma during operation. There is potential for mass loss of locally active bats and migratory bats from the area due to cumulative mortality from wind turbines of several neighbouring wind farms.

- **Bat mortalities due to direct blade impact or barotrauma during foraging (resident and migrating bats affected):**

Mortalities of bats due to wind turbines during foraging and migration can have significant ecological consequences as the bat species at risk are insectivorous and thereby contribute significantly to the control of nocturnal flying insects. On a wind farm specific level insect numbers in a certain habitat can increase if significant numbers of bats are killed off. But if such an impact is present on multiple wind farms in close vicinity of each other, insect numbers can increase regionally and possibly cause outbreaks of colonies of certain insect species. There is also the risk of complete loss of certain bat species from the area (namely *Tadarida aegyptiaca* and *Neoromicia capensis*).

The impacts will be partly reversible. The impact will occur throughout the lifespan of the wind energy facility as well as other facilities in the area, therefore bat population numbers may take very long to recover. There is a higher probability for population and diversity genetics to be permanently altered in cumulative impacts.

The impact will be of long duration, over the operational life span of the wind farm. It will take a significant time period for the population to achieve its previous numbers after the removal of the impact.

A high cumulative impact is expected. Mortalities of bats due to wind turbine collision or barotrauma during foraging and/or migration can have significant ecological consequences as the bat species at risk are insectivorous, and thereby contribute significantly to the control of nocturnal flying insects. If large numbers of a population of a resident species are lost to this impact, it will most likely lead to destabilization of the species population and ultimately possible extinction from the area. If migrating bats are killed off it can have detrimental effects on the ecology of the caves that the specific colonies utilise. This is since bat guano is the primary form of energy input into a cave ecosystem, and no sunshine which is needed for photosynthesis exists in cave ecosystems.

As such, the anticipated impact will be highly significant. In addition, the impact is anticipated to be high negative prior to mitigation measures being implemented. This impact can however be reduced to medium negative if the appropriate mitigation measures are implemented.

11.4 Surface Water Impacts

A literature review of other surface water and / or aquatic studies on the neighbouring adjacent properties were undertaken to ascertain any additional cumulative impacts that should be taken into consideration. Some of the project sites are at a very advanced stage, and the initial studies were undertaken in 2012 which are not currently publically available to download. Nonetheless, a fair amount of information was available. The information (including surface water / aquatic specialist studies, EIA / Scoping and EMPr Reports) that could be obtained for the surrounding renewable energy sites planned that were taken into account are shown in **Table 148** below.

Table 148: Literature Review of Surface Water Impacts for Surrounding Renewable Energy Developments

Project	Relevant Impacts to be Taken into Consideration from Surface Water Perspective	Impacts Significance Rating after Mitigation
Mulilo Sonnedix Prieska PV	▪ Impact on water resources (Scoping) ▪ Sediment and erosion (Scoping)	▪ None
Garob Wind Energy Facility Project	▪ Long term increased soil erosion risk ▪ Increased water run-off ▪ Siltation of watercourses and other natural resources	▪ Low
Humansrus Solar PV Energy Facility 1 and 2	▪ Loss of riparian systems ▪ Impact on dry river beds and localized drainage systems (road crossings) ▪ Impact on riparian systems through the possible increase in surface water runoff on riparian form and function (hydrological changes) ▪ Increase in sedimentation and erosion ▪ Physical disturbance by the supporting infrastructure on the riverine environment	▪ Low
Humansrus Solar PV Energy Facility 2 and 3	▪ Loss of riparian systems ▪ Impact on dry river beds and localized drainage systems (road crossings) ▪ Impact on riparian systems through the possible increase in surface water runoff on riparian form and function (hydrological changes) ▪ Increase in sedimentation and erosion ▪ Physical disturbance by the supporting infrastructure on the riverine environment	▪ Low
Mierdam Solar Photovoltaic Facility	▪ Impacts related to surface water resources	▪ Low
Platsjambok East and West Solar Photovoltaic Facility	▪ Loss of habitat	▪ Low

Helena Solar 1, 2 and 3 PV Energy Facility	▪ Impact associated with the construction lay-down area ▪ Vehicle and machinery degradation ▪ Human degradation of flora and fauna associated with surface water resources ▪ Degradation and removal of soils and vegetation associated with surface water resources ▪ Increased run-off and sedimentation ▪ Stormwater run-off associated with the PV facility, buildings, substation and associated infrastructure ▪ Oil leaks from the substation	▪ Low
PV 2-11 Solar Energy Plants on the Farm Hoekplaas	▪ Impact on water resources (Scoping) ▪ Sediment and erosion (Scoping)	▪ None

In terms of the review undertaken on the above reports, the main cumulative impacts from a catchment perspective for surface water resources in the regional area include both potential direct and indirect impacts. Direct impacts include cumulative loss of as well as further degradation of surface water resources due to the footprints of developments encroaching on surface water resources in the greater catchment. The indirect impacts relate mainly to increased run-off, sedimentation and erosion for linear and endorheic hydrological systems. The indirect impacts to hydrological systems (i.e. drainage lines) which are connected across several farm boundaries have a greater risk for potential cumulative impacts from developments upstream.

With these impacts in mind, the direct cumulative impact of loss of surface water resources and degradation will not be compounded by the proposed development. This is due to the wind turbines, substation and operation and maintenance buildings not being located in any surface water resources. However, provision for potential degradation of surface water resources due to associated infrastructure is noted. Should these potential impacts be avoided / reduced as per the mitigation measures stipulated in the specialist Surface Water report, the cumulative impact will be negligible and not impact at a site as well as regional level.

From an indirect cumulative impact perspective, the proposed development as a whole is not expected to contribute to the cumulative impacts of increased run-off, sedimentation and erosion since the drainage lines flow in a southerly direction to be contained on the proposed development area and not into any adjacent proposed or current renewable energy developments being constructed. Additionally, there is little risk of surrounding renewable energy developments impacting on the proposed development. The nearest renewable energy development upstream of the proposed development is the Moiblox Solar Project which is approximately 4km north. The potential risk of increased run-off, sedimentation and erosion impacting on the proposed development is minimal due to the distance. It would be important however, that provision for these impacts are taken into consideration by the proposed Moiblox Solar Project. That being said, with the implementation of stipulated mitigation measures, the indirect cumulative impact for the proposed development itself is again deemed to be negligible.

11.5 Soils and Agricultural Potential Impacts

There are a considerable number of other power generation projects proposed for the immediate area near Copperton and Prieska. The prevailing agricultural potential is low to very low, so there will be little or no cumulative impact in that regard. However, regarding wind erosion, there is a definite possible cumulative impact regarding potential topsoil removal by wind erosion on one site, which could then be blown for a considerable distance across other sites.

It was deemed that the extent of this impact will be contained to the local area. It is also anticipated that the impact will be partly reversible. With regards to the loss of resources, it was deemed that this impact will result in the marginal loss of resources. Additionally, the duration of this impact is expected to be medium term.

Ultimately, the cumulative effect of this impact was deemed to be medium, as wind-blown sediments can travel long distances. In addition, the intensity / magnitude is expected to be potentially high, due to the dry climate and sandy nature of many of the topsoils in the area. It should be noted that the impact was deemed to be medium negative prior to the implementation of mitigation measures, but can be reduced to low negative after the appropriate mitigation measures have been implemented.

11.6 Visual Impacts

The renewable energy developments that are being proposed in the surrounding area and their potential for large scale visual impacts could significantly alter the sense of place and visual character within the study area, if constructed. The cumulative visual impact experienced from each potentially sensitive visual receptor location will depend on the number of proposed renewable energy developments within viewing distance. The height of the development in combination with distance are critical factors when assessing visual impacts. As such, the proposed wind energy facilities are unlikely to be visible from beyond 8km, and from this distance the degree of visual impact would be considered to be insignificant. The proposed solar energy facilities are unlikely to be visible from beyond 5km, and from this distance the degree of visual impact would be considered to be insignificant.

It should be noted that the impact at each receptor location is indicative of the 'worst case' scenario which assumes that all of the proposed facilities would be developed. In addition, no layout information could be sourced for each proposed renewable energy facility during the time of this study. The distance of the potentially sensitive receptor locations from the actual layout could therefore not be utilised to determine whether the receptor is likely to be visually exposed to the development. As such, the distance from the farm on which each development is proposed was used to calculate the cumulative visual impact.

Other factors affecting visibility, such as localised screening from trees or topographical undulations have not been factored into the cumulative impact assessment. Instead the assessment should be seen as a representation of the number of proposed renewable energy facilities likely to be visible from each potentially sensitive receptor location, if they were all constructed.

The number of proposed developments that each receptor would be visually exposed to (i.e. the cumulative impact experienced at each site) is indicated in **Table 149** below.

Table 149: Cumulative visual impact from the sensitive and/or potentially sensitive receptor locations identified within the study area

PROPOSED RENEWABLE ENERGY FACILITY	DEVELOPER	SENSITIVE AND/OR POTENTIALLY SENSITIVE VISUAL RECEPTOR LOCATION										
		VR 1	VR 2	VR 4	VR 5	VR 8	VR 9	VR 11	VR 12	VR 14	VR 15	VR 16
Badudex Solar Project	Budadex (Pty) Ltd											
Moiblox Solar Project	Moiblox (Pty) Ltd	√					√					
Garob Wind Energy Facility Project	Garob Wind Farm (Pty) Ltd	√	√	√				√		√	√	√
Copperton Wind Energy Facility	Plan 8 Infinite Energy (Pty) Ltd	√	√									
Humansrus Solar PV Energy Facility 1 and 2	Humansrus Solar PV Energy Facility 1 (Pty) Ltd	√	√	√				√		√	√	√
Humansrus Solar PV Energy Facility 2 and 3	Humansrus Solar PV Energy Facility 3/4 (Pty) Ltd	√	√	√				√		√	√	√
Mierdam Solar Photovoltaic Facility	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd											

Platsjambok East and West Solar Photovoltaic Facility	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd		√	√				√		√		
Helena Solar 1, 2, and 3 PV energy facility	BioTherm Energy (Pty) Ltd											
Renewable Energy Farm near Prieska	NK Energie (Pty) Ltd											
Photovoltaic Power Generation Facility near Prieska	Mulilo Renewable Energy Solar PV Prieska (RF) (Pty) Ltd		√									
PV Energy Plant near Copperton	Mulilo Renewable Energy (Pty) Ltd		√									
Mulilo Sonnedix Prieska PV	Mulilo Sonnedix Solar Enterprises (Pty) Ltd		√	√				√				
Mulilo Prieska PV	Mulilo Prieska PV (Pty) Ltd											
PV 2, PV 3, PV 4, PV 5 and PV 7 Energy	Mulilo Renewable Energy (Pty) Ltd											

Plants on the Farm Klipgats Pan												
PV 2, PV 3, PV 4, PV 6, PV 7, PV 11 and PV 12 Solar Energy Plants on the Farm Hoekplaas	Mulilo Renewable Energy (Pty) Ltd		√	√				√				

As indicated in the table above, the greatest cumulative impact will be experienced from one (1) of the sensitive visual receptor locations, namely VR 2 - the Nelspoortjie Karoo Guest Farm. This is due to the fact that it could potentially be visually exposed to nine (9) of the proposed renewable energy developments (both wind and solar), in addition to the proposed 140MW Aletta Wind Energy Facility, should they all be constructed. In addition, the other sensitive receptor location, namely VR 1 - the Boesmansberg Guest Farm, is expected to be visually exposed to five (5) of the proposed renewable energy developments should they all be constructed. The next highest cumulative impacts will be experienced from VR 4 and VR 11, as these farmsteads / residential dwellings are expected to potentially be visually exposed to six (6) of the other renewable energy developments proposed nearby. It should also be noted that VR 5, VR 8 and VR 12 are not expected to be visually exposed to any of the other renewable energy developments proposed nearby should they all be constructed.

It should be noted that a literature review of other visual impact assessments / studies proposed on the neighbouring adjacent properties was undertaken to ascertain any additional cumulative impacts that should be taken into consideration. The information that could be obtained for the surrounding planned renewable energy sites that were taken into account are shown in **Table 150** below.

Table 150: Literature Review of Visual Impacts for Surrounding Renewable Energy Developments

Project	Relevant Impacts to be Taken into Consideration from a Visual Perspective	Proposed Mitigation Measures	Impacts Significance Rating after Mitigation
Mulilo Sonnedix Prieska PV	The potential construction phase visual impact is considered to be of medium intensity, site specific in extent and short term and therefore of low (-) significance, without mitigation. With the implementation of mitigation measures this would reduce to very low (-) significance. No difference in impact significance would result from the proposed alternatives.	The following mitigation measures are recommended: - Roads and hard-standings would be constructed as part of the works; - The first 50-100 mm of naturally occurring substrate should be retained and then spread over finished areas; - All excess material shall be removed off-site, and the ground shall be returned to original levels/gradients as far as possible; - New structures should be placed where they are least visible to the greatest numbers of people, in places where the topography can offer shielding, where possible; - Visibility of buildings and the local sub-station should be reduced by cladding the buildings in non-reflective colours and materials that will blend in with natural environment. E.g. cladding with local stone or plaster and paint with earthy tones for paint colours, roofs should be grey and non-reflective and doors and	▪ Very low negative; ▪ The cumulative impact is assessed as medium negative.

		window frames should reference either the roof or wall colours; - Finishing materials of the infrastructure (including support structures) should be of colours that are non-reflective and in dark matte colours such as dark grey or charcoal; and - Information on the project should be provided to local people, such as through a poster at the entrance to the site. - Minimise the construction period, where possible; - Access road are to be kept tidy, and measures shall be taken to minimise dust from construction traffic on gravel roads; - Top soil should be removed, conserved and used for rehabilitation; - Site offices, if required, should be limited to single storey and they should be sited carefully using temporary screen fencing to screen from the wider landscape; and - All site operatives should receive training in awareness of issues such as the use of hazardous chemical, proper disposal of waste, etc.	
Garob Wind Energy	Due to the low number of potentially sensitive visual receptors in the study area, the potential visual impact is expected to be of low	▪ Turbines located within 480m of any inhabited settlement, homestead or public road should be relocated to beyond	1. N/A; 2. N/A; 3. N/A;

Facility Project	significance. The proposed facility is therefore considered to be acceptable from a visual perspective. The following visual impacts were identified: 1) Visual Impact on users of arterial and secondary roads in close proximity to the proposed facility; 2) Visual impact on residents of homesteads and settlements in close proximity to the proposed facility; 3) Visual impact on sensitive visual receptors within the region; 4) Visual Impact on the town of Copperton; 5) Visual impact of on-site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed facility; 6) Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed facility; 7) Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility; 8) Visual impact of construction on sensitive visual receptors in close proximity to the proposed facility; and	this distance in order to negate the potential impact of shadow flicker; ▪ A lighting engineer should be consulted to assist in the planning and placement of light fixtures for the turbines and the ancillary infrastructure in order to reduce visual impacts associated with glare and light trespass ▪ No mitigation of impacts 1,2,3,4 and 9 is possible, but measures have been recommended as best practice; ▪ Proposed Mitigation / Management Measures include the following: **<u>Planning</u>:** - Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as far as possible, and make use of already disturbed areas rather than pristine sites where possible. - Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. - Limit aircraft warning lights to the turbines on the perimeter, thereby reducing the overall requirement.	4. N/A; 5. Low; 6. N/A; 7. Low; 8. Low; and 9. N/A.

	9) Visual impact of the proposed facility on the visual quality of the landscape and sense of place of the region.	- Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). - Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. - Make use of minimum lumen or wattage in fixtures. - Make use of down-lighters, or shield fixtures. - Make use of Low Pressure Sodium lighting or other types of low impact lighting. - Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. **Construction:** - Rehabilitate all of the construction areas. - Ensure that vegetation is not cleared unnecessarily to make way for access roads and ancillary buildings. - Ensure that vegetation is not unnecessarily removed during the construction period.	

		- Reduce the construction period through careful planning and productive implementation of resources. - Plan the placement of the lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. - Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. when dust becomes apparent). - Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. - Rehabilitate all disturbed areas immediately after the completion of construction works.	

		Operations: - Maintain the general appearance of the facility as a whole. - Maintenance of roads to avoid erosion and suppress dust. - Limit aircraft warning lights to the turbines on the perimeter, thereby reducing the overall requirement. - Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). - Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. - Make use of minimum lumen or wattage in fixtures. - Make use of down-lighters, or shield fixtures. - Make use of Low Pressure Sodium lighting or other types of low impact lighting. - Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. **Decommissioning**:	

		- Remove infrastructure not required for the post-decommissioning of the site - Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications - Monitor rehabilitated areas post-decommissioning and implement remedial actions.	
Humansrus Solar PV Energy Facility 2 and 3	The following visual impacts could take place during the life time of the proposed PV project: **<u>Construction</u>** ▪ Loss of site landscape character due to the removal of vegetation and the construction of the PV structures and associated infrastructure. ▪ Wind-blown dust due to the removal of large areas of vegetation. ▪ Possible soil erosion from temporary roads crossing drainage lines. ▪ Windblown litter from the laydown and construction sites. **<u>Operation</u>** ▪ Light spillage making a glow effect that would be clearly noticeable to the surrounding dark sky night landscapes.	▪ The laydown area should be sited away from the R357 road behind the disused railway line embankment, and preferably not located the more prominent ground to the south. ▪ Strict access control to a single track along the route making use of existing farm tracks for access from the road where possible. ▪ To assist in reducing the massing and crowding effects of the proposed PV structures the following is recommended: - A 75m No-go buffer from the R357 and Copperton roads should be maintained. - To reduce visual intrusion from the possible multiple power lines linking up to different proposed PV projects in the vicinity, it is recommended that the power	**<u>Preferred PV Option:</u>** - The Visual Impact Significance of the PV system and buildings is rated Medium to low for construction and low for operation phases; - If effective and integrated planning is undertaken, the cumulative visual significance has the potential to become medium positive; **<u>Alternative PV Option</u>**: - The Visual Impact Significance of both tracking and dual axis tracking PV system impacts was rated medium to low after mitigation; - Closure phase can be reduce to very low should the site be successfully rehabilitated; - With effective and integrated planning, the cumulative visual significance has the

	▪ Massing effect on the landscape from a large-scale modification. ▪ On-going soil erosion. ▪ On-going windblown dust. ▪ Sunlight glint off PV structures. **Decommissioning** ▪ Movement of vehicles and associated dust. ▪ Wind-blown dust from the disturbance of cover vegetation / gravel. **Cumulative** ▪ A long-term change in land use setting a precedent for other similar type of solar and wind energy projects. ▪ Construction of informal settlements in the town of Copperton (and surrounds) from in-migration of persons seeking construction employment from the many different solar and wind energy projects planned for the area. The following visual impacts could take place during the life time of the proposed transmission line: **Construction**	lines as much as possible follow existing transmission line corridors. - The lay down should be located away from the main roads (as much as possible). - Dust control measures should be implemented when required. - Lights at night have the potential to significantly increase the visual exposure of the proposed project. It is recommended that mitigations be implemented to reduce light spillage.	potential to become medium positive with mitigation; **Road Access Impact (all options):** - With mitigation and effective dust management, the Visual Impact significance of both Road access routes was rated low for construction and operation phases, and very low should effective rehabilitation be implemented; - With effective and integrated planning, the cumulative visual significance has the potential to be medium positive with mitigation. **Self-build Grid Connection to Kronos Substation:** - Construction and Operation Phase impacts were rated low with mitigation and the management of soil erosion; - With mitigation and integrating planning by DEA and Eskom, the cumulative impacts can be reduced to low; ▪ Due to the potential cluttering of the landscape from all the different power lines converging on the two local substations, the cumulative visual impact

	▪ Possible soil erosion from temporary roads crossing drainage lines. ▪ Windblown litter from the lay-down and construction sites. **<u>Operation</u>** ▪ On-going soil erosion. ▪ On-going windblown dust. ▪ Sunlight glint off cables and structures. **<u>Decommissioning</u>** ▪ Movement of vehicles and associated dust. ▪ Windblown dust from the disturbance of cover vegetation/gravel. **<u>Cumulative</u>** ▪ Massing effects from numerous power lines converging on the substations. ▪ Cluttering effects from ad-hoc routings that are not aligned with existing Eskom power line corridors. According to the findings of this report, all of the alternatives are suitable for development with mitigation. It was found that the proposed alternatives would not constitute a significant		significance was rated high without mitigation. With mitigation and integrating planning by DEA and Eskom, the cumulative impacts can be reduced to low.

	visual impact to the characteristic landscape for the following reasons: o The proposed project's close proximity to the Copperton mine and TSF. o The old railway line and borrow pits degrade the landscape in the immediate vicinity. o The area is an unofficial node for Solar Energy development with adjacent sites already having authorization. o The alignment of the proposed project with municipal planning.		
Mierdam Solar Photovoltaic Facility	The following visual impacts are associated with the construction of the proposed PV plant: **Construction** Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase. **Operation** The proposed solar arrays could create a visual impact on sensitive receptors in the	The following mitigation measures were provided for the anticipated impacts: - Carefully plan to reduce the construction period. - Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. - Maintain a neat construction site by removing rubble and waste materials regularly. - Make use of existing gravel access roads where possible. - Ensure that dust suppression techniques are implemented on all access roads.	Low negative

	study area by creating visual change and visual intrusion. ▪ The likely visual impact of the proposed solar power plant from most of the key receptor locations has been determined to be insignificant. This is mainly due to the extensive distance between the PV layouts and the key observation locations. ▪ The thick vegetation that surrounds most receptor locations is also very effective in shielding the actual receptor location (household) from views of the proposed project. ▪ Farmsteads located within, or on the boundaries of the development site would potentially be subject to a greater degree of visual impact. However due to these farmsteads belonging to, and being inhabited by the owners of the properties on which the development is proposed, these locations are not thought to be sensitive, as they will benefit from the project financially	▪ No specialist recommendations were provided in the report.	
Platsjambok East and West Solar Photovoltaic Facility	The following visual impacts are associated with the construction of the proposed PV plant: **<u>Construction</u>**	The following mitigation measures were provided for the anticipated impacts: - Carefully plan to reduce the construction period.	Low negative

	Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase. **<u>Operation</u>** The proposed solar arrays could create a visual impact on sensitive receptors in the study area by creating visual change and visual intrusion. ▪ The likely visual impact of the solar power plant from most of the key receptor locations has been determined to be insignificant. This is mainly due to the extensive distance between the PV layouts and the key observation locations. ▪ The thick vegetation that surrounds most receptor locations is also very effective in shielding the actual receptor location (household) from views of the proposed project. ▪ Farmsteads located within, or on the boundaries of the development site would potentially be subject to a greater degree of visual impact. However due to these farmsteads belonging to, and being	- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. - Maintain a neat construction site by removing rubble and waste materials regularly. - Make use of existing gravel access roads where possible. - Ensure that dust suppression techniques are implemented on all access roads.	

	inhabited by the owners of the properties on which the development is proposed, these locations are not thought to be sensitive, as they will benefit from the project financially		
Helena Solar 1, 2 and 3 PV Energy Facility	The following visual impacts are associated with the construction of the proposed PV plant and associated infrastructure: **<u>Construction</u>** ▪ Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. **<u>Operation</u>** ▪ The proposed PV energy facility, power line, substation, access roads and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts. The development may be	The following mitigation measures were provided for the anticipated impacts: - Carefully plan to reduce the construction period. - Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. - Maintain a neat construction site by removing rubble and waste materials regularly. - Make use of existing gravel access roads where possible. - Ensure that dust suppression techniques are implemented on all access roads. - All reinstated cable trenches should be re-vegetated with the same vegetation that existing prior to the cable being laid. - Light fittings for security at night should reflect the light toward the ground and prevent light spill. - The operations and maintenance buildings should not be illuminated at night.	Construction: Low negative; Operation: Medium negative (low negative for the power line, substation, access roads and building infrastructure).

	perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	- Align the power line to run parallel to existing power lines and other linear impacts, where possible. - Bury cables under the ground where possible. - The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. - Select the alternatives that will have the least impact on visual receptors.	
PV 2-11 Solar Energy Plants on the Farm Hoekplaas	Any tall structures, such as existing powerlines, are visible for many kilometres. According to the Draft Scoping Report (DSR), the potential therefore exists that the proposed PV plants and associated infrastructure would be visible from many kilometres away. As such, it was recommended that a specialist Visual Impact Assessment (VIA) be undertaken to ascertain potential impacts on visual aesthetics. The VIA has however not been undertaken yet as this specialist study was not available when compiling this report.	It was recommended that a specialist VIA be undertaken to ascertain potential impacts on visual aesthetics.	▪ None

A literature review of other visual specialist studies which were conducted for the other renewable energy developments being proposed and/or constructed in the area was undertaken as part of the VIA. This was done in order to clearly define the identified cumulative impacts, and to indicate how the recommendations, mitigation measures and conclusions of the other visual impact assessment reports have been taken into consideration when drafting the visual impact assessment report. In terms of the review undertaken on the above reports, it can be noted that the findings of the other specialist studies identified similar impacts for each of the renewable energy developments mentioned above. These include the visual impacts on users of arterial and secondary roads, the visual impacts on residents of homesteads and settlements, the visual impacts of shadow flicker on sensitive visual receptors, the visual impacts of lighting at night on sensitive visual receptors, the visual impacts of construction on sensitive visual receptors and the visual impacts on the visual quality of the landscape and sense of place. The impacts identified in the specialist studies that were reviewed are also similar to those identified in the VIA. As such, the VIA is deemed to have adequately defined, identified and assessed the cumulative visual impacts which could arise as a result of the development of the renewable energy facilities.

The visual impact assessment undertaken for the proposed Aletta Wind Energy Facility has provided mitigation measures which are in-line with those recommended in the other specialist studies. As such, the mitigation measures provided in the VIA are considered to be sufficient to reduce the visual impacts experienced within the study area. Should all of the recommended mitigation measures be implemented, it is anticipated that the visual impacts associated with the renewable energy developments could be mitigated to acceptable levels. This will also reduce the significance of the identified visual impacts and will aid in reducing the cumulative impacts experienced as a result of the other renewable energy facilities being proposed and/or constructed within the surrounding area. This was evident during the review of the other specialist studies as the significance rating for most of the identified impacts were deemed to be of medium to low significance after the implementation of mitigation measures. Additionally, with the correct mitigation and integrating planning, the significance rating of majority of the cumulative impacts will be relatively low due to the nature of the study area.

The visual specialist for the Garob Wind Energy Facility Project recommended that wind turbines located within 480m of any inhabited settlement, homestead or public roads should be relocated to beyond this distance in order to negate the potential impact of shadow flicker. A 1.4km Noise Buffer has however been implemented for the Aletta Wind Energy Facility. The above-mentioned 480m buffer recommendation can therefore be considered to be accounted for. It should be noted that some of the wind turbines have been positioned within 480m of the R357 road. This is however not considered to be necessary as this road is not considered to be a sensitive receptor road. It is used almost exclusively as a local access road, with very little use for any other purpose. In addition, this road does not form part of any scenic tourist routes, and is not specifically valued or utilised for its scenic or tourism potential. Additionally, the visual specialist for the Humansrus Solar PV Energy Facility 2 and 3 project recommended that a 75m no-go buffer from the R357 and Copperton roads should be maintained. This 75m no-go buffer is however not deemed necessary as the R357 road is not considered to be a sensitive receptor road and is used almost exclusively as a local access road, with very little use for any other purposes. As mentioned, this road does not form part of any scenic tourist routes, and is not specifically valued or utilised for its scenic or tourism potential. As such, this recommendation is not considered to be important for the proposed Aletta Wind Energy Facility and will therefore not need to be implemented.

The VIA was therefore deemed to have clearly defined the identified cumulative impacts, and has indicated how the recommendations, mitigation measures and conclusions of the other visual impact specialist reports have been taken into consideration when drafting this report.

11.7 Heritage and Palaeontology Impacts

This section evaluates the possible cumulative impacts (CI) on heritage resources with the addition of the Aletta WEF. The CI on heritage resources evaluated a 30-kilometer radius (**Figure 211**). It must further be noted that the evaluation is based on available heritage studies (**Figure 212**) and cannot take the findings of outstanding studies on current ongoing EIA's in consideration.

The following must be considered in the analysis of the cumulative effect of development on heritage resources:

- **Fixed datum or dataset:** There is no comprehensive heritage data set for the Copperton region and thus we cannot quantify how much of a specific cultural heritage element is present in the region. The region has never been covered by a heritage resources study that can account for all heritage resources. Further to this none of the heritage studies conducted can with certainty state that all heritage resources within the study area has been identified and evaluated ;
- **Defined thresholds:** The value judgement on the significance of a heritage site will vary from individual too individual and between interest groups. Thus implicating that heritage resources' significance can and does change over time. An so will the the tipping threshold for impacts on a certain type of heritage resource;
- **Threshold crossing:** In the absence of a comprehensive dataset or heritage inventory of the entire region we will never be able to quantify or set a threshold to determine at what stage the impact from developments on heritage resources has reached or is reaching the danger level or excludes the new development on this basis. (Godwin, 2011)

Keeping the above short comings in mind, the methodology in evaluating cumulative impacts on heritage resources has been as follows.

The analysis of the competed studies as listed in **Table 151**, took in to account the findings and recommendation of each of the sixteen evaluated HIA's. The cumulative impact on the cultural landscape was discounted as the HIA's, in most cases, did not address this and the Visual Impact Assessment covers such analysis in detail.

The overall findings of the 16 studies all concur that the area is characterised by numerous Stone Age findspots and archaeological resources. A large number of these concentrated around pans and outcrops in a landscape where water, food and shelter came at a premium. The sites around the pans and the outcrops where in most cases given a medium to high heritage significance on a local scale and in the majority of the cases were recommended as being no-go areas or extensive mitigation is required.

This cumulative assessment has also not addressed the possible cumulative impacts on the heritage landscape. The evaluated studies have in most cases not addressed or quantified the possible impact on the cultural landscape.

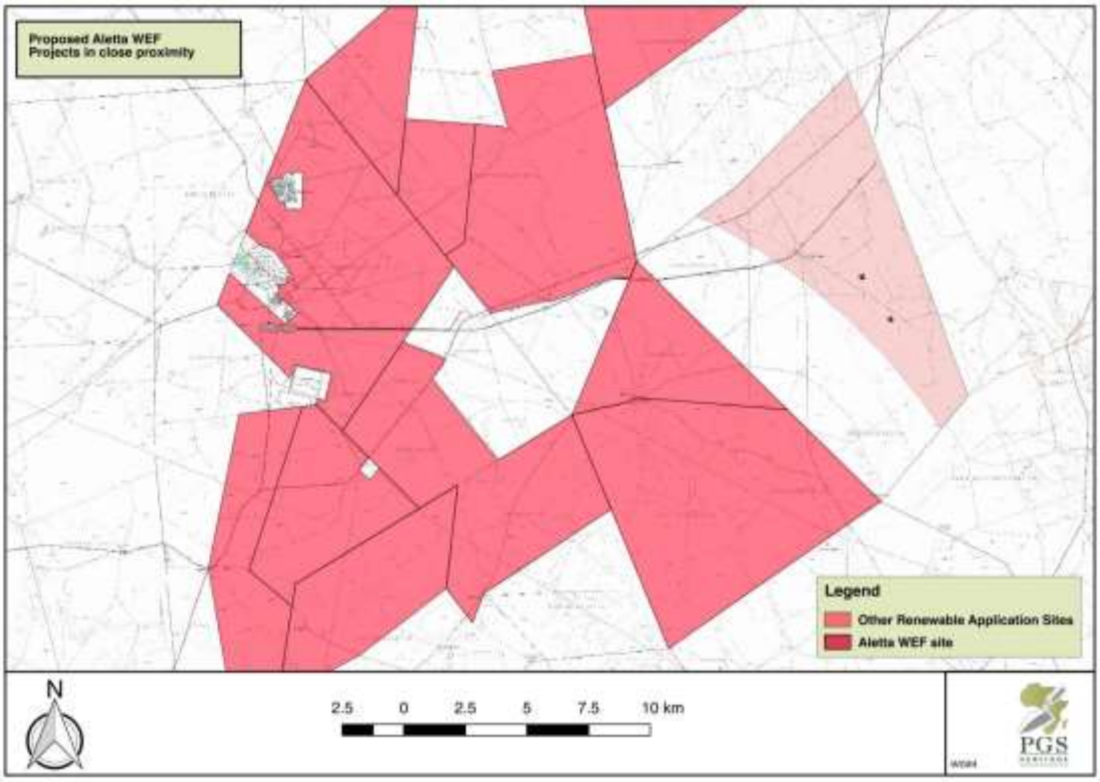


Figure 211: Other RE developments in relation to the Aletta WEF application area

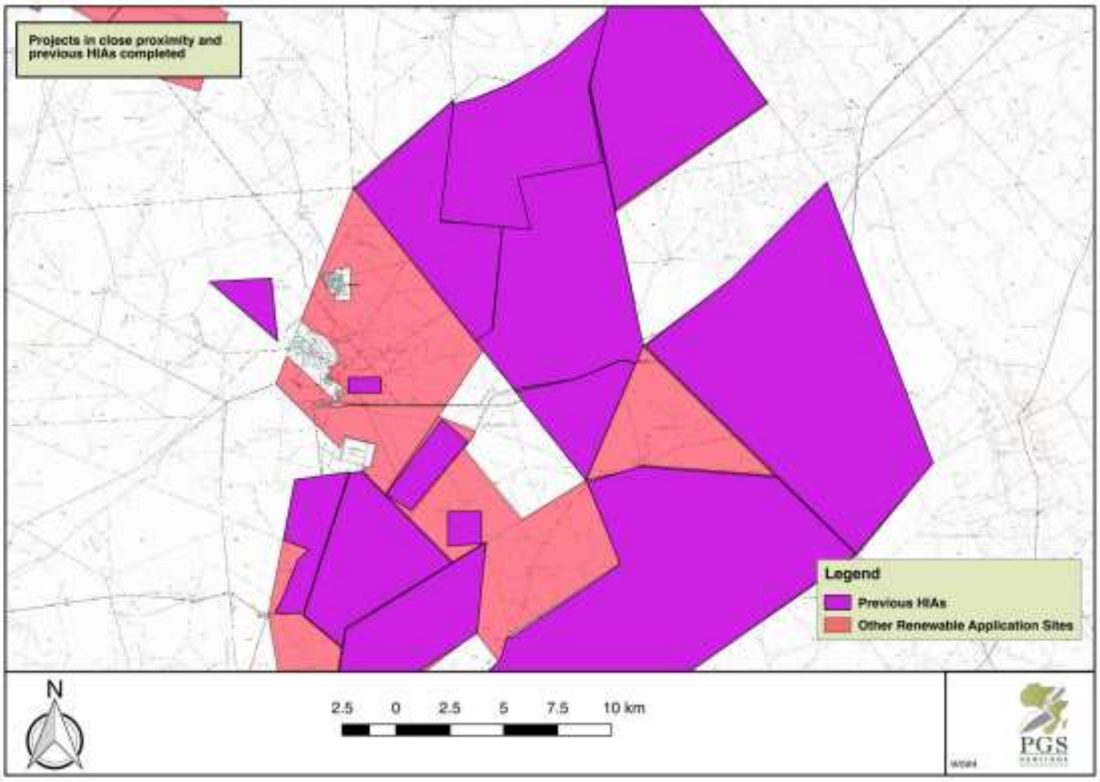


Figure 212: Other RE developments in relation to the Aletta WEF application area, where HIAs were completed

Table 151: Regional HIA's conducted

Study	Findings	Recommendation
KAPLAN, J.M. 2010. Archaeological Scoping Study and Impact assessment of a proposed photovoltaic power generation facility in Copperton Northern Cape. Agency for Cultural Resource Management	Rated low significance but recommended further fieldwork before construction.	▪ Further walkdown required
KAPLAN, J.M. & WILTSHIRE, N. 2011. Archaeological Impact Assessment of a proposed wind energy facility, power line and landing strip in Copperton, Siyathemba municipality, Northern Cape. Agency for Cultural Resource Management	Rated as having no-go areas of archaeological importance and stress the importance that the proposed wind farm on Struisbult is one of a number of energy related applications in the immediate area surrounding Copperton. Concentrations of lithic material around pans and outcrops	▪ SAHRA must assess this application in the broader context of other applications in the area in order to guide Eskom and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area.) ▪ Avoid pans and historical homesteads
ATWELL, M. 2011. Heritage Assessment Proposed Wind Energy Facility And Related Infrastructure, Struisbult: (Farm 103, Portions 4 And 7), Copperton, Prieska, Atwell & Associates	Found no fatal flaws, however agree that the area is abundant with Stone Age scatters. It is further stated that the scatters are background scatter with little significance except for one site with remains intact and must be avoided or a second phase mitigation to take place	▪ Avoid significant archaeological site
VAN SCHALKWYK, J. 2011. Heritage impact assessment for the Proposed Establishment of PV Solar Facilities by Mainstream Renewable Power on the Farm Mierdam in the Prieska Region Northern Cape Province	A number of open sites with surface scatterings of stone tools dating to the Middle and Later Stone Age were identified. These are mostly located on small hills or at the foot of the hill.	▪ As first option it is recommended that these areas are avoided if possible. If that is not possible, it is recommended that systematic surface collections are made and that this material is housed at a museum.
VAN SCHALKWYK, J. 2011. Heritage impact assessment for the Proposed Establishment of PV Solar Facilities by Mainstream Renewable Power on the Farm Platsjambok in the Prieska Region Northern Cape Province	A number of open sites with surface scatterings of stone tools dating to the Middle and Later Stone Age were identified. These are mostly located on small hills or at the foot of the hill.	▪ As first option it is recommended that these areas are avoided if possible. If that is not possible, it is recommended that systematic surface collections are made and that this material is housed at a museum.

Study	Findings	Recommendation
ORTON, JAYSON. 2012a. Heritage Impact assessment for a proposed photovoltaic energy plant on the farm Klipgats Pan near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town	A background scatter of Early Stone Age (ESA) and Middle Stone Age (MSA) artefacts was found across the site and is of very low archaeological significance. However, a large number of discrete Later Stone Age (LSA) sites were found focused around ephemeral pans and the hill.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.
ORTON, JAYSON. 2012b. Heritage Impact Assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town	This assessment found a scatter of stone age sites with concentrations around pans and rated them as medium significance with required mitigation	▪ Overall, impacts to heritage resources are not considered to be highly significant and it is ▪ thus concluded that the project may proceed but subject to the following recommendations: o The suggested archaeological mitigation measures should be implemented as o necessary; o Test excavations around the pans should be done to check for buried archaeological o material (if development encroaches within 100 m of any of the pan margins but excluding for access roads); o Transmission lines should stay at least 100 m away from the edge of any pans implicated in the final route;
ORTON, J & WEBLEY, L. 2013. Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on the Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape	This assessment found background scatter of stone age material and concentrations around pans which are rated as medium significance with required mitigation	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.
VAN DER WALT, JACO. 2013. Archaeological Impact Assessment Report for the proposed Bosjesmansberg PV Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)	Highlights pans and quartzite ridges as archaeologically highly sensitive and flag them as no-go areas. Wide spread scatters of Stone Age material occur. High concentrations of Stone Age material are associated with quartzite ridges.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.

Study	Findings	Recommendation
VAN DER WALT, JACO. 2012. Archaeological Impact Assessment Report for the proposed Garob Wind Energy Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)	Highlights pans and quartzite ridges as archaeologically highly sensitive and flag them as no-go areas. Wide spread scatters of Stone Age material occur. High concentrations of Stone Age material are associated with quartzite ridges.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.
FOURIE, W. 2012. Heritage Impact Assessment for the proposed Eskom Cuprum to Kronos Double Circuit 132kv Power line and Associated Infrastructure, Prieska, Northern Cape.	High density scatters of lithics around quartz outcrops were identified. Avoidance of site were recommended. One site was found to med medium to high significance.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed.
ORTON, J. 2015. Heritage Impact Assessment for Three Proposed Solar Energy Facilities and Three Associated Transmission Lines Near Copperton, Prieska Magisterial District, Northern Cape	The majority of the archaeological heritage resources identified are of low-medium or medium archaeological significance and a suggested grading for these resources would be no more than Grade 3C.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed.
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 1 PV project, Copperton Northern Cape.	13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required. ▪ Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 2 PV project, Copperton Northern Cape.	10 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required. ▪ Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

Study	Findings	Recommendation
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 3 PV project, Copperton Northern Cape.	13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required. ▪ Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Eureka WEF project, Copperton Northern Cape.	6 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.	▪ Final walkdown of infrastructure footprints ▪ Demarcate sites as no-go areas ▪ Demarcate and fence during construction if construction activities area to happened within 100 meters from a site. ▪ Monitor find spot areas if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

It is the considered opinion of the Heritage specialist that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.

It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, *"SAHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area."*

It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.

Palaeontology

The study area forms part of a large area in South Africa where associated applications for Wind Energy Facilities are presently considered. Following this desktop assessment it is clear that, although a Moderate Sensitivity id allocated to the entire study area, most of the fossils expected are difficult to observe and most of the fossils will only be exposed during construction phases of the projects.

Cumulative effects will however be an important factor and the EAP must note specifically where groundwater aquifers can extend into different study areas and need to be assessed carefully to prevent adverse contamination of these historic watering points that are key to the survival of Man and animals in this dry region of South Africa.

11.8 Socio-Economic Impacts

The establishment of a number of renewable energy facilities in the area has the potential to result in positive cumulative socio-economic impacts which include creation of employment, skills development opportunities and creation of local business opportunities. However, negative cumulative impacts on the area's sense of place and the landscape cannot be ignored.

The proposed project is to be located in the area of notable activity when it comes to renewable energy projects.

Impacts, both positive and negative are, likely to be amplified in the event that more than one renewable energy facility is built in the immediate vicinity of the Aletta facility. Four of the projects approved under RE IPPPP are already known to be located in direct vicinity of the project site. In addition to these, numerous other projects are investigated for the development in the area, although they are not yet authorised for implementation under the RE IPPPP or any other initiative. The likelihood of their construction is not high and will depend on the future bid rounds.

When assessing the cumulative effect, it is best to consider the projects that are already approved as the consideration of the proposed projects that have not yet been authorised for the development may result in overestimation of potential positive and/or negative socio-economic impacts. Nonetheless, it is important to take note of all projects proposed to be built in the area.

11.8.1 Literature review of socio-economic studies for existing and planned renewable enrgy projects

A review of currently available studies was undertaken to determine the socio-economic impacts of the current and proposed renewable energy projects in the area.

Table 152: Approved for construction and/or operational renewable energy projects in the area

Project	Specialised Study	Year	Status
Herbert PV Power Plant	EIA	2011	Operational
Copperton Windfarm	Final Amendment Report	2016	Approvals and finance
Garob Wind Farm	Social Impact Assessment	2012	Approvals and finance
Mulilo Prieska PV	Final EIR	2013	Awaiting Construction
Mulilo Sonnedix Prieska	Final EIR	2013	Awaiting Construction

The following sections summarise the socio-economic impacts and mitigation measures proposed in the reviewed specialist reports.

- **Herbert PV Power Plant (Van Zyl Environmental Consultants cc, 2011)**

Identified impact	Type	Impact description and proposed Mitigation
Construction Phase		
Degradation of roads (used by farmers) due to heavy construction vehicles	Negative	• Roads should be maintained regularly during the construction phase and any rehabilitation roads should be stored before the completion of the construction phase.
Increased heavy vehicle traffic due to construction	Negative	• Heavy machinery operators and truck drivers need to be informed of stock herders, pedestrians and stray animals on the road.
Utilisation of solar power	Positive	• Utilisation of solar technology increases the experience with renewables, in the long-run resulting in economic benefits that will translate into social impacts in the form of prosperity and human health.

Identified impact	Type	Impact description and proposed Mitigation
Loss of farm labour to construction	Negative	• Employment of farm labourers for construction purposes should be avoided. • Although one cannot prevent a farm labourer from applying, it should be explained that if they apply it will be leaving a permanent job for a temporary job due to the nature of the work.
Security risks	Negative	• Security measures need to be implemented to prevent construction workers entering the neighbouring farms. The proponent should be responsible for implementing.
Employment opportunities	Positive	• The project will result in short-term positive impacts as employment will be available for locals in the construction phase. The construction phase has an estimated duration of 6-9 months, there will still be a demand for labour in the operational phase, however the demand will decrease.
Unskilled labour force	Positive	• The local labour force is likely to be unskilled, this can be fixed through skills and training programmes. • The construction of Solar PV structures is relatively straightforward, therefore local labour force can be utilised and specialist staff and management can be outsourced from out of town. This will temporarily enhance surrounding communities through temporary job creation and social benefits.
Influx of employment seekers	Negative	• To prevent the influx of employment seekers, communication via local newspapers, local and district municipalities would keep the population informed on the number of available contracts and employment opportunities. In addition, it will inform them of the proceedings of the project.
Extra pressure on the local and district emergency and fire-fighting services	Negative	• The emergency and response plans will need to be amended by the district municipality to make provisions for the PV power station.
Local resources	Positive	• The Tenesol factory in South Africa will provide the PV modules and the bulk of the steel for the trackers will be sourced from South African suppliers. • South African companies will supply civil/building works, security systems, electrical reticulation and perimeter fencing. • An estimated 75% (R1 650 000 000) of capital costs will remain in South Africa, thus increasing GDP and improving economic growth.

Identified impact	Type	Impact description and proposed Mitigation
Traffic Impacts	Negative	• The highest impact would be on the R370 where trucks must travel frequently to transport material and equipment to the project construction area. The project manager will need to monitor and control trucks to ensure they do not cause traffic and congestion for long periods.
Operational Phase		
Degradation of roads (used by farmers) due to heavy construction vehicles	Negative	• Although the usage of roads decreases during the operational phase, regular maintenance of roads should be undertaken.
Employment opportunities	Positive	• Job creation will be in fields such as maintenance services and security.
Unskilled labour force	Positive	• Continued skills and training programme for locals.
Local procurement of goods, materials and services	Positive	• Positive indirect socio-economic impacts through the procurement of local goods, materials and services for the project.
Traffic Impacts	Negative	• Traffic is minimal during the operational stage as trucks will only be needed intermittently to transport infrastructure, this will only be in the maintenance and upgrade stage.
Influx of employment seekers	Negative	• Will mostly likely continue from the construction phase to the operational phase, continued communication via the channels indicated in the construction phase will mitigate the risk of employment seekers visiting the site and surrounding areas for jobs.

- **Copperton Wind Farm (Aurecon South Africa (Pty) Ltd, 2016)**

Impact	Type	Impact description and proposed Mitigation
Construction Phase		
Impacts on local economy (employment) and social conditions	Positive	• A medium local content is said to be employed with 40% of the expenditure within South Africa. • Construction, installation and direct manufacturing jobs could be created from the project, up to 548 local jobs and an additional 250 manufacturing jobs will be generated from the project with the construction duration lasting up to 3 years. • The labourers will be accommodated in Prieska, thus increasing spending and stimulating the local economy.

Impact	Type	Impact description and proposed Mitigation
		• The Local Municipality will benefit from increased revenue through increased taxes and rates arising from the project, therefore the municipality will have more money to spend on social programmes. • Preference for employment should be given to local communities and a list of locally available skills and labour should be obtained. • Recruitment should consider gender equality. • Training should be provided so labourers can utilise their skills in other construction and development projects within the region upon the completion of the project.
Operational Phase		
Impact on local economy (employment) and social conditions	Positive	• No material changes identified, accept the job opportunities are seen to be long-term opposed to short-term in the construction phase.

- **Garob Wind Farm (Barbour, 2012)**

Identified impact	Type	Impact description and proposed Mitigation
Construction Phase		
Creation of employment and business activities	Positive	• The project will run for approximately 18 months and there will be approximately 266 construction related jobs created. 25% (67 jobs) to skilled personnel (engineers, management, technicians and super advisory), 35% (93 jobs) to semi-skilled personnel (drivers and equipment operators), 40% (106 jobs) to low-skill personnel (construction labours and security staff). • The total wage bill is estimated to be around R66 million, and the low-skill and semi-skill worker's average salary is between R5 000 - R30 000 respectively. • Local community members form Prieska and Marydale will be likely to be eligible for low-skilled and semi-skilled positions. • Most job opportunities will be made available to the historically disadvantaged within the local community. • The project will propose a social benefit for the community given the high unemployment levels and limited job opportunities. • To mitigate the risk of locals not qualifying for jobs within the project due to the potential mismatch of skills and low education levels, the recruitment process and the implementation of a training and skills development programmes need to address this. • The recruitment process should also promote gender equality. • In addition, a database should be created with local companies and they should be notified of the tender process.

Presence of construction workers and potential impacts on family structures and social networks	Negative	• Local farmers in the area are against construction workers being accommodated on site. • Employment of local labourers will avoid the accommodation of workers from outside the area. • The establishment of a Monitoring Forum (MF) including stakeholders, representatives from the local community, local community, local farmers, local councillors and the contractor to monitor the risks and develop a Code of Conduct. • In addition, the implementation of a HIV/AIDS awareness programme should be implemented. • The contractor should be responsible for managing construction workers and the times they are permitted to be onsite.
Influx of job seekers	Negative	• Employment should favour the locals. • The MF should monitor and identify problems in the area due to the influx of job seekers. • Implementation of a 'no employment policy' at the gate will reduce the risk of job seekers hanging around and making the locals uncomfortable.
Loss of farm labour	Negative	• Liaising with local farmers in the area to prevent the employment of local farm workers for the project. • Farm workers need to be made aware that the nature of the work is temporary and only for the duration of the project as well as making them aware that the negative consequences from applying will be losing their permanent job.
Risk of stock theft, poaching and damage to farm infrastructure	Negative	• An agreement should be drawn up between the proponent and the affected landowners to ensure stock theft, poaching and damage to farm infrastructure is compensated by the proponent. • The Code of Conduct developed but by the MF should be drawn up prior to commencement of the project and signed by all contractors. • With the enforcement of the Code of Conduct, proponents should hold contractors liable to pay damages. • Any charges made for theft, poaching and damage should be per the Code of Conduct and in accordance to the South African labour legislation.

Risk of veld fires	Negative	• The contractor needs to ensure that open fires are only allowed in designated areas for cooking or heating and nowhere else. • Smoking should only be allowed in designated areas and nowhere else. • Construction related activities should be properly managed and confined to specific areas where there is a reduced risk of fire. • It is the contractor's responsibility to provide adequate fire-fighting equipment onsite and training for selected construction staff. • In a case where the fire is caused by a construction worker, the contractor, as per Code of Conduct, shall be liable to compensate the farmers for damages caused on their farms. • The contractor should also take responsibility for the firefighting costs incurred by the farmers.
Impact of heavy vehicles and construction activities	Negative	• To avoid times of the year when traffic is heavy, abnormal loads should be timed. • The contractor shall be responsible for all costs related to damage on the local farm roads caused by vehicle and construction activities and liable to repair all damages before the construction phase is completed. • Dust suppression measures should be implemented for heavy vehicles on a regular basis and vehicles used to transport sand and building materials should be fitted with tarpaulins or covers. • Drivers should be qualified, made aware of potential road safety issues, speed limits and vehicles should be road-worthy.
Operational Phase		
Creation of employment and business opportunities	Positive	• Job opportunities drastically reduced to 16 jobs required, 7 full-time positions and 9 part-time positions. • A training and skills development programme will be implemented as proposed by the proponent to compensate for limited jobs required. This should be done for the locals during the first 5 years of the operational phase.

Establishment of community trust	Positive	• Criteria should be established for the identifying and funding community projects and it should be focused on the community and not an individual. • Controls should be in place to ensure the trust benefits the community and not an individual. • The trust will support healthcare, education, training and skills development and support for SMME's.
Influx of job seekers	Negative	• Due to Prieska attracting several renewable energy projects, the influx of job seekers will be high in the area. • As discussed in the construction phase, the developed MF should manage these risks and implement a no employment at the gate policy, instead job seekers should go to employment offices in the area.
Loss of farm labour	Negative	• Liaising with local farmers in the area to prevent the employment of local farm workers for the project. • Farm workers need to be made aware that the nature of the work is temporary and only for the duration of the project as well as making them aware that the negative consequences as a result of applying will be losing their permanent job.
Visual impact on sense of place	Negative	• This impact for this is very low and minimal.
Impact on tourism	Positive	• The proponent should initiate interaction with the representatives from the SLM and the local tourism representatives to raise awareness of the proposed facility. • The proponent should look at establishing a renewable energy interpretation centre at the entrance of the site, which should include a viewing area where passing visitors can view the site.
Human Health	Positive	• Wind energy is associated with fewer health effects than traditional energy generation, it is said to be better for the health.

- **<u>Mulilo Prieska PV and Mulilo Sonnedix Prieska (Savannah Environmental (Pty) Ltd, 2013)</u>**

Identified impact	Type	Impact description and proposed Mitigation
Construction Phase		
Creation of employment and business opportunities during construction	Positive	• The construction phase of the project is expected to be between 18-24 months and create 291 jobs. 25% (73 jobs) will be available for skilled personnel (project managers, land surveyors, engineers etc.), 15% (43 jobs) to semi-skilled workers (drivers, equipment operators etc.)

Identified impact	Type	Impact description and proposed Mitigation
		and 60% (175 jobs) to low-skilled workers (drivers, equipment operators etc.). • The total wage bill is estimated to be around R60 million, and the low-skill and semi-skill worker's average salary is between R5 000 – R25 000 respectively for a period of 20 months. • The proponent should implement a "locals first" policy and should appoint local contractors, particularly for the semi and low skilled jobs. • A risk is the low-skill level in the area, which will result in the proponent being forced to fill positions from outside the area. • The proponent and their contractors should meet with the Siyathemba local municipality to establish the skills database of the area and made available to the contractors who are appointed for the construction phase. • The organisations, community representatives and local authorities should be informed of the employment procedures and final decisions regarding the project and potential job opportunities the proponent has undertaken in the construction phase. • Prior to the initiation of the construction phase, training and skills development programmes should be initiated. • The employment of women where possible and gender equality should be considered in the recruitment selection process. • A database for local companies, specifically BEE companies should be created and the companies should be informed of the tender process along with an invitation to bid for project-related work.
Potential impacts of family and structures and social networks associated with the presence of construction workers	Negative	• The promotion of the 'locals first policy' will reduce the impact of workers affecting local families and social networks. • A Monitoring Forum (MF) should be created including stakeholders, representatives from the local community, local community, local farmers, local councillors and the contractor to monitor the risks and develop a Code of Conduct. • An HIV/AIDS awareness programme should be implemented. • Management from the contractor is essential to manage construction workers and the times they are permitted to be onsite.

Identified impact	Type	Impact description and proposed Mitigation
Potential impacts of family and structures and social networks associated with the influx of job seekers	Negative	• The established MF should establish a 'no job at the gate policy', instead job seekers should visit employment offices in Prieska.
Potential impact on local farmers associated with loss of farm labour to the construction phase	Negative	• It should be emphasised that the construction work is temporary and the farm labourer will be giving up a permanent job for a temporary job. • Liaison with local farmers is necessary.
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers onsite	Negative	• Prior to the commencement of construction, an agreement should be reached between the landowners and the proponent to ensure that the company will compensate the landowner for any damage and losses. • Before the contractors are deployed on site, a Code of Conduct should be developed and signed by the landowners, proponent and contractor. • Contractors should be held liable by the proponent to losses and damages of farm infrastructure. • Contractors should be made aware of the consequences of stock theft, damage and losses and if found guilty of an offense as per Code of Conduct breach, dismissal should follow South Africa labour legislation.
Operational Phase		
Creation of employment and business opportunities associated with the operational phase	Positive	• Sixty permanent jobs will be created during the 20-year operational phase. • Skilled employees will equate to 33% (20 jobs), semi-skilled 17% (10 jobs) and low-skilled 50% (30 jobs). • The local community will qualify for low-skilled and some semi-skilled jobs available. • Preference will be given to Historically Disadvantaged members of the local community. • During the first 5 years of the operational phase, a training and skills development programme should be implemented for the locals to maximise the number of locals that are employed within the operational phase.

Identified impact	Type	Impact description and proposed Mitigation
Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	Positive	• Local and economic community development can be stimulated from the trust over a 20-year timeframe. • The trust will support healthcare, education, training and skills development and support for SMME's. • A criterion should be established by the Siyathemba Local Municipality and the proponent to ensure the benefits are for the community and not for individuals within the community. • Financial controls and audits should be in place by the Siyathemba Local Municipality and the proponent to ensure the benefits are for the community and not for individuals within the community.
Potential impact on family structures, social networks and community services associated with the influx of job seekers	Negative	• Same as construction phase except influx may reduce due to the operational phase requiring less jobs than the construction phase. • The 'no employment at the gate' policy should still be emphasized even in the operational phase and job seekers should be redirected to employment offices in Prieska.
Potential impact on local farmers associated with loss of farm labour	Negative	• Although farm labour can be replaced, loss of farm labour will impact farm operations in the time between replacement of worker, however this will be temporary.

11.8.2 Summary of the projects cumulative effects

The following table summarises the social and socio-economic impacts identified during the literature review of social and socio-economic studies referred to earlier in this section. The table also summarises the potential cumulative effects that could be generated by all projects together within the construction and operational phases, which is then taken into account when assessing cumulative effects of the project under review. However, it is important to note that not all socio-economic studies reviewed included quantitative data; therefore, the summary of the cumulative effects is limited to the data available for each project reviewed and the information contained in the reviewed documents; thus, some of the cumulative effects may be underestimated.

- **<u>Construction Phase:</u>**

Impact	Details
• Temporary job creation	A total of 1 105 direct jobs will be created over 6 and a half years during the construction phase of the projects.

	250 indirect jobs will be created in manufacturing and other indirect job opportunities will be created in hospitality, tourism and security as a result of the projects.
	140 of the jobs will be offered to the skilled labour force. 136 of the jobs will be offered to the semi-skilled labour force. 281 of the jobs will be offered to the low-skilled labour force.
	Majority of the local labourers residing in the Prieska vicinity will qualify for the semi-skilled and low-skilled positions
	The wage-bill will be R126 million and the salary of low-skilled to semi-skilled workers will range from R5 000 to R30 000, respectively.
	A database should be created for local companies to access information on the tender process and invite local companies to bid for project work.
• Unskilled labour force	The reviewed specialist reports recommend the following to address the lack of skills of the local labourers: • Skills and development programmes implemented by proponents. • Preference should be given to the locals for low-skilled level and semi-skilled level jobs. Skilled jobs can be outsourced from the surrounding communities.
• The effect on family structures and social networks within the community due to the influx of job seekers and the presence of workers	Due to the high unemployment within the area and the surrounding areas, job seekers will gather at the project requesting jobs. The specialised reports recommend the following measures to reduce the increased security risks to the farmers: • Preference is given to locals to reduce the risk of outsiders creating a threat to families and businesses due to a lack of understanding of the community • 'No employment at the gate' policy should be implemented • Communication of job positions are via newspapers and employment offices The presence of the workers will be unavoidable but can be managed. As per mitigation measures in specialist reports: • The creation of a Monitoring Forum (MF) should be initiated between the proponent, Local Municipality, community and farmers to manage the risks of the projects • A Code of Conduct should be formulated and signed between the proponent, contractors, construction workers and farmers prior to construction commencing so a common understanding is established and negative impacts on the community is reduced • The contractor should take responsibility for managing the construction workers

	Stock losses, poaching, theft and damage to farm infrastructure is a potential result from the presence of construction workers onsite. • Contractors shall be liable to pay for any losses incurred by farmers as a result of construction workers • The Code of Conduct should specify regulations in regards to the theft and damage to property • Dismissal and disciplinary measures should be in accordance to the developed Code of Conduct and South African labour legislation
Potential impact on local farmers associated with loss of farm labour	• The impact on the loss of farm labour is minimal due to the temporary nature on farming operations during the replacement period. • Farm labourers cannot be excluded from applying for construction jobs. • It should be emphasised that construction jobs are temporary in comparison to permanent jobs to weigh in on the negative impacts so farm labourers can make an informative decision.

- **Operational Phase:**

Impact	Details
• Temporary job creation	76 jobs will be created over the operational phase, much lower than the construction phase.
	20 of the jobs will be offered to the skilled labour force. 10 of the jobs will be offered to the semi-skilled labour force. 30 of the jobs will be offered to the low-skilled labour force.
• Unskilled labour force	A training and skills development programme should be implemented for the locals to maximise the number of locals that are employed within the operational phase, this should be implemented during the first 5 years.
• Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	The trust will promote economic growth within the local community and support healthcare, education, training and skills development and support for SMME's
• The effect on family structures and social networks within the community due to the influx of job seekers and the presence of workers	The influx of job seekers may reduce as there will be less jobs available within the operational phase. The same 'no gate policy' and communication channels in regards to employment should be followed in the operational phase. The Code of Conduct established prior to the construction phase and the MF should continue in the operational phase to manage security risks, theft, losses and damages. Alterations may need to be agreed upon and changes made to the Code of Conduct to suit operational conditions.
• Potential impact on local farmers associated with loss of farm labour	Continuous liaison with farmers within the community will prevent loss of farm labour within the community.

When evaluating the cumulative effect of the proposed project, the analysis of socio-economic impacts identified in EIA studies conducted by specialists for other projects proposed to be located in the area and summarised earlier in the socio-economic report were taken into account. The formulation of the proposed mitigation measures also took into account recommendations made by other specialists as part of EIAs conducted for other renewable energy projects proposed to be built in the area.

11.9 Traffic Impacts

There are Fourteen (14) other Renewable Energy sites in the immediate surround to the Aletta WEF. The majority of these facilities are Photovoltaic Energy facilities with four (4) additional wind energy facilities.

The cumulative effect of the abnormal load vehicles on the daily traffic volume would elevate the delay experienced by the road user. This is assuming the exact same route will be used by all the individual developments. However, due to the REIPPP bidding process, it is highly unlikely that all these above mentioned facilities will be constructed at the same time. The normal heavy and light vehicles will not affect the level of service of any of the sections of road proposed for use in terms of reaching its volume capacity. The speed of the abnormal load trucks will however impact on the average travel speed (ATS) and percentage time spent following (PTSF) of the roadways. This can however be mitigated by allowing other road users to pass at regular intervals and by avoiding clusters of abnormal load transport vehicles.

The additional cumulative trips generated in the event that all the facilities are in construction at the same time, is summarised in the tables below.

Table 153: Cumulative Impact Summary of Trips (Route 1)

Station	ADT (vpd)	Abnormal trips per day	Normal trips per day	New ADT (vpd)
N7 near Saldanha	4365	15	90	4470
N7 south of Vanrhynsdorp	1300	15	90	1405
N7 north of Vanrhynsdorp	950	15	-	965
R27 near Calvinia	700	15	90	805
R63 near Williston	190	15	90	295
R63 near Carnarvon	140	15	90	245
R384 near Britstown	200	15	90	305
N10 near Prieska	300	15	215	530

Table 154: Cumulative Impact Summary of trips (Route 4)

Station	ADT (vpd)	Abnormal trips per day	Normal trips per day	New ADT (vpd)
N2 north of Coega	11500	15	90	11605
N10 south of Cradock	1670	15	-	1685
R61 near Tarkastad	1220	15	90	1325
R401 near Middelburg	-	15	90	-
N10 south of Britstown	700	15	90	805
N10 near Prieska	300	15	215	530

The Normal vehicle trips over the long distance routes are solar energy equipment transport vehicles delivering solar equipment to the ten (10) proposed solar facilities at Prieska.

11.9.1 Cumulative Effect Rating

- **<u>Long Distance Route</u>**

The trips generated by the delivery of wind turbine components to site are insignificant when compared to the ADT of the immediate road network as it does not affect and/or change the current Level of Service provided that the abnormal vehicle create passing opportunities on a regular basis.

The suggested haulage routes are mainly single carriageways, and would therefore have a probable impact on the current traffic volumes during the construction period.

- **<u>Intersections</u>**

The intersections will be temporary blocked, but will be of short duration and will not affect the LOS in any significant way. Traffic will be allowed to pass the abnormal load vehicle to minimize the queuing lengths.

The blocking of intersections will have a definite impact, but will be compensated for as mentioned in the Impact section above.

- **<u>Local Traffic</u>**

Roadways surrounding Prieska have an abundance of spare capacity and will be able to accommodate the estimated additional traffic generated by delivery vehicles, construction vehicles, on-site staff, etc.

The chances of local traffic being adversely affected by the construction traffic are considered extremely low.

- **<u>Community</u>**

The construction of this wind energy facility will have a positive impact on the surrounding communities as it will create more job opportunities.

The construction of the wind energy facility will have a definite positive impact on the communities in the surrounding areas of the site.

All of the impacts mentioned above are completely reversible as the project is of short duration. All impacts mentioned above will not result in the loss of any resources. The estimated construction to completion period is 18 months. Therefore the impact and its effects will last for the period of a relatively short construction period. The construction of the Aletta WEF will have low negative cumulative effects on the traffic and low positive cumulative effects on the community. As the construction of this wind energy facility is of short term duration the impacts on the area will only be temporary and the roadways will continue to function in a moderately modified way. The significance of the traffic and community impact is negative and positive low, respectively, as they are temporary and extend over a short period of time.

12 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALTERNATIVES

Prior to the start of the EIA, BioTherm intended to construct 125 turbines on the Aletta site. This number of turbines provided flexibility in that turbines of 1-1.5MW can be considered, however consideration of the Square Kilometre Array (SKA) necessitated the reduction of the 125 turbines to a proposed 80 turbine layout. The turbine layout was then further amended to only include 60 turbines. Although the reduction of the number of turbines equated to a reduction in capacity, this design amendment was done taking environmental considerations into account.

Various environmental specialists assessed the site during the scoping phase. Their assessments encompassed the entire proposed development site and included the identification of sensitive areas. These sensitive areas were used during the scoping phase to perform a preliminary comparison of layout alternatives. The design and layout alternatives which were considered during the scoping phase included a comparative assessment of a 60 turbine layout versus an 80 turbine layout, and alternative locations for the onsite substations and O&M buildings. The 60 turbine layout was clearly selected as the preferred alternative as per the scoping phase specialist findings and it is recommended that both alternatives for the substation and O&M building for the 60 turbine layout be taken through to the EIA phase for further assessment. These layouts are presented in **Figure 213**.

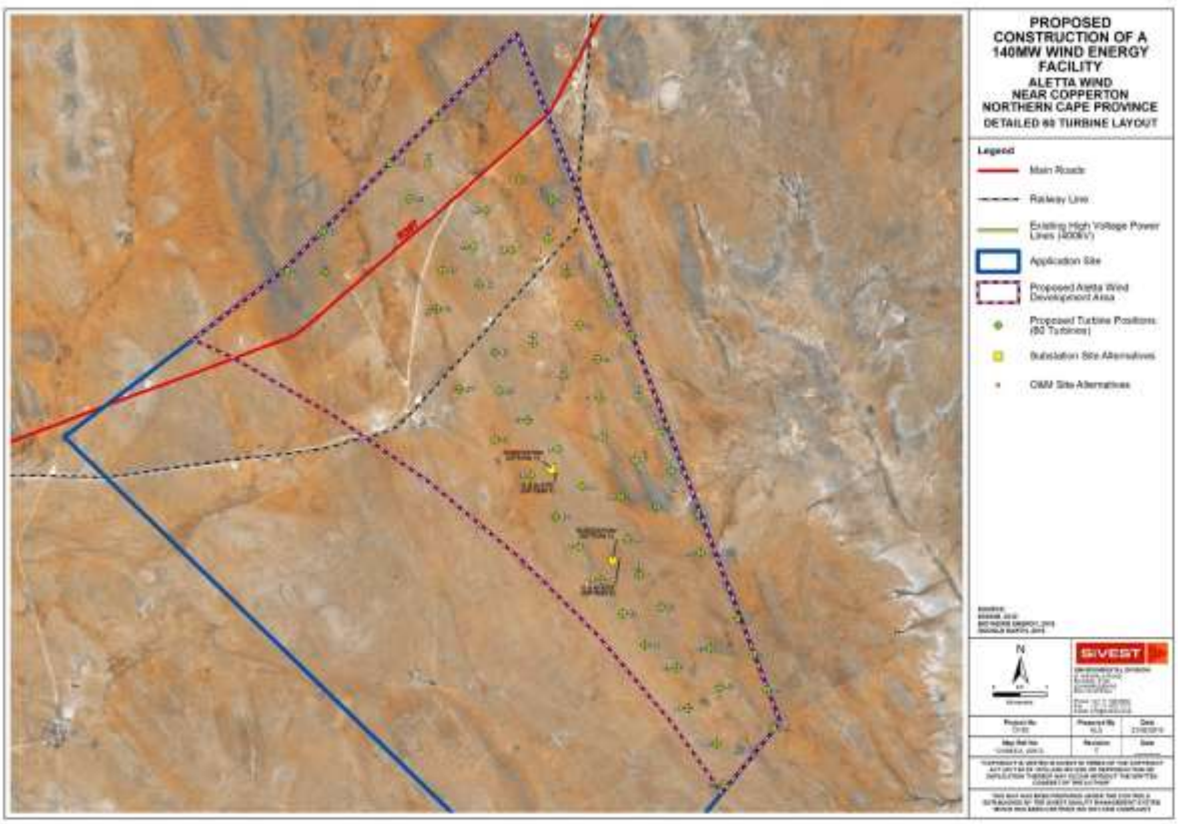


Figure 213: EIA phase layout alternatives

The sensitive areas used to determine the alternatives in the scoping phase were based on desktop studies. The specialist studies in the EIA phase have provided a more detailed assessment of sensitive areas. The highly sensitive areas identified by each specialist study in relation to the EIA phase layout alternatives are presented in **Figure 214** below. Each of these alternatives are comparatively assessed below in terms of the findings from the specialist studies conducted during the EIA.

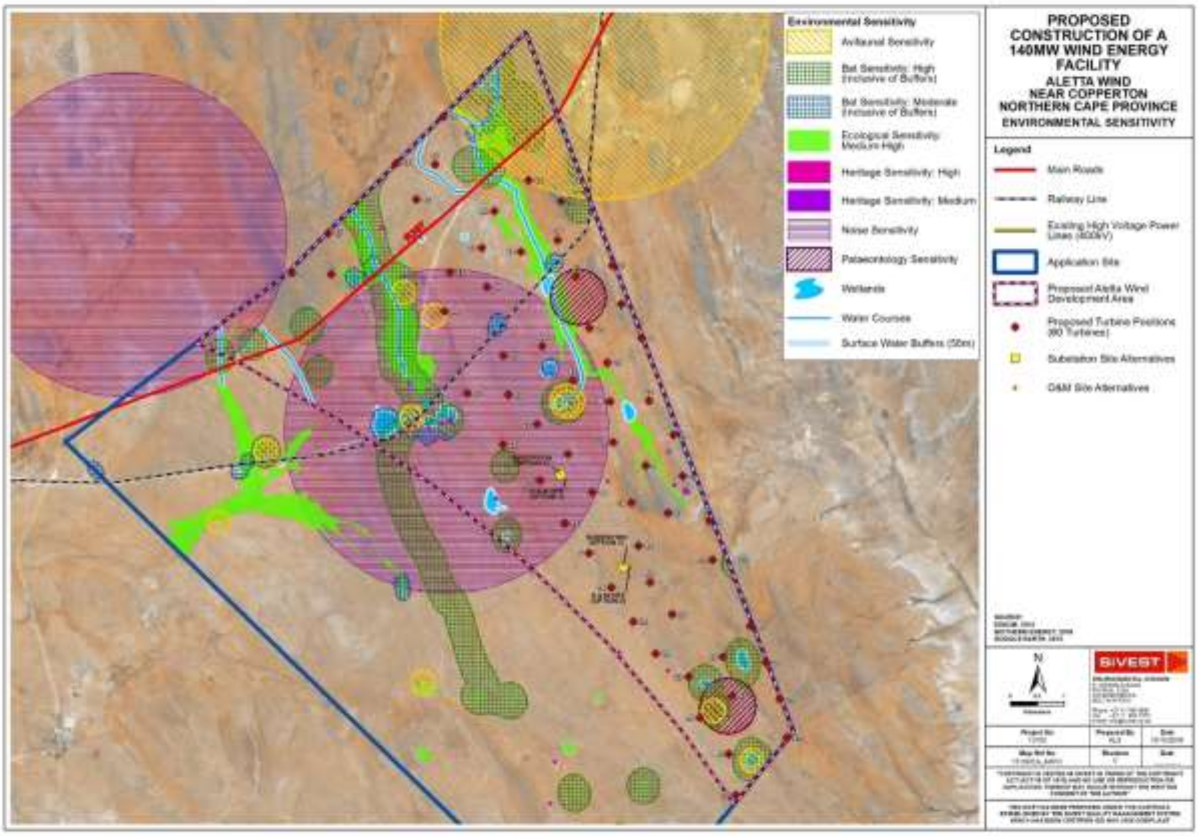


Figure 214: EIA phase layout alternatives in relation to sensitive areas

Additionally, several no-go areas were also identified by some of the specialists and were subsequently incorporated into the EIA phase layout. As a result of the no-go areas, the layout proposed had to be amended slightly in order to avoid these areas. A map layout indicating the identified no-go areas is provided in **Figure 215** below.

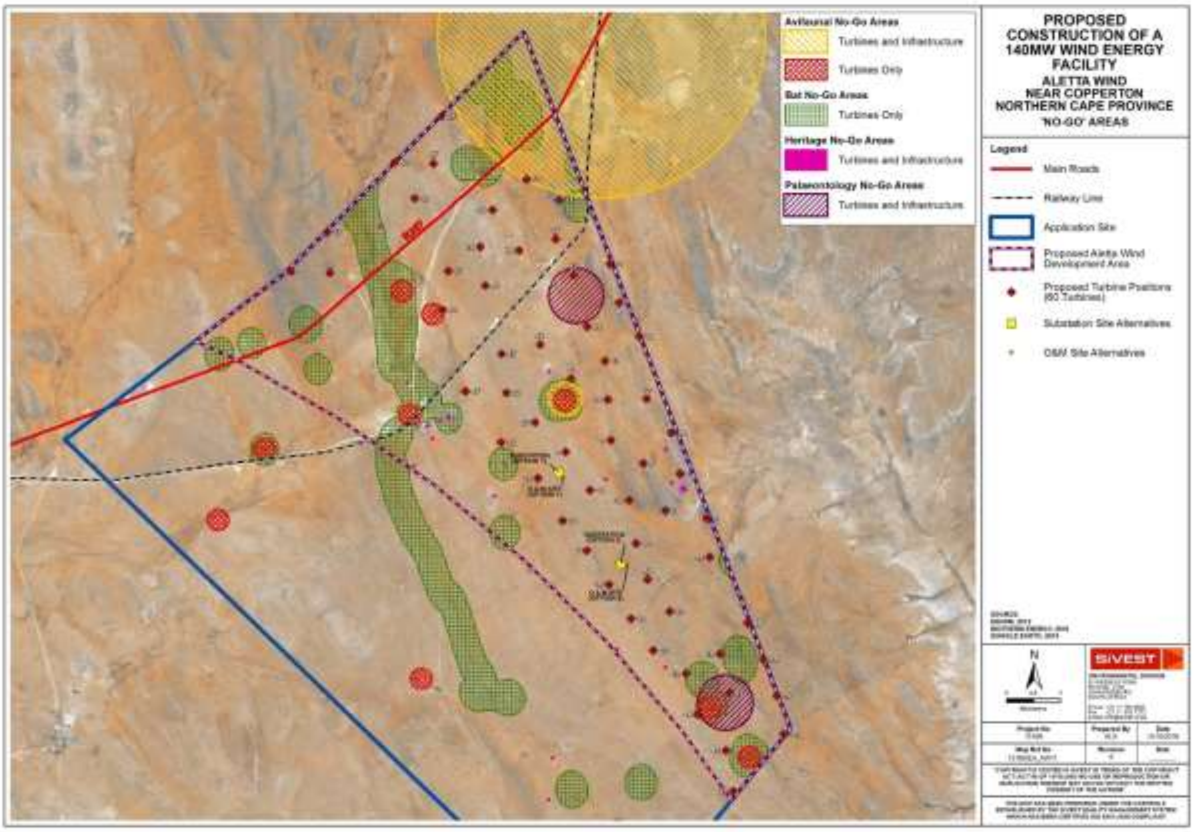


Figure 215: EIA phase layout alternatives in relation to no-go areas

Table 155 below highlights the issues and preferences associated with each alternative thereby identifying the preferred alternative.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 155: Alternatives Assessment summarising the impacts, highlighting issues/concerns and indicating the preference associated with each alternative

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
132kV ONSITE SUBSTATION AND OPERATION & MAINTENANCE (O&M) BUILDING				
Aletta Wind Energy Facility 132kV onsite Substation and Operation & Maintenance (O&M) Building Option 1	Biodiversity	NO PREFERENCE	The impact will be relatively insignificant	No Fatal Flaws
	Avifauna	NO PREFERENCE	The habitat at the proposed turbine site is highly homogenous. The impact that the substation will have on the available habitat is therefore likely to be similar, irrespective of where the substation is located.	No Fatal Flaws
	Bats	NO PREFERENCE	The location and specification of the substation and Operation and Management building does not have an impact on the bat fauna.	No Fatal Flaws
	Surface Water	NO PREFERENCE	There are no surface water resources either directly within, or within a radius of 1km of this alternative. No direct potential impacts are therefore anticipated. As a result, this option is preferred.	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	Low prevailing agricultural potential	No Fatal Flaws
	Noise	NO PREFERENCE		No Fatal Flaws
	Visual	NO PREFERENCE	No sensitive or potentially sensitive visual receptors can be found within 500m of this proposed Substation and O&M Building alternative, within the very high impact zone. In addition, no sensitive or potentially sensitive visual receptors can be found within 2km of the proposed alternative, within	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			the high impact zone. It must however be noted that three (3) potentially sensitive visual receptors can be found within 5km of the proposed alternative, within the moderate impact zone. In addition, one (1) potentially sensitive visual receptor can be found within 8km of the proposed Substation and O&M Building alternative, within the low impact zone, while five (5) potentially sensitive visual receptors can be found further than 8km from this alternative and are therefore expected to be negligible from a visual perspective. It is important to note that both visually sensitive receptors, namely the Boesmansberg Guest Farm (VR 1) and the Nelspoortjie Karoo Guest Farm (VR 2), can also be found further than 8km for the proposed Substation and O&M Building alternative and are therefore also expected to be negligible from a visual point of view. As such, there is no notable preference between Substation and O&M Building Option 1 and 2. Although Option 1 will be marginally preferred as it is located slightly further from one (1) of the potentially sensitive receptor locations, both are regarded as favourable options. In addition, the proposed substation and O&M building would form part of the wind energy facility and would be dwarfed by the large number of wind turbines that would be visible.	
	Heritage	PREFERRED	No heritage resources have been identified in the general area of the substation footprint.	No Fatal Flaws
	Palaeontology	NO PREFERENCE	The areas are all underlain by Moderately sensitive Palaeontological formations and the proviso is that the	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			development must be away from existing Groundwater Resources, most notably historic spring sites and the ECO must work closely with the HIA specialist to ensure that all new, chance finds of fossils be recorded during the construction phase of the project	
	Socio-economic	NO PREFERENCE	No differentiation between two alternatives; equally acceptable	No Fatal Flaws
Aletta Wind Energy Facility 132kV onsite Substation and Operation & Maintenance (O&M) Building Option 2	Biodiversity	NO PREFERENCE	The impact will be relatively insignificant	No Fatal Flaws
	Avifauna	NO PREFERENCE	The habitat at the proposed turbine site is highly homogenous. The impact that the substation will have on the available habitat is therefore likely to be similar, irrespective of where the substation is located.	No Fatal Flaws
	Bats	NO PREFERENCE	The location and specification of the substation and Operation and Management building does not have an impact on the bat fauna.	No Fatal Flaws
	Surface Water	NO PREFERENCE	There are no surface water resources either directly within, or within a radius of 1km of this alternative. No direct potential impacts are therefore anticipated. As a result, this option is preferred.	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	Low prevailing agricultural potential	No Fatal Flaws
	Noise	NO PREFERENCE		No Fatal Flaws
	Visual	NO PREFERENCE	No sensitive or potentially sensitive visual receptors can be found within 500m of this proposed Substation and O&M	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			Building alternative, within the very high impact zone. In addition, no sensitive or potentially sensitive visual receptors can be found within 2km of the proposed alternative, within the high impact zone. It must however be noted that four (4) potentially sensitive visual receptors can be found within 5km of the proposed alternative, within the moderate impact zone. In addition, one (1) potentially sensitive visual receptor can be found within 8km of the proposed Substation and O&M Building alternative, within the low impact zone, while four (4) potentially sensitive visual receptors can be found further than 8km from this alternative and are therefore expected to be negligible from a visual perspective. It is important to note that both visually sensitive receptors, namely the Boesmansberg Guest Farm (VR 1) and the Nelspoortjie Karoo Guest Farm (VR 2), can also be found further than 8km for the proposed Substation and O&M Building alternative and are therefore also expected to be negligible from a visual point of view. Although Substation and O&M Building Option 2 is located slightly closer to one (1) of the potentially sensitive receptor locations there is no notable preference between the two options and both are considered to be favourable. In addition, the proposed substation and O&M building would form part of the wind energy facility and would be dwarfed by the large number of wind turbines that would be visible.	

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Heritage	FAVOURABLE	A site occurs at this location. This site is however of a low significance.	No Fatal Flaws
	Palaeontology	NO PREFERENCE	The areas are all underlain by Moderately sensitive Palaeontological formations and the proviso is that the development must be away from existing Groundwater Resources, most notably historic spring sites and the ECO must work closely with the HIA specialist to ensure that all new, chance finds of fossils be recorded during the construction phase of the project	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No differentiation between two alternatives; equally acceptable	No Fatal Flaws

As depicted in **Table 155**above, the two (2) 132kV onsite substation and O&M building site alternatives are very similar in terms of which is the environmentally preferred alternative. Almost all of the specialists found there to be no preference between the two (2) alternatives, with the only exception being the heritage specialist. The 132kV onsite substation and O&M building Option 2 was however deemed to be the favourable option, as despite the fact that a heritage site occurs at this location it is deemed to have a low significance.

It is important to note that no fatal flaws were identified and the layout avoids all no-go areas and therefore both of the alternatives mentioned above are considered to be acceptable, although not necessarily preferable from an environmental perspective. The preferred site layout in relation to the sensitive areas identified by the specialists is indicated in

Figure 217. It should be noted that although a 3 000 m buffer around the onsite residence could not be achieved the developer has set the turbines back 1.4km from the onsite residence in order to reduce the impact of noise.

As previously mentioned, several no-go areas were also identified by some of the specialists and were subsequently incorporated into the EIA phase layout. As a result of the no-go areas, the site layout was amended slightly in order to avoid these areas. The preferred site layout in relation to the no-go areas identified by the specialists, including the 1.4km noise buffer and SKA buffer, are indicated in **Figure 217**.

Refer to **Appendix 9** for the coordinates of the preferred site layout.

It should be noted that micro-siting may be required within the development area during the detailed design phase to avoid any additional sensitive areas. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction.

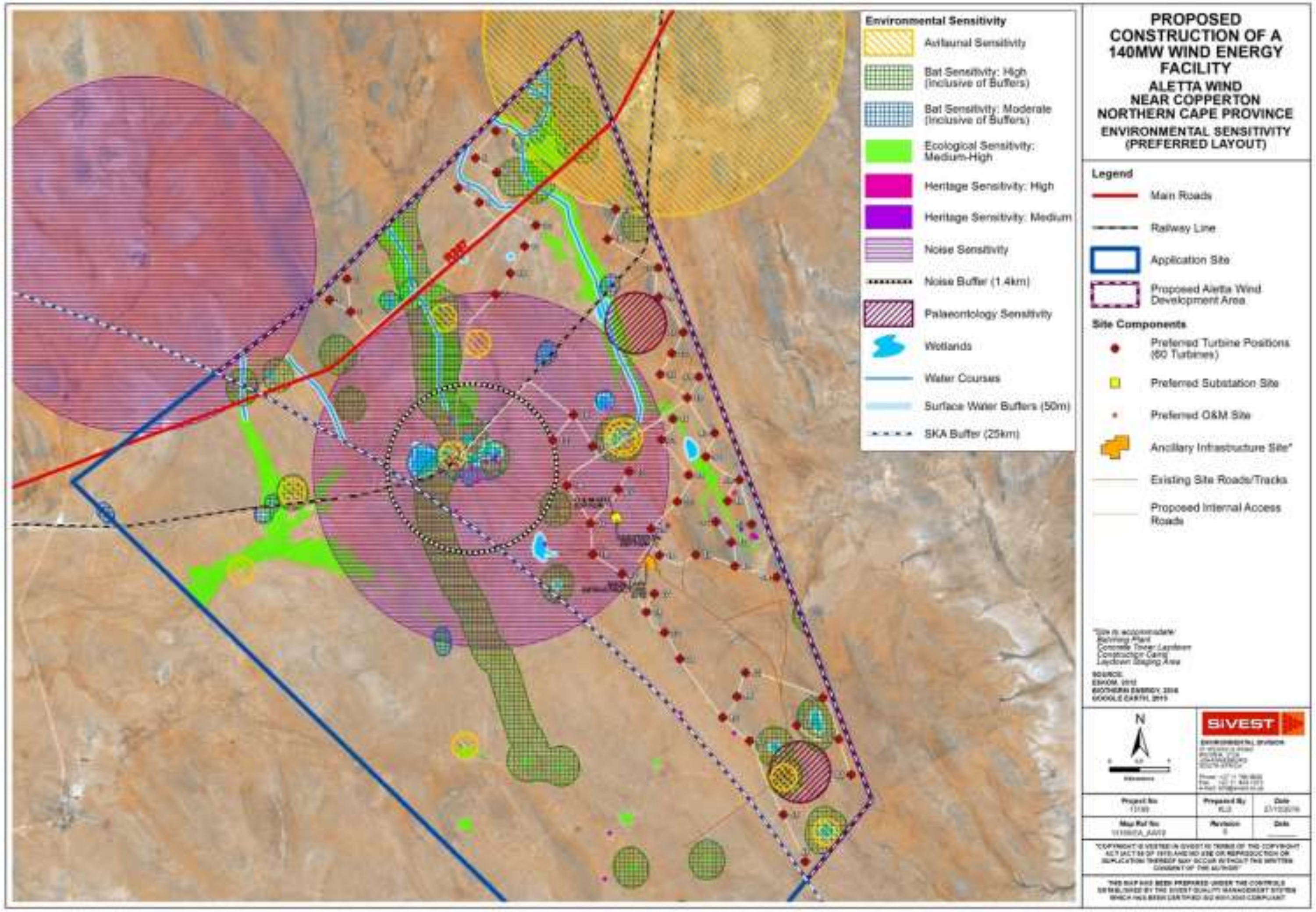


Figure 216: Preferred Site Layout in relation to Sensitive Areas

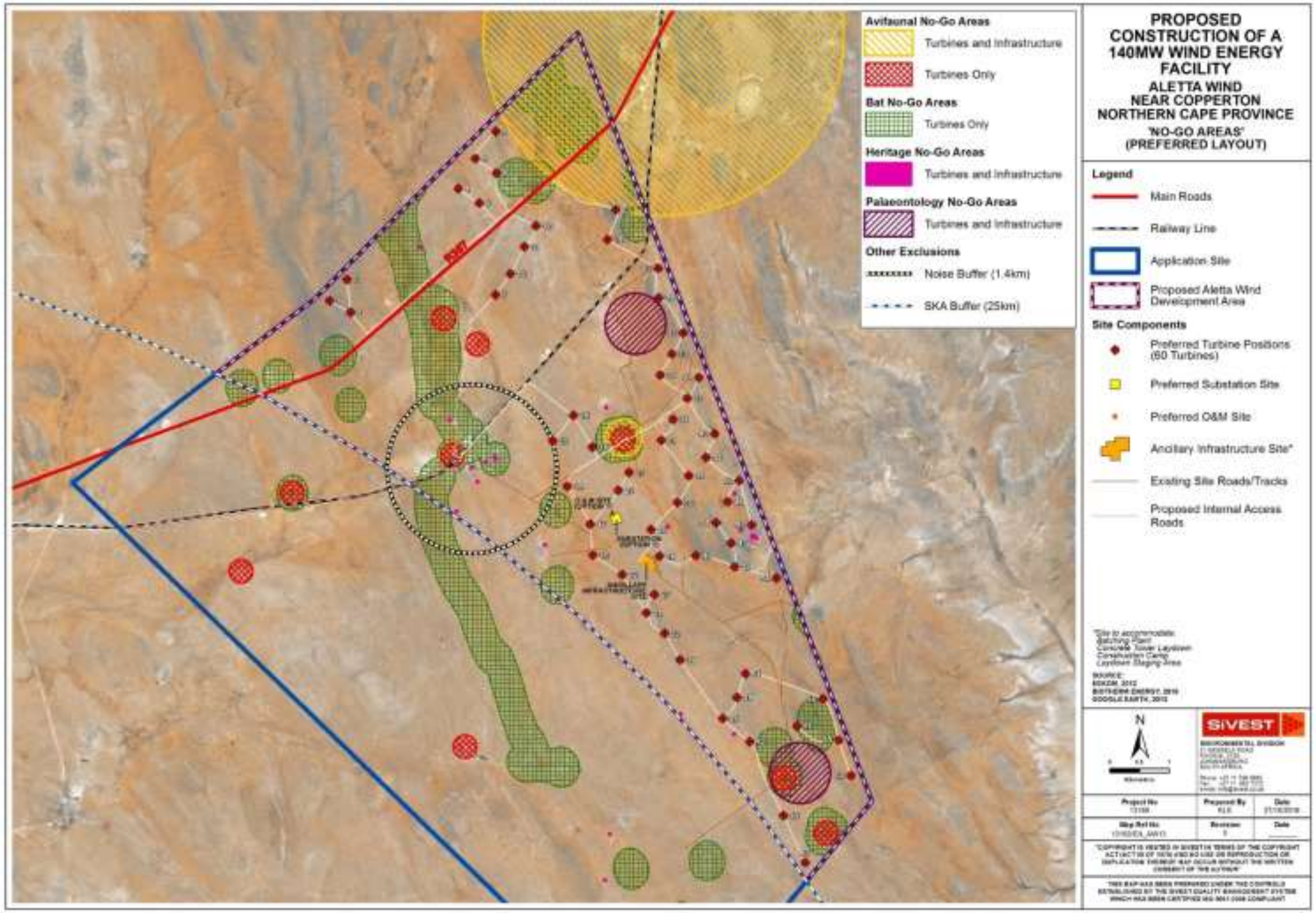


Figure 217: Preferred Site Layout in relation to No-go Areas

It is important to note that the preferred site layout provided above is only the EIA phase layout and therefore not the final layout for the proposed development. This is due to the following reasons:

- The technology is constantly changing where higher yielding a more efficient turbines are being bought into the marked and as a result the Developer cannot commit to a specific turbine, and associated layout, at this stage.
- The EPC Contractor has not been appointed and hence the turbine manufacture is unknown. The EPC contractor is only appointed once the project has been selected as a Preferred Bidder.
- The final turbine manufacture is unknown and hence the final turbine generation capacity is unknown. The turbine generation capacity directly determines how many turbines will be present in the project area. A 2MW turbine will result in a layout with 70 turbines, where as a 3MW turbine will result in a layout with 47 turbines.
- The relocation, adding or removing of a single wind turbine has an impact on the entire wind farm. With a single change a new yield assessment and model must be conducted to determine the highest yielding layout. Hence a facility with 50 turbines will have a completely different layout to a facility with 70 turbines. The EPC contractor may also insist on their own optimised layout for the facility.
- The current project has four 500m corridors where turbines have been preliminary excluded from. Depending on the final powerline corridor selection, turbines may be relocated to be within the remaining corridors.
- If surrounding wind projects are bid and selected as Preferred Bidders before the Aletta facility, then the adjacent wind projects final layouts may include turbines on the boundary of our facility and hence these neighbouring turbines will have to be considered into the final Aletta facility layout once it has been selected as a Preferred Bidder.
- As the turbine positions are still not final the road and ancillary infrastructure layouts are also subjected to change.

It should also be noted that the specialist sensitivities and no-go areas will be incorporated into the layout design when completing the final layout. In addition, a 1.4km buffer will be placed around the land owner's house. This is 450m further than the original EIA phase layout.

12.1 No-go Alternative

The option of not implementing the activity, or **the 'no-go' alternative, is considered in the EIA**. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is 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 energy facility 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 addressing the problem. 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.

Although the negative impacts identified would not occur if the project did not go ahead, the socio economic benefits of the proposed project should not be overlooked. The No-Go alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated and that by not building the project, the socio-economic benefits would be lost.

13 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 nature 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.
- Oil spillages
- Dust and gaseous emissions.
- Water quality
- Noise and vibration
- Change in biodiversity
- 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 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 a 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 independent 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 8**.

14 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 156** 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 156** 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 the IFC Performance Standards on Environmental and Social Sustainability.

Table 156: Compliance with Equator Principles

PRINCIPLES	COMPLIANCE LEVEL	REFERENCE
Performance Standard 1 Environmental & Social Reporting		
1. Baseline Information		Refer to **Section 6**
2. Impacts and Risks		Refer to **Section 9**
3. Global impacts		N/A
4. Transboundary		N/A
5. Disadvantaged / vulnerable groups		Refer to **Section 8.9**
6. Third party		Refer to **Section 8.9**
7. Mitigation measures		Refer to **Section 10.1** and the EMPr - **Appendix 8**
8. Documentation of Assessment process		Refer to **Section 9**
9. Action Plans		No major Action Plans required as mostly generic mitigation measures have been required.
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. Labour 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 - **Appendix 8**
2. Wastes		Refer the EMPr - **Appendix 8**
3. Hazardous material		Refer the EMPr - **Appendix 8**
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		No greenhouse gas emissions will result from the proposed development.
Performance Standard 4, Health & Safety		
1. Hazardous materials safety		Refer the EMPr - **Appendix 8**
2. Environmental and natural resource issues		Refer to **Sections 6** and **8**
Performance Standard 5, Land Acquisition		Refer to **Section 5**
Performance Standard 6, Biodiversity		Refer to **Section 6.6** and **8.1**

Performance Standard 7, Indigenous People		Refer to **Section 8.9**
Performance Standard 8, Cultural Heritage		Refer to **Section 8.9**

15 EVALUATION AND RECOMMENDATIONS

Table 157 summarises the key recommendations for the environmental issues identified in the Draft Environmental Impact Assessment Report (DEIAr). 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 (where practical and possible) have been 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 project. 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 EMPr is included with this DEIAr as **Appendix 8**.

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.

The preferred site layout in relation to the sensitive areas identified by the specialists is indicated in **Figure 216**.

The preferred site layout in relation to the no-go areas identified by the specialists is indicated in **Figure 217**.

15.1 Summary of Findings

Table 157: Summary of findings and Recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	The vegetation types that occur within the region (Bushmanland Arid Grassland, Lower Gariep Broken Veld and Bushmanland Vloere and possibly floristic elements of Bushmanland Basin Shrubland and Northern Upper Karoo) are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation on the sites is therefore not considered to have high conservation status. The area is not within a Centre of Plant Endemism or in areas identified in Provincial Conservation Plans to be of concern, but it does occur within an area identified as part of the National Parks Area Expansion Strategy. Local factors that may lead to parts of the sites having elevated ecological sensitivity are the potential presence of the following: ▪ Presence of natural vegetation on site, although of low conservation priority. ▪ Presence of a number of provincially protected plant species. ▪ Presence of a number of individuals of one protected tree species, Boscia albitrunca. ▪ Presence of drainage areas and pans.	The report concludes that the project is unlikely to have highly significant impacts on the ecological receiving environment and impacts that will occur can be controlled and reduced to low significance. Mitigation measures are provided to avoid or minimise these impacts. Some impacts require permits to be issued, either by National or Provincial authorities. If mitigation measures are applied then the potential impacts can be well-managed, in which case the project is supported and it is recommended that it be authorised.

	▪ Presence of low, rocky hills with higher biodiversity than surrounding areas. ▪ Potential presence of the following animals of potential conservation concern: o Honey badger (NT) o Littledale's Whistling Rat (NT) o Giant Bullfrog (NT/LC) ▪ Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features. Cumulative impacts of this project in combination with similar projects is likely to be of low significance. The two (2) proposed sites for the combination of on-site substation and operation & maintenance (O&M) building were evaluated and both sites were found to be favourable. No significant features of concern were found at either site.	
Avifauna	The proposed BioTherm Aletta (Copperton) Wind Farm will have a variety of impacts on avifauna which range from low to high. The impacts are (1) displacement of priority species due to disturbance during construction phase (2) displacement of priority species due to habitat destruction during construction phase (3) displacement of priority species due to disturbance during operational phase (4) and collisions of priority species with the turbines in the operational phase.	The impacts of the proposed WEF on priority avifauna could be mitigated to acceptable levels, therefore the development could proceed provided that mitigation measures are strictly implemented.

	Displacement of priority species due to disturbance during construction phase is likely to be a temporary medium negative impact, but can be reduced to low with the application of mitigation measures. Mitigation measures are the restriction of construction activities to the construction footprint area, no access to the remainder of the property during the construction period, measures to control noise and dust, maximum use of existing access roads, the implementation of a 3km no development buffer zone around a Verreaux's Eagle nest, and a 300m no development buffer zone around a Southern Pale Chanting Goshawk nest. Displacement of priority species due to habitat destruction during construction phase is likely to be a medium negative impact and will remain so, despite the application of mitigation measures. Mitigation measures comprise strict adherence to the recommendations of the specialist ecological study and maximum use of existing access roads with the construction of new roads kept to a minimum. Displacement of priority species due to disturbance during the operational phase is likely to be of low significance and it could be further reduced through the application of mitigation measures. Mitigation measures are the restriction of operational activities to the plant area, no access to other parts of the property unless it is necessary for wind farm related work, post-construction monitoring, and if densities of key priority species are proven to be significantly reduced	

	due to the operation of the wind farm, engagement of the wind farm management to devise ways of reducing the impact on these species. Collisions of priority species with the turbines in the operational phase are likely to be a high negative impact but it could be reduced to medium negative through the application of mitigation measures. Mitigation measures are the implementation of post-construction monitoring and, if actual collision rates indicate high mortality levels, curtailment of selective turbines. Lastly, the implementation of a 3km no development buffer zone around a Verreaux's Eagle nest, a 200m no turbine zone around water points and a 300m no development buffer zone around a Southern Pale Chanting Goshawk nest are recommended. Finally, it is concluded that, after taking into account the expected impact of proposed renewable energy projects within a 35km radius around Kronos MTS, that the cumulative impact of the proposed Aletta WEF on priority avifauna, after appropriate mitigation has been implemented, will range from minor to insignificant. The impacts of the proposed Aletta WEF on priority avifauna could be mitigated to acceptable levels, therefore the development could proceed provided that mitigation measures are strictly implemented.	

Bats	The site was first visited in July 2015 wherein two SM2BAT+ detectors were installed on one 10m mast, and one meteorological mast. The long-term monitoring study aims to identify bat species at risk of fatality to wind turbines, and patterns in their activity and distributions (temporal and spatial). A sensitivity map was drawn up indicating potential roosting and foraging habitat. The turbine layout is respective of the bat sensitivity map is deemed acceptable with regards to the bat monitoring study since no turbines are encroaching on any sensitive area. Four bat species were detected namely, Tadarida aegyptiaca, Neoromicia capensis, Miniopterus natalensis, and Eptesicus hottentotus. Neoromicia capensis and Tadarida aegyptiaca were most commonly detected across both of the monitoring systems. The migratory species, Miniopterus natalensis, was detected by all monitoring systems and is rather prevalent on site. The relative abundance of this species was highest, as detected by all monitoring systems, over the months of September - October 2015 and February - April 2016.	If elevated bat mortalities are found during the operational monitoring, mitigation measures may need to be implemented as outlined in **Table 142**. The affected turbines to which such mitigation may apply are 18, 28, 33, 34, 38, 41, 48 and 49. In the case of a migratory event, a mitigation schedule will be drawn up specifically for the event. The Moderate bat sensitivity areas and associated buffer zones must be prioritised during operational monitoring and preferably be avoided during turbine placement, if another feasible option is available. High Bat Sensitivity areas are 'no-go' areas due to expected elevated rates of bat fatalities due to wind turbines. No turbines are allowed to be placed in High Bat Sensitivity areas and their associated buffers.
Surface Water	Ultimately, it was found that there were nine (9) watercourses (drainage lines) and twenty two (22) depressions (depression wetlands). For the depression wetlands, these were sub-divided into two sub-categories for the fifteen (15) natural depression wetlands and the seven (7) artificial (man-	Specialist recommendations include the following: ▪ All stipulated mitigation measures are to be adhered to; ▪ All surface water resources and buffer zones must be avoided as far as practically possible;

	made) depression wetlands identified. A buffer zone of 50m for watercourses and the natural depression wetlands have been applied in consideration of the factors above. No buffer zone was applied to the artificial depression wetlands as these were not identified to be of any major ecological significance. The artificial depression wetlands would however need to be avoided and should be viewed as exclusion zones. In the context of NEMA (1998) and the EIA Regulations (2014), considering the layout of the proposed development, no listed activities will be triggered based on the wind turbine, substation and operation and maintenance building facility layout since none of these structures are directly within or within close proximity (within 32m) to the identified surface water resources. However, it is presumed that internal access roads will be required which will need to route to the respective wind turbines locations and various buildings and infrastructure to be constructed. Since the drainage lines can extend for some kilometres and the distribution of the wetlands are amongst the wind turbine locations, there is a good chance the internal access roads and other associated infrastructure not shown on the current layout will need to cross or be within close proximity to the delineated surface water resources. Therefore, provisionally, Activities 12 and 19 of Government Notice 983 Listing Notice 1 are identified to potentially be triggered thereby requiring Environmental Authorisation.	▪ Where it is not possible to avoid impacting on the identified surface water resources, the relevant environmental authorisation and water use license must be applied for.

	In the context of the NWA (1998) and the proposed development, a "water use" is required where construction activities will impact on a water resource. As such, for the proposed development, since there is no anticipated direct impact or any potential indirect impact based on the current wind turbine, substation and operation and building layout, it is anticipated that no water uses will be triggered. However, as stated in above, it is anticipated the internal roads and other associated infrastructure not displayed on the current layout may need to cross or be within 500m of the identified wetlands and / or watercourses thereby triggering water uses (c) and (i). The application of these water uses can however only be confirmed once the internal road layout is available. It was identified that several potential impacts may affect the surface water resources within the proposed development area during the pre-construction, construction, operation and decommissioning phases. It is not anticipated that the proposed development will need to be decommissioned. Should this need to take place, the same impacts as identified for the construction phase of the proposed development can be anticipated. Hence, the same impacts are expected to occur and the stipulated mitigation measures where relevant must be employed to minimise impacts. Potential cumulative impacts were assessed given that numerous proposed and currently constructed renewable	

	energy developments can be found in the surrounding area. As such, the direct cumulative impact of loss of surface water resources and degradation was found not to be compounded by the proposed development as the wind turbine, substation and operation and maintenance buildings were not located in any surface water resources. However, provision for potential degradation of surface water resources due to associated infrastructure was noted. Should these potential impacts be avoided / reduced as per the mitigation measures stipulated, the cumulative impact will be negligible. From an indirect cumulative impact perspective, the proposed development as a whole was not expected to contribute to the cumulative impacts of increased run-off, sedimentation and erosion since the drainage lines flow in a southerly direction and will be contained on the proposed development area, and not into any adjacent proposed or current renewable energy developments being constructed. That being said, with the implementation of stipulated mitigation measures, the cumulative impact was again deemed to be negligible.	
Soils and Agricultural Potential	The agricultural potential for this area corresponds with the initial findings in the scoping report. Thus, an overall low potential for irrigation for map units Cg1, Cg2, Py1 with a low to moderate irrigation potential for map unit Py2, consisting of gravelly Plooysburg and Hutton soils, with soil depth 300-800 mm onto rock.	The mitigation measures proposed are as follows: ▪ Ensure that the minimum area possible is set aside for the project infrastructure, so that the natural vegetation is undisturbed and grazing of livestock can continue on site post-construction; ▪ Protection of the vegetation covering is vital, so that as little vegetation as possible to be removed. If bare

	Virtually all of the study area comprises shallow, often calcareous soils with rock outcrops. Coupled with these shallow soils, the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20 ha/large stock unit (ARC-ISCW, 2004). Two main impacts are possible. The first deals with the unavailability of land for agriculture due to the fact that a wind energy generating facility is to be established, while the second impact refers to the possibility that construction of such a facility will lead to disturbance of the topsoil and surface vegetation cover, so that erosion of topsoil by wind action will increase. There are a considerable number of other power generation projects proposed for the immediate area near Copperton and Prieska. The prevailing agricultural potential is low to very low, so there will be little or no cumulative impact in that regard. However, regarding wind erosion, there is a definite possible cumulative impact regarding potential topsoil	topsoil results, it should be covered by a soil protection layer, such as a geotextile, to stabilize the site until vegetation can re-establish. ▪ Regular communication between responsible officials at all sites in the vicinity is essential. ▪ Regular monitoring (at least monthly during any construction phase and approximately six-monthly thereafter) is strongly recommended to pick up any potential problems before they arise.

	removal by wind erosion on one site, which could then be blown for a considerable distance across other sites. Two potential sites were proposed regarding positions of the substation and other infrastructure. However, there are no sensitive areas in the study area and the natural resources are very similar, so there will be no specific difference between the two sites. Due to the occurrence of shallow soils, coupled with the extremely hot and dry nature of the climate, there are no significant impacts from the project.	
Noise	The results of the investigation indicated that the predicted impact of noise during construction phase would be confined to residences within the WEF boundaries. There would be a temporary loss of "quiet" low residual noise level with a high intensity of noise impact on the residences at location L2 during daytime if the existing access farm road in close proximity to the residences were to be upgraded. Construction of a new road and site works at least 1 000 m from the residences would reduce the impact to Low. Based on the wind energy turbine noise emission data provided, assessment of the predicted noise during the operation phase in terms of SANS 10103:2008 indicated that the intensity of noise impact on land adjacent to the WEF boundaries would range from Very High close to the boundaries to Low at a distance of 3 000 m.	In order to legally comply with the requirements of the NCR, the wind turbines would need to be relocated with a minimum distance of 2 600 m from any WEF boundary. However, as this would prevent the development from proceeding, it is recommended that a written application for exemption of provisions of the NCR be made to the local authority with the due consideration and approval by all affected parties.

	The intensity of noise impact on residences within the WEF boundaries at location L2 would be High. At residences at locations L3 and L4, at a distance of 3 100 m beyond the WEF boundaries, the intensity of noise impact would be Low and Negligible, respectively. In terms of the National Noise Control Regulations (NCR), noise emanating from the wind energy turbines would be adjudicated as disturbing noise on land within 2 600 m from the northern, eastern and southern boundaries. Compliance with the legal requirements of the NCR would require all turbines to be set back 2 600 m from the WEF boundaries. In terms of SANS 10103:2008 the intensity of noise impact on adjacent land close to the boundaries would be Medium.	
Visual	The impact assessment revealed that the proposed development would have a negative low visual impact during construction and a negative medium visual impact during operation, with several mitigation measures available to reduce the visual impact. The visual impacts are not significant enough to prevent the project from proceeding and an EA should be granted. From a visual impact perspective, only two (2) visually sensitive receptors with tourism significance have been identified within the study area, namely the Boesmansberg Guest Farm (VR 1) and the Nelspoortjie Karoo Guest Farm (VR 2).	▪ It is recommended that all mitigation measures should be implemented.

	In addition, the existing electrical infrastructure and other linear elements already present within the study area have already altered the natural character of the surrounding environment to a degree and are expected to lower the visual contrast of the Aletta Wind Energy Facility slightly. The visual impact of the proposed development on most the potentially sensitive visual receptors identified within the study area was rated as being low or medium. In addition, the proposed development would have a negligible visual impact on one (1) potentially sensitive visual receptor, while a high visual impact will be experienced by three (3) potentially sensitive visual receptor locations. SiVEST is therefore of the opinion that the impacts associated with the construction and operation phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.	
Heritage and Palaeontology (Desktop)	Heritage Impact Assessment: The Heritage Scoping Report completed in February 2016 has shown that the proposed Aletta site to be developed as a Wind Energy Facility (WEF) may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites. The subsequent field work completed for the HIA component in August 2016, has confirmed the presence of 3 archaeological find spots, 5 historical sites, 21 archaeological sites or resources and 3 grave sites. The	The mitigation measures proposed are as follows: Pre-Construction ▪ A detailed walk down of the final approved layout will be required before construction commences. ▪ Any heritage features of significance identified during this walk down will require formal mitigation, permits if required or where possible a slight change in design could accommodate such resources. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

	archaeological sites are associated with the Early Stone Age (ESA), Middle (MSA) and Later Stone Age (LSA) and are representative of archaeological sites with a medium to high significance. The design process and methodology followed by the developer for this project enabled the heritage assessment to provide input into the proposed layouts before the impact assessment. This resulted in cognisance being taken of the positions of the heritage sites and thus the reduction of impacts at an early design phase. The comparative assessment of the alternatives has shown that an overall low impact on heritage is foreseen, as all of the heritage sites identified fall outside the proposed alternative foot prints. The application site however holds a Negative Medium Impact. Allowing for a 60m diameter construction foot print for on all turbine positions has shown that all the find spots and sites fall outside and in most case more than 100 meters away from any construction activities. One archaeological resource occurs at the option 2 substation (Rated as having low heritage significance). Substation and O&M Building Option 1 is thus the preferred alternative from a heritage perspective as no heritage	Palaeontology ▪ The ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Paleontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Paleontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged. ▪ The two historic spring sites indicated on the sensitivity map are of extreme importance as Geological Heritage points and these points must for at least 500m around them be declared “No-Go” zones. ▪ The recommendations must be included in the EMPr of the project. Archaeological Sites ▪ A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be.

	resources has been identified in the general area of the substation footprint. It is the specialist's considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate. It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "SAHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area." Palaeontological Desktop Assessment: The Desktop Paleontological Survey Identified that the proposed development is allocated a Moderate Paleontological Sensitivity. Geological structures associated with groundwater were mapped as well as spring sites which are part of the Heritage of this area. The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group.	▪ Sites ALE 4 and ALE 36 must be monitored during construction, as they are close to turbine construction activities. ▪ Demarcate and fence during construction if construction activities are within 100 meters from a site. ▪ Monitor find spot areas if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase. Historical Sites ▪ Demarcate sites as no-go areas. ▪ Demarcate and fence during construction if construction activities area to happened within 100 meters from a site. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Grave Sites and cemeteries ▪ Adjust the development layout (where possible) and demarcate the grave sites with at least a 5-10-meter buffer.

	The allocation of a Moderate sensitivity for Paleontological Heritage to the entire study area except the two historic spring sites, which indicate Very High point sources of Groundwater Heritage. Although the Uitdraai Formation can provide new information on micro-fossils of Mokolian age, these fossils are very difficult to identify and are more of academic interest. Both the Dwyka Group and Gordonia Formations are however known for some very significant fossil finds and although scarce, the fossils can contribute significantly to our understanding of depositional environments during the Carboniferous, Permain and Quaternary ages in South Africa.	▪ In the event that the sites cannot be excluded from the development footprint, a grave relocation process (as described in Appendix A of the Heritage Assessment report) needs to be implemented. Cumulative Impact ▪ It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.
Socio-economic	The economy of the Siyathemba LM is in need of investment and development and the establishment of the wind facility in the area will offer such an opportunity. Furthermore, if the other proposed projects are approved, this could contribute to the growth of this sector as well as stimulate economic development further. The project will have the potential to improve the standard of living of the communities located within a 50 km radius given the commitments towards socio-economic and enterprise development. The construction and operation of the facility will result in various positive economic impacts.	▪ The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure. ▪ Consultation with the directly affected and adjacent land owners must be on-going to limit the effect on productive agricultural land. ▪ It is recommended that in order to curb the increase in property prices in the area, proper planning concerning accommodation of the construction crew must be done. ▪ Construction vehicles should only access the construction site via demarcated access roads and

	▪ It is estimated that the capital expenditure on the 140 MW wind facility will be R2.6 billion. Approximately, 128 employment opportunities will be created during the construction phase at peak construction. About 40% of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. ▪ The annual revenue generated by the plant could amount to up to R1.3 billion. Furthermore, it is expected that 39 jobs per annum will be created at the plant. Overall, the impacts discussion and evaluation revealed that no fatal flaws are present from a socio-economic perspective, preventing the proposed development from being approved and implemented. In fact, all of the expected negative socio-economic impacts are of low significance.	should not be allowed to cut across farms or vacant (agricultural) land. ▪ The project developers and affected land owners should discuss and agree on appropriate construction procedures, which will minimise disruption of current farming activities. ▪ Aim to hire as many people from the local community as possible to limit the increase in demand for accommodation. ▪ Where possible and feasible, local procurement of labour should be applied to ensure the maximum benefit to the impacted / local community. ▪ Where feasible, training and skills development programmes targeted at the locals should be initiated prior to commencement of the construction phase. ▪ Knowledge sharing and on-the-job training should be promoted by the developer among the appointed contractors. ▪ Raise awareness among construction workers on health issues, including HIV/AIDS. ▪ Locals should be informed upfront about employment opportunities so that there are no unrealistic expectations on the part of the community. ▪ The project proponent should attempt to resolve issues and concerns, which they are made aware of immediately.

		▪ Ensure clear communication of the project information and effective public participation processes to minimise the influx of migrant job seekers. ▪ Movement of construction workers on and off site must be closely monitored and managed. ▪ Prior construction, rules and regulations regarding presence of construction workers on site need to be devised in consultation with the land owners of directly affected and adjacent properties. ▪ During construction the rules and regulations must be clearly communicated to all workers, personal property must be respected and avoided. ▪ Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities, local authorities and local land owners. ▪ Establish a health facility for the duration of the construction period to provide services to the construction crew and alleviate pressure on the local facilities.
Electromagnetic Interference Path Loss and Risk Assessment (Including Emission Control Plan)	This risk assessment would enable one to estimate the maximum permissible radiated emissions from the equipment installed within the Aletta wind energy facility and will be compared to known radiated emission data from the Acciona AW125/3000 Wind Turbine Generator (WTG). Acciona AW125/3000 WTG is a large turbine type and was used to show the typical impacts of a similar technology and sized turbine. The assessment and Electromagnetic Control	In order to evaluate the impact of the completed windfarm on the ambient emissions, reference measurements are to be done before construction and after construction. A separate test plan will be developed for that. Items identified as EMC emitters and therefore being a risk for the SKA will be analysed independently and mitigation measures will be applied.

	Plan addresses mitigation actions required to reduce the radiated emissions of the AW 125 TH 100A WTG to levels acceptable for installation within the declared Karoo Central Astronomy Advantage Area. The intent of this plan is thus to ensure that the proposed Aletta wind energy facility poses a low risk of detrimental impact on the SKA by describing specific mitigation measurements to be implemented in order to achieve 40 dB of attenuation, as agreed with SKA South Africa. In addition, this plan concerns itself with the goal of eliminating causes of electromagnetic interference (EMI), which can adversely affect the performance of the SKA Radio telescope. The current Electromagnetic Compatibility (EMC) requirement is a 30dB reduction in radiated emissions to ensure the cumulative emission level of a wind farm is within the requirements of SKA. This requirement is based on measurements on the Acciona AW 125 TH100A WTG at the Gouda facility in South Africa and Barosoain windfarm, Navarra, Spain. Very similar design will be used for the Copperton/ Garob facilities. To prevent an impact on the SKA Project, Biotherm Energy has reviewed the facility lay-out to increase the distance from the closest turbine to the closest SKA infrastructure from 20km to 25km. The number of turbines has also been reduced from the initial 125 turbines to 60 turbines.	To verify overall windfarm emissions, ambient measurements should be done at the new site before construction starts. Tests points should be carefully selected based on test equipment sensitivity with the objective to observe the increase in ambient emissions as construction progresses. Final site tests will be done on completion of the project and results should be compared to results in the Electromagnetic Interference Path Loss and Risk Assessment Report to prove the effectiveness of the mitigation techniques applied to the turbine. Although not anticipated, proper mitigation measures on identified emitters will be studied and implemented if final test shows emissions exceeding the SKA threshold. Lighting All lights in the at least the tower (due to the height) and in the nacelle should be LED or incandescent types. Due to the arcing nature of strobe lights, aircraft warning light for Garob and Copperton windfarms will be LED type. The synchronization among these obstruction light will be done through GPS. Fluorescent lights in the tower and nacelle will be replaced by LED. By implementing the suggested mitigation measures, the impact on the SKA project will be reduced. Where possible, the mitigation measures will be verified by means of laboratory tests.

	As mitigation techniques are source and coupling path specific, tests were be done on a current WTG to confirm the suspected noise sources. The results indicated shielding required at frequencies in the FM Radio band as well as other controlled frequency bands, especially in the nacelle area. With regards to the Convertor Cabinet, test results obtained at the current installation including a 10dB safety margin shows no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect highlighted a few frequencies that will require additional attenuation. Further analysis of the frequencies above the 0dB line proved that they are ambient frequencies in the FM, TV and cell phone band. The shielding effectiveness of the concrete tower was not taken into account. No additional shielding of the bottom converter cabinet would therefore be required. With regards to the Bottom Control Cabinet, test results obtained at the current installation including a 10dB safety margin shows that no additional attenuation is required. Adding a 17.8dB requirement to accommodate cumulative effect, highlighted the frequencies that will require additional attenuation of 12dB maximum excluding the FM radio frequencies. Further analysis of these signals proved that they are ambient signals from intentional transmitters. No additional shielding of the bottom control cabinet would therefore be required.	The following mitigation principles have been provided: ▪ Cable Emissions (DM) o Shield wires o Control loop areas ▪ Cable Emissions (CM) o Ferrites and absorbers o Control loop areas ▪ Enclosure Shielding o Improve shielding – EMC Gaskets – Conductive viewing aperature – Cooling aperature shield

	With regards to the Top Control Cabinet, when taking cumulative effect into consideration, a significant amount of shielding is required. This is the combined effect of the cables entering and exiting the Top Control Cabinet and equipment mounted in the cabinet. Further analysis of the highest peaks revealed that they can be attributed to FM radio stations, TV and GSM intentional transmitters. However, not all signals that require attenuation could be attributed to intentional transmitters. Mitigation should include shielded cabinets, shielded cable trays and the use of absorptive cable sleeves. Laboratory tests will be done to narrow down the source possibilities. Although site measurements were done, there is always the risk of interference signals (A) being masked by a higher amplitude interference signal (B). Signal A will then only become apparent once signal B has being mitigated. As the wind turbine generator and control equipment is a matured design, mitigation will be limited to non-invasive techniques.	
Traffic	As part of the traffic assessment haulage routes were compared. Route Alternative 1 and Route Alternative 4 were deemed to be the preferred options. Route Alternative 1 avoids the Van Rhyns Pass and the Piekenierskloof Pass, however, there is a railway bridge on the N7 (located approximately 42km southeast of the town of Nuwerus) which may be a possible obstruction. As such, Route Alternative 4 was deemed to be the preferred option as it	In order to avoid the railway bridge on the N7 (located approximately 42km southeast of the town of Nuwerus) which may be a possible obstruction, an application to use the facility road adjacent to the N7 must be investigated. The existing gravel track off the R357, which is currently the farmer's access road, will need upgrading and extension and will need to be suitably maintained. Re-

	doesn't have any gravel roads and is much shorter than the other alternatives. Based on the available information, it was calculated that the development will generate 6845 trips over an 18 month period. It was assumed that two (2) turbines will be delivered to site each week which roughly equates to three (3) deliveries per day. Fifteen normal heavy and light vehicles will also travel to and from site daily but, over a much shorter distance. Access to the site will be via an existing gravel track off the R357, which is currently the farmer's access road, approximately 34km from the N10 intersection. Sight distance at the access is more than adequate and the pavement structure seems to be sound and with little to no defects. It is expected that the community of Prieska will participate in the construction phase of this development. From a traffic point of view, the total daily construction traffic is deemed to be very low and will not significantly impact this community. The cumulative effect on the community was rated as a positive low impact.. The impact of the construction traffic on the general traffic and the surrounding communities along the haulage route is considered to be low. The level of service on the roadways	gravelling may be necessary as a maintenance measure, from time to time, throughout the operational life of the plant. Should damage be caused by the transport vehicles along the access roadway, it should be assessed and mitigating maintenance should be initiated. Additional delays experienced by the level of service on the roadways on which the components are transported can be mitigated by: ▪ Allowing the general traffic to pass the transport vehicle at regular intervals. ▪ The abnormal vehicles should not travel in groups of two or more so as to limit the delays caused by the relatively slow vehicles. Permits must be obtained for the oversized vehicles in order to transport the turbine components. SANRAL Western / Southern Region will need to be contacted in order to obtain consent for the abnormal load transport on their roadways. Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period.

	on which the components are transported may experience some additional delay. All the components will be transported by truck from Saldanha or Coega harbour to the site using the defined routes with possible minor deviations. These vehicles are classified as oversize vehicles and permits must be obtained in order to transport the turbine components. The access to the site is on road R357 which is a Provincial road and will necessitate the involvement of the Northern Cape provincial roads and transport department. The cumulative impact and significance of the development of the wind energy farm is considered to be low negative and low positive impacts when traffic and surrounding community parameters, respectively, are examined.	

A summary of the impact rating of the proposed development according to each environmental aspect are provided in

Table 158 below.

Key

LOW NEGATIVE	**LOW POSITIVE**
MEDIUM NEGATIVE	**MEDIUM POSITIVE**
HIGH NEGATIVE	**HIGH POSITIVE**

Table 158: Impact rating summary for the proposed Aletta Wind Energy Facility during the construction phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss of indigenous natural vegetation	-38 (high negative)	-36 (medium negative)
	Loss of individuals of protected plant species	-11 (low negative)	-9 (low negative)
	Loss of individuals of protected trees	-12 (low negative)	-9 (low negative)
	Damage to sensitive habitats	-36 (medium negative)	-10 (low negative)
	Mortality of individuals of sedentary fauna	- 26 (low negative)	-11 (low negative)
	Displacement of individuals of mobile fauna	- 8 (low negative)	- 8 (low negative)
Avifauna	Displacement of priority species due to disturbance during construction phase	-39 (medium negative)	-18 (low negative)
	Displacement of priority species due to habitat destruction during construction phase	-32 (medium negative)	-30 (medium negative)
Bats	Destruction of bat roosts due to earthworks and blasting	-68 (high negative)	-16 (low negative)
	Loss of foraging habitat	-30 (medium negative)	-8 (low negative)
Surface Water	Construction Lay-down Area	- 22 (low negative)	- 6 (low negative)
	Vehicle and Machinery Degradation	- 26 (low negative)	- 6 (low negative)
	Human Degradation of Flora and Fauna associated with Surface Water Resources	- 10 (low negative)	- 6 (low negative)
	Degradation and Removal of Soils and Vegetation in Surface Water Resources	- 42 (medium negative)	- 6 (low negative)
	Increased Run-off, Erosion and Sedimentation	- 39 (medium negative)	- 6 (low negative)
	Loss of agriculturally productive land	- 20 (low negative)	- 20 (low negative)

Soils and Agricultural Potential	Increased erosion of topsoil by wind	-45 (medium negative)	- 18 (low negative)
Noise	Temporary loss of “quiet” low residual noise level during construction phase for residential area within the WEF boundaries.	- 27 (low negative)	- 6 (low negative)
Visual	Rating of visual impacts of the proposed 140MW Aletta Wind Energy Facility during construction	-24 (low negative)	-22 (low negative)
	Rating of visual impacts of the infrastructure associated with the proposed 140MW Aletta Wind Energy Facility during construction	-22 (low negative)	-20 (low negative)
Heritage and Palaeontology	Impact on Palaeontological sensitive rock formations	-51 (high negative)	-15 (low negative)
	Impact on Stone Age find spots and Sites	-40 (medium negative)	-16 (low negative)
	Impact on Historical structures and cemeteries	-34 (medium negative)	-16 (low negative)
	Impact on Unidentified heritage structures	-34 (medium negative)	-17 (low negative)
Socio-economic	Loss of agricultural land during construction	-13 (low negative)	-13 (low negative)
	Disruption of farming activities due to construction related activities	-8 (low negative)	- 8 (low negative)
	Temporary employment creation during construction	+12 (low positive)	+12 (low positive)
	Loss of farm labour to the construction phase	-11 (low negative)	-10 (low negative)
	Skills development and training during construction	+32 (medium positive)	+34 (medium positive)
	Impact on health during construction	-11 (low negative)	-12 (low negative)
	Impact on social relations during construction	-22 (low negative)	-18 (low negative)
	Impact on safety and security during construction	-28 (medium negative)	-22 (low negative)
	Change in the sense of place	-16 (low negative)	-16 (low negative)
	Temporary increase in production and Gross Domestic Product during construction	+42 (medium positive)	+42 (medium positive)

	Temporarily increased traffic and the impact on road infrastructure during construction	-26 (low negative)	-12 (low negative)
	Increased demand for social facilities	-28 (low negative)	-13 (low negative)
	Impact on service delivery	-28 (low negative)	-13 (low negative)
	Temporary increase in household disposable income during construction	+28 (low positive)	+28 (low positive)
	Impact on property values and desirability of property	+11 (low positive)	+11 (low positive)
	Temporary increase in tax revenue for government during construction	+13 (low positive)	+13 (low positive)
Traffic	Impact on Long distance route	-22 (low negative)	-6 (low negative)
	Impact on Intersections	-20 (low negative)	-6 (low negative)
	Impact on Local traffic	-7 (low negative)	-6 (low negative)
	Impact on Community	+28 (low positive)	N/A

Table 159: Impact rating summary for the proposed Aletta Wind Energy Facility during the operational phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Establishment and spread of declared weeds	-28 (low negative)	-11 (low negative)
Avifauna	Displacement of priority species due to disturbance during operational phase	-26 (low negative)	-24 (low negative)
	Collisions of priority species with the turbines in the operational phase	-51 (high negative)	-30 (medium negative)
Bats	Bat mortalities due to direct turbine blade impact or barotrauma during foraging activities (not migration)	-76 (very high negative)	-26 (low negative)
	Impact on bat populations, foraging and diversity due to artificial lighting	-30 (medium negative)	- 8 (low negative)

	Cumulative bat mortalities due to direct turbine blade collision or barotrauma during operation.	-57 (high negative)	-30 (medium negative)
Surface Water	Vehicle Damage to Surface Water Resources	- 42 (medium negative)	- 8 (low negative)
	Stormwater Run-off Impacts to Surface Water Resources	-28 (low negative)	-11 (low negative)
Soils and Agricultural Potential	Loss of agriculturally productive land	- 20 (low negative)	- 20 (low negative)
	Increased erosion of topsoil by wind	-45 (medium negative)	- 18 (low negative)
	Cumulative impacts on increased erosion of topsoil by wind	-45 (medium negative)	- 18 (low negative)
Noise	Loss of "quiet" low residual noise level for residences within the WEF boundaries for the operational life of the wind farm.	-39 (medium negative)	-10 (low negative)
	Disturbance of low residual noise level for the operational life of the wind farm.	-22 (low negative)	-9 (low negative)
	Loss of "quiet" low residual noise level on land beyond the WEF boundaries for the operational life of the wind farm.	-42 (medium negative)	-11 (low negative)
Visual	Visual impacts of the proposed 140MW Aletta Wind Energy Facility during operation	-40 (medium negative)	-36 (medium negative)
	Visual impacts of the infrastructure associated with the proposed 140MW Aletta Wind Energy Facility during operation	-34 (medium negative)	-28 (low negative)
Socio-Economic	Loss of agricultural land during operations	-13 (low negative)	-13 (low negative)
	Sustainable employment during operation	+13 (low positive)	+13 (low positive)
	Skills development and training during operations	+16 (low positive)	+17 (low positive)
	Sustainable increase in production and GDP during operations	+34 (medium positive)	+34 (medium positive)
	Sustainable increase in household disposable income during operations	+34 (medium positive)	+34 (medium positive)
	Impact on property values and desirability of property	+11 (low positive)	+11 (low positive)

	Increase in tax revenue for government during operations	+30 (medium positive)	+30 (medium positive)

15.2 Conclusion and Environmental Impact Statement

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 Aletta wind energy facility. 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 to reduce impacts. These are included within the EMPr to ensure that these areas receive special attention.

It was determined during the EIA that the proposed project will result in limited potential negative impacts and certain positive impacts. A preferred layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

A detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations, 2014. In addition, all issues raised by I&APs will be captured in the FEIAr 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 DEIAr has strived to demonstrate that where impacts were identified, these have been considered in the determination of the preferred layout.

It should be noted that micro-siting may be required within the development area during the detailed design phase to avoid any additional sensitive areas, and any new palaeontological outcrops. In addition, the final wind turbine layout will be determined during the detailed design phase. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction.

It is the opinion of the EAP that the information and data provided in this DEIAr is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Further, it is the opinion of the EAP that based on the findings of the EIA that the proposed project should be granted an EA and allowed to proceed provided the following conditions are adhered to:

- The substation and O&M building should be constructed within the preferred substation and O&M building sites for Option 1.
- All feasible and practical mitigation measures recommended by the various specialists must be implemented.
- All micro siting of the turbines and associated infrastructure must be repositioned within the authorised buildable area and must exclude all no-go areas identified by the specialists.
- Where applicable monitoring should be undertaken to evaluate the success of the mitigation measures recommended by the various specialists.
- Final EMPr should be approved by DEA prior to construction.
- The final layouts should be submitted to the DEA for approval prior to commencing with the activity.

SiVEST as the EAP is therefore of the view that:

- An environmentally preferred substation site, as well as an O&M building site has been identified which is less environmentally sensitive compared to the other site considered during the EIA phase.
- 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 proposed project can be mitigated to acceptable levels.

The date on which the activity will commence cannot be determined at this stage as they are based on the timeframes dictated by the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) bid windows. The date of the next round of bid submissions has not yet been announced. The construction of the Aletta wind energy facility is dependent on being selected as a preferred bidder. The project will therefore require an authorisation of at least 5 years.

It is trusted that the DEIAr provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

16 REFERENCES

- Angel, J. 2016: Aletta Wind Energy Facility: Heritage Impact Report, PGS Heritage.
- Broughton, E., 2016: Environmental Impact Assessment for the Aletta 140MW Wind Farm: Socio-economic Impact Study, Urban Econ Development Economists.
- Fouché, C., 2016: Path Loss and Risk Assessment Report for the New Aletta Wind Farm Layout including Emission Control Plan for the AW125 TH100A WTG. Interference Testing and Consulting Services (Pty) Ltd. Pretoria.
- Gibb, A., 2016: Proposed Construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province: Visual Impact Assessment Report – Impact Phase, SiVEST. Rivonia.
- Hoare, D., 2016: Ecological study on the potential impacts of the proposed BioTherm Aletta Wind Energy Facility near Copperton Northern Cape Province, David Hoare Consulting. Pretoria.
- Jongens, A.W.D., 2016: Environmental Noise Impact Study: Proposed Establishment of a Wind Energy Facility, Aletta. near Copperton in the Northern Cape Province. Jongens Keet Associates.
- Marais, W. and Moir, M. 2016: Final Progress Report of a 12-month Preconstruction Bat Monitoring Study for the proposed Aletta 1 Wind Energy Facility Northern Cape Province. Cape Town.
- Paterson, D.G., 2016: Soil Information for the Proposed Aletta Wind Energy Facility, ARC-Institute for Soil, Climate and Water. Pretoria.
- Taylor, S., 2016: Proposed Construction of the Aletta 140MW Wind Farm Facility near Copperton Northern Cape Province - Surface Water Impact Assessment Report. SiVEST. Rivonia.
- Van der Merwe, D., 2016: Proposed Construction of Aletta Wind 140MW Wind Energy Facility: Traffic Impact Study for the Transport of Wind Energy Equipment to a Facility in the Northern Cape Province. BVi Consulting Engineer. Sentury City.
- Van Rooyen, C., 2016: Bird Impact Assessment Study: Proposed BioTherm Aletta Wind Energy Facility near Copperton in the Northern Cape Province, Chris van Rooyen Consulting.

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