Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without Mitigation	Long Term	3	Localised	1	Severe	4	Unlikely	1	**9**	**MODERATE -**
With Mitigation	Long Term	3	Localised	1	Moderate	2	Unlikely	1	**7**	**LOW -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long term	3	Regional	3	Severe	4	Definite	4	**14**	**HIGH -**
With mitigation	N/A		N/A		N/A		N/A			**N/A**

9.2.5 Impact 4: Impact of Noise during the Operation Phase

The impact of the noise pollution that can be expected from the site during the operational phase will largely depend on the climatic conditions at the site. The ambient noise increases as the wind speed increases. Under very stable atmospheric conditions, a temperature inversion or a light wind the turbines will not be operational as the cut-in speed is 4m/s.

Cause and Comment
During the operational phase, the results indicate the following:

- The noise level at four noise sensitive areas during the operational phase is unacceptable.
- The impact of low frequency noise and infra-sound will be negligible and there is no evidence to suggest that adverse health effects will occur as the sound power levels generated in the low frequency range are not high enough (i.e. are well below 90 dB) to cause physiological effects.

Mitigation and Management
Given that it is not possible to eliminate all noise during the operational phase, the following general recommendations are made:

- WTG 117 should be moved to a distance exceeding 500m from Ou Smoor Drift Farm House
- WTG 190 should be moved to a distance exceeding 500m from Matjesfontein Farm House
- WTG 19 should be moved to a distance exceeding 500m from Jagersfontein Farm House
- WTG 147 should be moved to a distance exceeding 500m from Rietfontein Farm House

Significance Statement

Noise sensitive areas (NSA) 1, 5, 7, 8, 9, 10, 11, 12 & 13
Without mitigation
The impact of noise on *NSA 1, 5, 7, 8, 9, 10, 11, 12 & 13* the above-mentioned noise sensitive areas in the operation phase would be **definite** and have ***severe*** long-term negative impacts. This would affect the *local area* and would be of HIGH negative significance.

***Noise sensitive areas (NSA)* 2, 3, 4 & 6**
Without mitigation
The impact of noise on *NSA 2, 3, 4 & 6* as a result of the operation phase would be **definite** and have ***severe*** long-term negative impacts. This would affect the *local area* and would be of HIGH negative significance.

With mitigation
The impact of noise *NSA 2, 3, 4 & 6* as a result of the operation phase **may occur** and have ***slight*** long-term negative impacts. This would affect the *local area* and would be of LOW negative significance.

Cumulative Impact Statement
The cumulative impacts of noise during operational phase could be determined to be low negative. The noise will be localised and only slight as the turbines would be micro-sited away from homesteads and noise sensitive receptors. Due to the remoteness and distance away from nearest neighbours, no cumulative impact is envisaged.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE NSA *1, 5, 7, 8, 9, 10, 11, 12 & 13*										
Without Mitigation	Long Term	3	Localised	1	Slight	1	May occur	2	**7**	**LOW -**
With Mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
OPERATIONAL PHASE NSA *2, 3, 4 & 6*										
Without Mitigation	Long Term	3	Localised	1	Severe	4	Definite	4	**12**	**HIGH -**
With Mitigation	Long Term	3	Localised	1	Slight	1	May occur	2	**7**	**LOW -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long Term	3	Localised	1	Slight	1	May occur	2	**7**	**LOW -**
With mitigation	Long Term	3	Localised	1	Slight	1	May occur	2	**7**	**LOW -**

9.2.6 Impact 5: Disturbance of birds

Cause and Comment
During operation the disturbance caused by the noise and visual movement of the wind turbines will disturb avifauna. This disturbance is likely to result in shy and sensitive species leaving the area.

Mitigation and Management
No mitigation is required, as it is unlikely that any measures that are feasible will reduce the impact of this disturbance to an extent where the shy and sensitive species will remain. In comparison to the other impacts, this impact is relatively minor.

- Wind turbines should be fitted with technology that reduces the amount of noise produced by their machines. This will especially reduce the disturbance to nesting birds.
- The wind turbines must not be placed on the leading edge of the ridges as that is the prime area the birds (mainly raptors) move along depending on the direction of the wind.
- Noise must be kept to a minimum when servicing the wind energy facility.
- Visitors and maintenance staff to the facility or vehicles should stick to the roadways.
- If practical, red aircraft warning lights should be used in preference to white lights.

Significance statement
While the table below shows that this impact has been rated as moderate, this is misleading as the temporal scale and risk or likelihood push this impact score up. The significance should rather be seen as low.

Without mitigation
The impact of disturbance displacement during the operation of the wind energy facility would **probably** have ***moderate*** long term negative impacts. This would affect the *study area* and would be of MODERATE negative significance.

With mitigation
The impact of disturbance displacement during the operation of the wind energy facility would **probably** have ***slight*** long term negative impacts. This would affect the *study area* and would be of MODERATE negative significance.

Cumulative Impact Statement
The cumulative impact on birds increases due to the spatial scale increasing from *study area* to *regional*, as well as the impact being of a *severe* nature. The sensitivity map presented in the specialist study aids to guide the placing of turbines. Low sensitivity is reported for the area surrounding the power lines traversing the proposed site. There are no mitigation measures available to address on a cumulative scale. Thus mitigation should be considered by the individual proponents as suggested above.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without Mitigation	Long Term	3	Study Area	2	Slight	1	Probable	3	**9**	**MODERATE -**
With Mitigation	Long Term	3	Study Area	2	Slight	1	Probable	3	**9**	**MODERATE -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long Term	3	Regional	3	Severe	4	Probable	3	**13**	**HIGH -**
With mitigation	Long Term	3	Regional	3	Severe	4	Probable	3	**13**	**HIGH -**

9.2.7 Impact 6: Disruption in local bird movement patterns

Cause and Comment
Large scale wind energy facilities will no doubt be a significant obstacle for birds to avoid and this avoidance behaviour may lead to decreased fitness[2] as birds expend more energy flying from one point to another. Of particular concern is the cumulative impact of multiple wind energy facilities in one area (as will be the case here).

Mitigation and Management
The following mitigation measures can be used to minimise the effects of barriers caused by the wind energy facility:

[2] The ability to survive to reproductive age and produce viable offspring. Fitness also describes the frequency distribution of reproductive success for a population of sexually mature adults.

- Corridors must be left between turbines to allow birds to fly safely from one side of the site to the other.

Significance statement
The significance of this impact has been rated as moderate both with and without mitigation. The mitigation for this impact should not be seen as solving the problem as it is uncertain as to whether birds will use corridors between turbines and if they do how much increased risk they will face from collisions.

Cumulative Impact Statement
Important Bird Areas (IBAs) (Birdlife South Africa www.birdlife.org.za) have been mapped during the investigation of cumulative impacts for the Terra Wind Energy Golden Valley Project. IBAs are key sites for conservation globally. There are 122 IBAs in South Africa. They are small enough to be conserved in their entirety and often already part of a protected area network. They hold significant numbers of one or more threatened bird species; endemic species; and/or hold large numbers for migratory or congregatory bird species. The closest IBA to the Cookhouse area is 95km away near to Fort Beaufort. Table 9-2 below details the IBAs within approximately 250km of Cookhouse.

Table 9-2 – Important Bird Areas near to the Terra Wind Energy Golden Valley Project

NAME OF IMPORTANT BIRD AREA	AREA AND PROTECTION STATUS
Katberg – Readsdale Forest Complex (Sa091)	20,000ha, Partially Protected
Amathole Forest Complex (Sa092)	42,000ha, Partially Protected
Alexandria Coastal Belt (Sa094)	15,460ha, Partially Protected
Algoa Bay Islands Nature Reserve (Sa095)	40ha, Fully Protected
Swartkops Estuary, Redhouse And Chatty Salt (Sa096)	926ha, Partially Protected
Maitland-Gamtoos Coast (Sa097)	1,800ha, Unprotected
Kouga-Baviaanskloof Complex (Sa093)	172,000ha, Partially Protected

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without Mitigation	Long term	3	Study area	2	Moderate	2	Definite	4	**11**	**MODERATE -**
With Mitigation	Long term	3	Study area	2	Slight	1	Probable	3	**9**	**MODERATE -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long term	3	Regional	3	Moderate	2	Definite	4	**12**	**HIGH -**
With mitigation	Long term	3	Regional	3	Slight	1	Probable	3	**10**	**MODERATE -**

9.2.8 Impact 7: Collisions of birds with the turbines

Cause and Comment
The cause of birds colliding with the turbines has been explained in this report and the various theories presented. Please refer to sections 8.1.1 and the Avifauna Specialist Report in the Specialist Volume. In general, the main cause will be the positioning of the turbines in or close to important bird flight paths. This impact of collisions is seen as the largest impact on avifauna for this project and as such the one that requires the most mitigation.

Mitigation and Management
The most important mitigation activity will be positioning the turbines away from sensitive avifaunal sites. These sites include the Fish River and the associated agriculture, as well as the canals, dams and pans etc.

The following mitigation measures can be used to minimise the effects of bird mortalities from collision with the wind energy facility:

- Reduce the number of perches available to birds on the turbine and tower. It is clear that the tubular tower greatly reduces opportunities for perching and therefore should be the structure of choice for the new wind energy project.
- Intermittent lighting must be used if possible (i.e. if it does not contradict aviation regulations), as well as red light which is less attractive to birds than white light.
- These recommendations are in line with the *Aviation Act (Act No. 74 of 1962): 13th Amendment of the Civil Aviation Regulations 1997* which states that: Night time wind turbine obstruction lighting should consist of medium intensity type B aviation red flashing lights. Minimum intensities of 2 000 candela for night-time red flashing or strobe lights are required. *Note: Steady-burning obstruction lights shall not be used.*
- To reduce the effects of motion smear rotor blades must either be painted with black stripes across the blade, in different positions on each blade, or a single solid black blade with two solid white blades. However, such marking of blades would possibly enhance the visual impact to surrounding communities and would need to be assessed by a specialist prior to further consideration. According to the *Aviation Act (Act No. 74 of 1962): 13th Amendment of the Civil Aviation Regulations 1997:* nothing is mentioned about the colour of rotor blades. The only instance that colour is mentioned is in reference to the colour of the actual turbine: Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required.
- The wind turbines must not be placed on the leading edge of the ridges as that is the prime area the birds (mainly raptors) move along depending on the direction of the wind.
- Spacing between turbines at a wind facility can have an effect on the number of collisions. Therefore turbines should be placed at least 300m apart.
- Monitoring for at least the first two years of operation should take place. If high bird mortalities are recorded then the wind farm must investigate emitting broadcasts of a certain radio frequency to discourage birds from entering high collision areas.
- Turbines could be programmed to switch off under specific conditions prone to bird collision such as during low wind.

Significance statement
The impact of collisions is a moderate impact and must be mitigated to reduce the impact. The site specific EMP will, to a large extent, tighten up and further define the mitigation measures required in order to do this.

Without mitigation
The impact of bird mortalities associated with the wind energy facility would **probably** have ***severe*** long term negative impacts. This would affect the *study area* and would be of MODERATE negative significance.

With mitigation
The impact of bird mortalities associated with the wind energy facility **may** have ***moderate*** long term negative impacts. This would affect the *study area* and would be of MODERATE negative significance.

Cumulative Impact Statement
While a relatively low rate of bird mortality is associated with an individual wind energy facility, the cumulative impact of many wind farms on any one area will greatly increase the rate of mortalities. The proposed turbines may shield the power lines from bird collisions and from a cumulative impact point of view this will be advantageous for avifauna. There will be little or no need for specific site assessment during the EMP

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without Mitigation	Long Term	3	Study area	2	Severe	4	Probable	3	**11**	**MODERATE -**
With Mitigation	Long Term	3	Study area	2	Moderate	2	May occur	2	**9**	**MODERATE -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long Term	3	Regional	3	Severe	4	Probable	3	**13**	**HIGH -**
With mitigation	Long Term	3	Regional	3	Moderate	2	May occur	2	**10**	**MODERATE -**

9.2.9 Impact 8: Collisions and electrocutions of birds with power lines and substations

Cause and comment
Collisions are one of the biggest single threats posed by overhead power lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted are bustards, storks, cranes and manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines. Depending on the routes and number of overhead power lines in this project, this could have a serious impact on avifauna.

Electrocutions of birds in the substation yards and on the power line poles could also have a large effect depending on the design of the infrastructure.

Mitigation and management
Mitigation for the impact of the electrical infrastructure will include the following:

Electrocutions- It is highly recommended that the steel monopole design be used for the 132KV power line poles. This design is generally very safe for birds as the clearances between live phases and earth phases is greater than 1.8 metres, which is the length of the largest species wingspan. The steel monopole must also have the standard bird perch fitted, which will allow raptors a safe area to perch on the pole.

Electrocutions in the substation yards should not be significant as the sensitive species are not known to use these sites for perching or roosting. If fatalities are recorded during monitoring mitigation measures should entail adding insulation to infrastructure.

Collisions- The significance of the short power lines that will service this facility in relation to the collision risk of birds with the turbines is very small. In addition the 132KV lines will, for the most

part, follow existing transmission lines. This will help to mitigate the impact of collision as power lines grouped together are more visible to birds while in flight.

The power line routes must be walked during the site specific EMP and any sections of collision concern should be marked with standard anti-collision marking devices to mitigate the impact of collision.

Significance Statement
The significance has been rated as moderate. However, should the steel monopole design be used for the power line and sensitive areas marked for collisions during the EMP, this can rather be viewed as a low impact.

Without mitigation
The impact of the collisions and electrocutions of birds with power lines and substations during the operational phase **may** have ***moderate*** long-term negative impacts. This would affect the *study area* and would be of MODERATE negative significance

With mitigation
The impact of the collisions and electrocutions of birds with power lines and substations during the operational phase **may** have ***slight*** long-term negative impacts. This would affect the *study area* and would be of MODERATE negative significance

Cumulative Impact Statement
There is a low sensitivity reported for the area surrounding the power lines traversing the proposed site (Avifauna Specialist Report in Specialist Volume). The proposed turbines may shield the power lines from bird collisions and from a cumulative impact point of view this will be advantageous for avifauna.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Long-term	3	Study area	2	Moderate	2	May occur	2	**9**	**MODERATE -**
With mitigation	Long-term	3	Study area	2	Slight	1	May Occur	2	**8**	**MODERATE -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
With mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long-term	3	Regional	3	Moderate	2	May occur	2	**10**	**MODERATE -**
With mitigation	Long-term	3	Regional	3	Slight	1	May Occur	2	**9**	**MODERATE -**

9.2.10 Impact 9: Loss of Thicket

Cause and comment
During operation, the wind farm will require maintenance and transport to and from the various wind turbines. As such, a limited amount of disturbance and trampling of vegetation will occur during these operations. Mitigation measures can be used in order to reduce the trampling and rehabilitate the vegetation respectively. If nothing were built on the site, the overall significance would be positive

Mitigation and management
Mitigation measures include the following:

- Keep removal of vegetation to a minimum.
- Proposed turbine sites are not situated within the few remaining patches of thicket.

Significance Statement

Without mitigation

In the operation phase of the development, the impact will be permanent, localised, may occur and moderate, resulting in an overall significance of moderate negative. This impact was assessed with a high level of confidence.

With mitigation

In the operation phase of the development, severity of the impact is reduced to slight and remains an overall significance of low negative.

Cumulative Impact Statement

Due to the scope of this study it was not possible to ascertain vegetation types at all four proposed wind farm sites. Therefore, it is determined that the vegetation loss over the extent of the four proposed wind energy facilities could be extensive[3]. Every effort must be made to reduce the trampling and disturbance of vegetation, including the rehabilitation of affected areas. The spatial scale of the loss of vegetation is increased to regional and the overall impact is moderately negative, with and without mitigation.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Permanent	4	Localised	1	Moderate	2	May occur	2	**9**	**MODERATE -**
With mitigation	Permanent	4	Localised	1	Slight	1	Unlikely	1	**7**	**LOW-**
NO-GO OPTION										
Without mitigation	Permanent	4	Localised	1	Beneficial	1	May occur	2	**8**	**MODERATE +**
With mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
CUMULATIVE IMPACT										
Without mitigation	Permanent	4	Regional	3	Moderate	2	May occur	2	**11**	**MODERATE -**
With mitigation	Permanent	4	Regional	3	Slight	1	Unlikely	1	**9**	**MODERATE -**

9.2.11 Impact 10: Loss of Bedford Dry Grassland

Cause and comment

Construction of the wind farm will result in loss of Bedford Dry Grassland on the site. This loss will occur as a result of trampling of the vegetation as well as extra clearing needed for construction. Mitigation measures can be used in order to reduce the trampling and rehabilitate the vegetation respectively.

If nothing were built on the site, the overall significance would be positive

Mitigation and management

Mitigation measures include the following:

- Keep removal of vegetation to a minimum.

[3] Determination reached based on the precautionary principle, as there is a lack of information.

Significance Statement
Without mitigation
In the operation phase of the development, the impact will be permanent, restricted to the study are, probable and slight, resulting in an overall significance of moderate negative. This impact was assessed with a high level of confidence.

With mitigation
For the operation of the development, some Bedford Dry Grassland will have to be permanently removed. In the operation phase of the development, only the severity of the impact is reduced, resulting in an unchanged overall significance of moderate negative.

Cumulative Impact Statement
Due to the scope of this study it was not possible to ascertain vegetation types at all four proposed wind farm sites. Therefore, it is determined that the vegetation loss over the extent of the four proposed wind energy facilities could be extensive[4]. Every effort must be made to reduce the tramping and disturbance of vegetation, including the rehabilitation of affected areas. The spatial scale of the loss of vegetation is increased to regional and the overall impact is moderately negative, with and without mitigation. The impact is reduced to moderately negative with mitigation measures in place.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Permanent	4	Study area	2	Moderate	2	Probable	3	**11**	**MODERATE -**
With mitigation	Permanent	4	Study area	2	Low	1	Probable	3	**10**	**MODERATE -**
NO-GO OPTION										
Without mitigation	Permanent	4	Study area	2	Beneficial	1	Definite	4	**11**	**MODERATE +**
With mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
CUMULATIVE IMPACT										
Without mitigation	Permanent	4	Regional	3	Moderate	2	Probable	3	**12**	**HIGH -**
With mitigation	Permanent	4	Regional	3	Low	1	Probable	3	**11**	**MODERATE -**

9.2.12 Impact 11: Loss of Karroid Thicket

Cause and comment
Construction of the wind farm will result in loss of Karroid Thicket on the site. This loss will occur as a result of trampling of the vegetation as well as extra clearing needed for construction. Mitigation measures can be used in order to reduce the trampling and rehabilitate the vegetation respectively.

If nothing were built on the site, the overall significance would be a positive.

Mitigation and management
Mitigation measures include the following:

- Keep removal of vegetation to a minimum.

Significance Statement
Without mitigation

[4] Determination reached based on the precautionary principle, as there is a lack of information.

In the operation phase of the development, the impact will be permanent, restricted to the study are, probable and moderate, resulting in an overall significance of moderate negative. This impact was assessed with a high level of confidence.

With mitigation
In the operation phase of the development, only the severity of the impact is reduced, resulting in an unchanged overall significance of moderate negative.

Cumulative Impact Statement
Due to the scope of this study it was not possible to ascertain vegetation types at all four proposed wind farm sites. Therefore, it is determined that the vegetation loss over the extent of the four proposed wind energy facilities could be extensive[5]. Every effort must be made to reduce the tramping and disturbance of vegetation, including the rehabilitation of affected areas. The spatial scale of the loss of vegetation is increased to regional and the overall impact is moderately negative, with and without mitigation. The impact is reduced to moderately negative with mitigation measures in place.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Permanent	4	Study area	2	Moderate	2	Probable	3	**11**	**MODERATE -**
With mitigation	Permanent	4	Study area	2	Low	1	Probable	3	**10**	**MODERATE -**
NO-GO OPTION										
Without mitigation	Permanent	4	Study area	2	Beneficial	1	Definite	4	**11**	**MODERATE +**
With mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
CUMULATIVE IMPACT										
Without mitigation	Permanent	4	Regional	3	Moderate	2	Probable	3	**12**	**HIGH -**
With mitigation	Permanent	4	Regional	3	Low	1	Probable	3	**11**	**MODERATE -**

9.2.13 Impact 12: Loss of Scrub Grassland

Cause and comment
Construction of the wind farm will result in loss of Scrub Grassland on the site. This loss will occur as a result of trampling of the vegetation as well as extra clearing needed for construction. Mitigation measures can be used in order to reduce the trampling and rehabilitate the vegetation respectively.

If nothing were built on the site, the overall significance would be positive.

Mitigation and management
Mitigation measures include the following:

- Keep removal of vegetation to a minimum.

Significance Statement
Without mitigation
In the operation phase of the development, the impact will be permanent, restricted to the study are, probable and moderate, resulting in an overall significance of moderate negative. This impact

[5] Determination reached based on the precautionary principle, as there is a lack of information.

was assessed with a high level of confidence.

With mitigation
In the operation phase of the development, only the severity of the impact is reduced, resulting in an unchanged overall significance of moderate negative.

Cumulative Impact Statement
Due to the scope of this study it was not possible to ascertain vegetation types at all four proposed wind farm sites. Therefore, it is determined that the vegetation loss over the extent of the four proposed wind energy facilities could be extensive[6]. Every effort must be made to reduce the tramping and disturbance of vegetation, including the rehabilitation of affected areas. The spatial scale of the loss of vegetation is increased to regional and the overall impact is moderately negative, with and without mitigation. The impact is reduced to moderately negative with mitigation measures in place.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Permanent	4	Study area	2	Moderate	2	Probable	3	**11**	**MODERATE -**
With mitigation	Permanent	4	Study area	2	Low	1	Probable	3	**10**	**MODERATE -**
NO-GO OPTION										
Without mitigation	Permanent	4	Study area	2	Beneficial	1	Definite	4	**11**	**MODERATE +**
With mitigation	N/A		N/A		N/A		N/A		**N/A**	**N/A**
CUMULATIVE IMPACT										
Without mitigation	Permanent	4	Regional	3	Moderate	2	Probable	3	**12**	**HIGH -**
With mitigation	Permanent	4	Regional	3	Low	1	Probable	3	**11**	**MODERATE -**

9.2.14 Impact 13: Introduction of alien plant species

Cause and comment
As with all building operations, the introduction of alien and invader species is inevitable; with disturbance comes the influx of aliens. Alien invader species need to be consistently managed over the entire operation phase of the project.

Mitigation and management
Mitigation measures to reduce the impact of the introduction of alien invaders, as well as mitigation against alien invaders that have already been recorded on the site should be actively maintained throughout both the construction and operation phases. Removal of existed alien species should be consistently done. Also, rehabilitation of disturbed areas after the construction of the wind energy facility should be done as soon as possible after construction is completed. Invasive plant species are most likely to enter the site carried in the form of seeds by construction vehicles and staff, these should be cleaned before entering the site to prevent alien infestation

Significance Statement
Without mitigation
In the operation phase of the project, the impact will be permanent, restricted to the study area, definite and with a severe severity. Overall significance would be a high negative. Should the

[6] Determination reached based on the precautionary principle, as there is a lack of information.

proposed development not go ahead (the No-Go option), the impact would be permanent, definite and restricted to the study area with a severity of moderate and an overall significance of high negative. This impact was assessed with a high level of confidence.

With mitigation
For the operation phase of development; temporal scale is reduced to medium-term, severity of impact to slight and likelihood to may occur, thus reducing the overall significance from high negative to low negative. Alien invasion is just as likely to occur if no development takes place and mitigation measures for the No-Go option will reduce temporal scale, severity and likelihood as well, giving an overall significance of low negative.

Cumulative Impact Statement
It is uncertain how much of the surrounding land is infested with alien vegetation, and how the alien vegetation will spread during the construction and operation phases of the four wind energy facilities. The results from the Ecological Report (Specialist Volume) were extrapolated across the four proposed wind energy projects to give an indication of the possible cumulative impact of the introduction and spread of alien species. The spatial scale of the introduction of alien species is increased to regional and the impact, without mitigation, is high. The impact is reduced to moderately negative with mitigation measures in place.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Permanent	4	Study area	2	Severe	4	Definite	4	**14**	**HIGH-**
With mitigation	Medium term	2	Study area	2	Slight	1	May occur	2	**7**	**LOW -**
NO-GO OPTION										
Without mitigation	Permanent	4	Study area	2	Moderate	2	Definite	4	**12**	**HIGH -**
With mitigation	Medium term	2	Study area	2	Slight	1	May occur	2	**7**	**LOW -**
CUMULATIVE IMPACT										
Without mitigation	Permanent	4	Regional	3	Severe	4	Definite	4	**15**	**HIGH-**
With mitigation	Permanent	4	Regional	3	Slight	1	May occur	2	**10**	**MODERATE -**

9.2.15 Impact 14: Disturbance displacement of bats

Cause and comment
The lack of bat feeding and roosting sites in the area suggest that there are not many bats (Prof Bernard, pers comm). Disturbance or displacement from around the turbines may result in reduced breeding productivity or reduced survival if bats are displaced from preferred habitat and are unable to find suitable alternatives. Disturbance may be caused by the presence of turbines, and/or by maintenance vehicles and people, as well as during the construction of the turbines.

Mitigation and management
Not a great deal can be done to minimise the effects of disturbance displacement from construction activities. However, within reason noise must be kept to a minimum when constructing the wind energy facility.

Significance Statement
In the operation phase without mitigation the impact will occur over the long term, be restricted to the study area, is probable and moderate with an overall significance of Moderate Negative. In the operation phase with mitigation (continual monitoring and application of new mitigation measures), the severity is likely to be reduced to slight, resulting in an overall impact of Moderate Negative.

Cumulative Impact Statement
The cumulative impact of the disturbance caused to bats over an expanse of land similar to that disturbed by the construction and operation of four wind energy facilities in the area is far-reaching. The spatial scale is increased to regional and the severity will be moderate. There are not many mitigatory measures available and thus the cumulative impact remains moderately negative.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Long term	3	Study area	2	Moderate	2	Probable	3	**10**	**MODERATE-**
With mitigation	Long term	3	Study area	2	Slight	1	Probable	3	**9**	**MODERATE-**
NO-GO OPTION										
Without mitigation	Long term	3	Localised	1	Slight	1	May occur	2	**7**	**LOW +**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long term	3	Regional	3	Moderate	2	Probable	3	**11**	**MODERATE-**
With mitigation	Long term	3	Regional	3	Slight	1	Probable	3	**10**	**MODERATE-**

9.2.16 Impact 15: Loss of bat habitat due to vegetation clearing

Cause and comment
The lack of bat feeding and roosting sites in the area suggest that there are not many bats (Prof Bernard, pers comm.). Change to or loss of habitat due to wind turbines and associated infrastructure. A relatively small area of habitat for bats will be completely destroyed in the construction process.

Mitigation and management
The following mitigation measures can be used to minimise the effects of loss of habitat:

- The wind turbines should not be placed on the tops of ridges.
- Every effort should be made to rehabilitate the damaged vegetation to minimise the habitat losses to resident bat species.

Significance Statement
Without mitigation
In the operation phase without mitigation the impact occurs over the long term, is restricted to the study area, is probable and has a slight severity giving an overall significance of Moderate Negative.

With mitigation
With mitigation the overall significance remains Moderate Negative.

Cumulative Impact Statement
Similar to the impact discussed above, the spatial scale is increased to regional and the severity will be moderate. There are not many mitigatory measures available and thus the cumulative impact remains moderately negative.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Long term	3	Study area	2	Slight	1	Probable	3	**9**	**MODERATE-**
With mitigation	Long term	3	Study area	2	Slight	1	May occur	2	**8**	**MODERATE-**
NO-GO OPTION										
Without mitigation	Long term	3	Study area	2	Slight	1	May occur	2	**8**	**MODERATE +**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Long term	3	Regional	3	Slight	1	Probable	3	**10**	**MODERATE-**
With mitigation	Long term	3	Regional	3	Slight	1	May occur	2	**9**	**MODERATE-**

9.2.17 Impact 16: Bat mortalities from colliding with turbine blades, tower and/or associated infrastructure

Cause and comment

This impact is probably the most crucial impact associated with the wind farm in regard to bats. Collision with the moving turbine blades, with the turbine tower or associated infrastructure such as overhead powerlines, or the wake behind the rotors can cause injury, leading to direct mortality of bats.

The behavioural responses of bats to wind turbines (see Box 1 below) explains why many of them are killed, however, there are additional explanations for this behaviour. There are several reasons proposed for the number of bat fatalities, one is that the turbines attract insects, and thus foraging insect-eating bats (Ahlen 2003, Kunz *et al*. 2007). Alternatively, bats may mistake turbines for trees when they are looking for a roost, or be acoustically attracted to the wind turbines (Kunz *et al*. 2007). The cause of death is not entirely explained by collision with turbine blades, but instead is caused by internal haemorrhaging. Most bats are killed by barotrauma, which is "caused by rapid air-pressure reduction near many turbine blades" (Baerwald *et al*.). Barotrauma "involves tissue damage to air-containing structures caused by rapid or excessive pressure change" (Baerwald *et al*.).

BOX 1: BEHAVIOURAL RESPONSES OF BATS TO WIND TURBINES

Horn *et al*. (2008) conducted a study on the behavioural responses of bats to wind turbines and discovered the following:

- Bats actively forage near operating turbines
- Bats approach both rotating and non rotating blades
- Bats followed or were trapped in blade-tip vortices
- Bats investigated the various parts of the turbine with repeated fly-bys
- Bats were struck directly by rotating blades

This impact will definitely occur as bats are known to be killed directly by wind turbines, and there are several species that may occur in the proposed Terra Wind Energy Golden Valley Project area.

Mitigation and management

The tops of ridges should be avoided for placement of turbines, turbines should also be shut off during times when bats are active, low wind speeds at night is the best time (and when little electricity is being generated by the turbines). The lower the turbines the less bat fatalities there are likely to be. If cut-in speed is set at 6 metres per second, bat fatalities can be halved. It is recommended that bat fatalities, and their causes at the wind farm are monitored, as there is no

information available for wind farms in South Africa. More applicable mitigation measures (see Box 2) can be applied when there is more information.

BOX 2: MITIGATION MEASURES TO AVOID BAT FATALITIES AT WIND FARMS

In a study conducted to determine the effects of turbine size on bat fatalities, Barclay *et al*. (2007) discovered that the diameter of the rotor had no effect on bat fatalities. Height of the turbines, however, though having no effect on bird fatalities, bat fatalities increased exponentially with an increase in turbine height (Barclay *et al*. 2007). There are, as a result, a few mitigation measures that have been suggested to reduce bat fatalities, these are:

- Ultrasound broadcast can deter bats from flying into wind turbines. (Szewczak and Arnett 2007)
- Minimizing turbine height will help to reduce bat fatalities (Barclay *et al*. 2007).
- Turbine sites on ridges should be avoided (Brinkman *et al*. 2006).
- Wind turbine operating times should be restricted during times when bat activity is high (Brinkman *et al*. 2006). Bats are at higher risk of fatality on nights with low wind speeds (Horn *et al*. 2008).
- Introduce a turbine cut-in wind speed of at least 5m.s^{-1} (Arnett *et al*., 2009)

Significance Statement

This impact applies only to the operation phase of the development. Without mitigation the impact is probable, is restricted to the study area, over the long term with a moderate severity and an overall significance of Moderate Negative. With mitigation the likelihood is reduced to may occur but the overall significance remains Moderate Negative.

Cumulative Impact Statement

Similar to the two impacts on bats discussed above, the spatial scale is increased to regional and the severity will be moderate. There are few many mitigatory measures available and thus the cumulative impact remains moderately negative.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Long term	3	Study area	2	Moderate	2	Probable	3	**10**	**MODERATE-**
With mitigation	Long term	3	Study area	2	Moderate	2	May occur	2	**9**	**MODERATE-**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACTS										
Without mitigation	Long term	3	Regional	3	Moderate	2	Probable	3	**11**	**MODERATE-**
With mitigation	Long term	3	Regional	3	Moderate	2	May occur	2	**10**	**MODERATE-**

9.2.18 Impact 17: Heritage Impacts

Cause and comment

During the operational life of the wind farm, it is expected that physical impacts to heritage will diminish or cease. Impacts to intangible heritage are expected to occur. There could be numerous impacts on contemporary cultural values and sense of place within a given study area (AWEA & ACNT, 2004). People sometimes describe an emotional and spiritual connection with places where wind farms are proposed. Sometimes, these connections appear to be shared by the community generally, or by particular groups. There may be cultural connections made to an area within poetry, art, theatre and/or music. Those connections might be adversely affected by the introduction of wind farms into those places. By adding a mechanical element (in the form of many turbines) into an environment, feelings towards the landscape may change.

In the case of this project, impacts to remote and rural landscape and wilderness qualities are of concern. The point at which a wind turbine may be perceived as being "intrusive" from a given visual reference point is a subjective judgment, however it can be anticipated that the presence of such facilities close to (for example) wilderness and heritage areas will destroy many of the intangible and aesthetic qualities for which an area is valued. The characteristics of wind turbines that invoke these impacts are listed below.

- Due to the size of the turbines the visual impacts are largely immitigable (they are easily visible from 10 km) in virtually all landscapes (personal observations), however indications are (PGWC 2006) that they are perceived to aesthetically/artistically more acceptable in agricultural or manicured landscapes.
- Visual impact of road cuttings into the sides of slopes will affect the cultural, natural and wilderness qualities of the area.
- Residual impacts can occur after the cessation of operations. The large concrete base will remain buried in the ground indefinitely. Bankruptcy of, or neglect by a wind energy company can result in turbines standing derelict for years creating a long term eyesore.

Mitigation and Management
The number, size and placement of turbines will influence the degree to which they impact on the intangible qualities of an area. Mitigation of visual impacts is not feasible; however some measures can be taken to avoid impacts to the farm houses and their surrounds. Almost all the farm houses in the study area rest with the general protections of the NHRA and therefore the act applies to the aesthetic and intangible elements of each structure that is more than 60 years old.

It is recommended that the following mitigation measures are implemented.

- Turbines must be positioned in such a way that they are at least 500m away from farm complexes.
- Turbines must be positioned in such a way that shadow flicker does not affect any farm complexes.
- Road alignments must be planned in such a way that the minimum of cut and fill operations are required.
- Guarantees for demolition of turbines after their useful life must be in place as a condition of approval.

Significance Statement
Implementation of the proposed activity will change the character of the study area and its surrounds. The rural and wilderness qualities of the study area will change for the long term and take on a more industrial character in places. It is predicted that at first the presence of the wind turbines will be perceived as a novelty and evoke some interest in the area, however as this kind of industry gains pace in South Africa, the novelty value will fall away and the perceived visual impacts will increase.

In summary the way the landscape looks will change, its wilderness qualities will diminish. Given that there are no heritage sites on the landscape that are of any particular importance, the overall impact to cultural landscape is moderate. The impact on wilderness qualities of the site will be high, however the natural element of cultural heritage is only protected under the NHRA if it can be associated with an area of exceptional biodiversity in terms of the definition of cultural significance.

The no-go alternative. Not implementing the proposal will result in no impacts to heritage, apart from those impacts caused by natural forces such as erosion.

Without mitigation
Heritage impacts in the operation phase would **definitely** have ***high*** permanent negative impacts. This would affect the *study area* and would be of HIGH negative significance.
With mitigation

Heritage impacts in the operation phase would **probably** have ***moderate*** permanent negative impacts. This would affect the *study area* and would be of HIGH negative significance.

Cumulative Impact Statement

Impacts relate to changes relating to feel, atmosphere and identity of a place or landscape. Such changes are evoked by visual intrusion, noise, changes in land use and population density. This is especially the case in terms of cumulative impacts given the fact together with three similar proposals adjacent to the study area, which if authorized will create one of the biggest clusters of wind farms in the world (http://en.wikipedia.org/wiki/List_of_large_wind_farms). This change is likely to have a knock-on effect in terms of changes to the identity and associations of the towns of Bedford and Cookhouse. The cumulative impact is determined to be high, regardless of the mitigation measures proposed.

Impact	Effect						Risk or Likelihood		Total Score	Overall Significance
	Temporal Scale		Spatial Scale		Severity of Impact					
OPERATIONAL PHASE										
Without mitigation	Permanent	4	Study area	2	Severe	4	Definite	4	**14**	**HIGH -**
With mitigation	Permanent	4	Study area	2	Moderate	2	Definite	4	**12**	**HIGH -**
NO-GO OPTION										
Without mitigation	N/A		N/A		N/A		N/A			**N/A**
With mitigation	N/A		N/A		N/A		N/A			**N/A**
CUMULATIVE IMPACT										
Without mitigation	Permanent	4	Regional	3	Severe	4	Definite	4	**14**	**HIGH -**
With mitigation	Permanent	4	Regional	3	Moderate	2	Definite	4	**13**	**HIGH -**

10 CONCLUSIONS AND RECOMMENDATIONS

In terms of section 32 (2) of the EIA regulations (2006), *an environmental impact assessment report must include:-*

(m) An opinion as to whether the activity should or should not be authorised;
(n) An environmental impact statement which contains (i) a summary of the key findings of the EIA; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.

In line with the above-mentioned legislative requirement, this Chapter of the EIR provides a summary of the findings of the proposed Terra Wind Energy-Golden Valley Project EIA, a comparative assessment of the positive and negative implications of the proposed project and identified alternatives. In addition, this Chapter provides the EAP's opinion as to whether the activity should or should not be authorised as well as the reason(s) for the opinion.

10.1 Summary of the key findings of the EIA

Table 10-1 provides a summary of the impacts associated with the proposed Terra Wind Energy-Golden Valley Project with and without mitigation.

10.1.1 Construction Phase

During the construction phase, the proposed Terra Wind Energy-Golden Valley Project will have a high visual impact with regards to the intrusion of large and highly visible construction activity on sensitive viewers. This is mainly because the height of the features that will be built, and the siting on ridges will expose construction activities against the skyline. Additionally, an increase in activity, vehicles and workers in an otherwise quiet area will affect views. Activity at night is also probable since transport of large turbine components may occur after work hours to minimise disruption of traffic on main roads. With the incorporation of mitigation measures, this impact will be reduced to moderate.

However, as previously stated in Section 9.1.1., in Chapter 9 above, it is also worth noting that the visual impact of the construction phase may likely to be positive, especially during assembly of the turbine towers. The construction engineering feat of lifting and attaching components weighing more than 50 tons in a highly visible area is bound to be spectacular (see for example, (Degraw 2009)). Further, most of the sensitive viewers living in close proximity to the turbines have agreed to have turbines on their properties and are presumably informed on the effect of the construction phase on their views (*pers.comm.*CES).

The Loss of plant Species of Special Concern (SSC) including *Pachypodium bispinosum, Pelargonium sidoides, Crassula perfoliata, Euphorbia globosa, Euphorbia meloformis, Aloe tenuior, Anacampestros* sp, *Euphorbia meloformis, Tritonia* sp, *Watsonia* sp, *Drosanthemum* sp, *Psilocaulon* sp and *Trichodiadema* sp. during the construction phase of the proposed Terra Wind Energy-Golden Valley Project is of concern

The majority of the other impacts associated with the proposed project during the construction phase before mitigation are of moderate or low significance, and the significance of all of these impacts with the exception of the Loss of plant SSC during the construction phase (see Section 10.2 below), palaeontological impacts, and the loss of bird habitat due to vegetation clearing, after the incorporation of appropriate mitigation measures, can be reduced to Low.

Table 10-1: Summary of impacts associated with the proposed Terra Wind Energy-Golden Valley Project

IMPACT	SIGNIFICANCE					
					CUMULATIVE IMPACT	
	WITHOUT MITIGATION		WITH MITIGATION		WITHOUT MITIGATION	WITH MITIGATION
		NO-GO		NO-GO		
CONSTRUCTION PHASE						
Intrusion of large and highly visible construction activity on sensitive views (**visual** impact)	HIGH -	N/A	MOD -	N/A	The cumulative impacts for the construction phase are **not considered** due to the fact that it is **highly unlikely** that all four wind energy facilities will be constructed at the same time.	
Impact of the construction **noise** on the surrounding environment	LOW -	N/A	LOW -	N/A		
Disturbance of **birds**	LOW -	N/A	LOW -	N/A		
Loss of **bird** habitat due to habitat destruction	MOD -	N/A	MOD -	N/A		
Loss of Thicket	LOW -	MOD +	LOW -	N/A		
Loss of Bedford Dry Grassland	MOD -	MOD +	LOW -	N/A		
Loss of Karroid Thicket	MOD -	MOD +	LOW -	N/A		
Loss of Scrub Grassland	MOD -	MOD +	LOW -	N/A		
Loss of **plant** species of special concern	MOD -	MOD +	MOD -	N/A		
Introduction of alien **plant** species	MOD -	HIGH -	LOW -	LOW -		
Loss of **faunal** biodiversity	MOD -	HIGH +	LOW -	N/A		
Loss of **faunal** species of special concern	LOW -	HIGH +	N/A	N/A		
Disturbance displacement of **bats**	LOW -	LOW +	LOW -	N/A		
Loss of **bat** habitat due to vegetation clearing	LOW -	MOD +	LOW -	N/A		
Construction of the wind farm and its impact on **heritage** aspects	MOD -	N/A	LOW -	N/A		
Palaeontological Impacts	LOW -	LOW -	MOD +	N/A		

IMPACT	SIGNIFICANCE					
	WITHOUT MITIGATION		WITH MITIGATION		CUMULATIVE IMPACT WITHOUT MITIGATION	CUMULATIVE IMPACT WITH MITIGATION
		NO-GO		NO-GO		
OPERATIONAL PHASE						
Impact of a change in the agricultural landscape as a result of establishing a wind farm (**visual** impact)	MOD -	N/A	MOD -	N/A	HIGH -	N/A
Intrusion of large wind turbines on the existing views of sensitive visual receptors (**visual** impact)	HIGH -	N/A	HIGH -	N/A	HIGH -	N/A
Impact of shadow flicker on residents in close proximity to wind turbines (**visual** impact)	MOD -	N/A	LOW -	N/A	HIGH -	N/A
Impact of the operational **noise** on the surrounding environment (NSA 1,5, 7,8,9,10,11,12 & 13)	LOW -	N/A	N/A	N/A	LOW -	LOW -
Impact of the operational **noise** on the surrounding environment (NSA 2,3,4 & 6)	HIGH -	N/A	LOW -	N/A	LOW -	LOW -
Disturbance of **birds**	MOD -	N/A	MOD -	N/A	HIGH -	HIGH -
Disruption in local **bird** movement patterns	MOD -	N/A	MOD -	N/A	HIGH -	MOD -
Bird mortalities from colliding with turbine blades, tower, and/or associated infrastructure	MOD -	N/A	MOD -	N/A	HIGH -	MOD -
Collisions and electrocutions of **birds** with power lines and substations	MOD -	N/A	MOD -	N/A	MOD -	MOD -
Loss of Thicket	MOD -	MOD +	LOW -	N/A	MOD -	MOD -
Loss of Bedford Dry Grassland	MOD -	MOD +	MOD -	N/A	HIGH -	MOD -
Loss of Karroid Thicket	MOD -	MOD +	MOD -	N/A	HIGH -	MOD -
Loss of Scrub Grassland	MOD -	MOD +	MOD -	N/A	HIGH -	MOD -
Introduction of alien **plant** species	HIGH -	HIGH -	LOW -	LOW -	HIGH -	MOD -
Disturbance of **bats**	MOD -	LOW -	MOD -	N/A	MOD -	MOD -
Loss of **bat** habitat due to vegetation clearing	MOD -	MOD +	MOD -	N/A	MOD -	MOD -
Bat mortalities from colliding with turbine blades, tower and/or associated infrastructure	MOD -	N/A	MOD -	N/A	MOD -	MOD -
Impacts of the operation of the wind farm on **heritage** aspects	HIGH -	N/A	HIGH -	N/A	HIGH -	HIGH -

The No-Go Option will have a few beneficial/positive impacts with regards to the following:-

- Loss of Thicket
- Loss of Bedford Dry Grassland
- Loss of Karroid Thicket
- Loss of Scrub Grassland
- Plants Species of Special Concern (SSC)
- Loss of faunal biodiversity
- Loss of faunal species of special concern (SSC)
- Disturbance/displacement of bats
- Loss of bat habitat

However, the introduction of alien species will be a High negative with the No-Go Option (i.e. No development), but with mitigation measures, the significance of this impact can be reduced to Low negative.

10.1.2 Operational Phase

During the operational phase, the proposed Terra Wind Energy-Golden Valley Project will have a high visual impact with regards to the intrusion of large wind turbines on the existing views of sensitive visual receptors (residents living on or close to the wind farm area). Regardless of the incorporation of mitigation measures, this impact will remain high.

Bat fatalities as a result of the proposed project are likely to be of moderate significance. Regardless of the incorporation of appropriate mitigation measures, this impact will remain moderate. It is important to note however, that there is currently no information available on bat fatalities, and their causes at windfarms in South Africa, therefore this EIA assumed the worst-case scenario.

The introduction of alien species will also be high with the proposed project as well as the No-Go option. However, if alien invader species are consistently managed over the entire operation phase of the project, and an alien eradication program implemented (in terms of the No-Go option), the significance of this impact can be reduced to low.

Noise during the operational phase of the proposed Terra Wind Energy-Golden Valley Project for NSA 2, 3, 4 & 6 is considered a high impact. However, this impact can be reduced to low with the incorporation of appropriate mitigation measures because the noise levels generated will result in unacceptable noise impacts to the local residents as the cumulative impact will result in the ambient noise being exceeded.

Majority of the other impacts associated with the proposed project during the operational phase before mitigation are of moderate significance, and the significance of all of these impacts with the exception of the following (whose significance is reduced to low after the incorporation of appropriate mitigation measures), after the incorporation of appropriate mitigation measures remains moderate-

- Impact of shadow flicker on residents in close proximity to wind turbines
- Loss of thicket

10.1.3 Cumulative Impacts

The cumulative impact of many wind farms being proposed for the area of Cookhouse and Bedford has far-reaching and serious impacts which require careful consideration during the environmental impact process, as well as other process authorising these wind farms such as, but not limited to, rezoning, geotechnical studies, National Energy Regulating licence application.

Assessing cumulative impacts is a relatively new discipline when considering the effects on wind farms and as such the individual specialists did not always include such findings in their reports.

Another important finding of the process of compiling cumulative impacts, was the discovery of a glaring lack of guidance strategically. It is strongly recommended that a Strategic Environmental Assessment (SEA) be undertaken for the purpose of providing guidance when siting and developing wind farms.

Cumulative impacts were not assessed during the construction phase of the project as it is highly unlikely that all four wind farms will be constructed at the same time. Cumulative impacts were, however, identified and assessed for the operational phase of the project.

All the visual cumulative impacts were assessed to be of high significance. There are no mitigation measures available and so the impact is marked as “not applicable”. Other cumulative impacts assessed to be of high significance were disturbance to birds; disruption in local bird movement patterns; bird mortalities from colliding with turbine blades, tower, and/or associated infrastructure; loss of certain types of vegetation; and the introduction of alien plant species. The cumulative impact on heritage, first introduced in the heritage Specialist Study, is also assessed to be of high significance.

Mostly all of the cumulative impacts with high significance can be mitigated to ratings of moderate or low negativity, except for disturbance of birds and the impact on heritage aspects.

10.2 EAP’s Recommendation

The decision regarding whether to proceed with the proposed development should be based on weighing up of the positive and negative impacts as identified and assessed by the independent specialists. In addition to the findings of the specialist studies, it is also necessary to consider the following when making a decision:

- The majority of the impacts associated with the proposed project can be mitigated by applying set back distances as well relocating turbines, albeit in less efficient locations for electricity generation;
- Many of the sensitive receptors identified by the specialists are owners of the properties on which the turbines will be situated and who are enthusiastic about contributing to the environment in a positive way;
- The project proponent has taken the issues raised by interested and affected parties into consideration and provided alternative layout options, although some are less financially viable;
- The project has potential environmental and socio-economic benefits including the generation of clean energy for the surrounding area, and
- The project will contribute directly and significantly to social upliftment through an educational trust and skills transfer.

Based on the above, it is believed that, with appropriate mitigation, the benefits of the proposed Terra Wind Energy-Golden Valley Project will outweigh the negative impacts, and it is the opinion of the EAP that the No-Go option should not be considered any further and that the proposed Terra Wind Energy-Golden Valley Project should be granted authorisation.

The opinion of the EAP was also influenced by the fact that the proposed project will aid in:

- The reduction of greenhouse gases by the use of alternatives to fossil fuel - derived electricity will assist South Africa to begin demonstrating its commitment to meeting international obligations/legislative instruments such as the 1992 United Nations Framework Convention on Climate Change (FCCC) and the Kyoto Protocol (2002);

- Meeting the goals of the White Paper on the Energy Policy for South Africa (Energy White Paper) which aims to create energy security by diversifying energy supply and energy carriers and sets out the policy principles, goals and objectives to achieve, "*An energy economy in which modern renewable energy increases its share of energy consumed and provides affordable access to energy throughout South Africa, thus contributing to sustainable development and environmental conservation*", and;
- The Department of Minerals and Energy (DME) (now the Department of Energy) Integrated Energy Plan (IEP) to develop the renewable energy resources, while taking safety, health and the environment into consideration setting a target of, "*10 000 GWh (0.8Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro*".
- South Africa has also often experienced major power shortages largely as a result of demand outstripping supply. This, in many cases, has resulted in financial losses (many of the sectors contributing to the GDP are practically driven by electricity) and impacted on quality of life (hospitals and schools were among the affected, jobs were lost etc). The national power utility, Eskom, has indicated that South Africa is not past this crisis and that the possibility of further power cuts remains. This is particularly true for the Blue Crane Route Municipality where power outages continue to be a problem. With local generation, the networks can be freed up to supply power to other areas and the local community will have a much better chance of more consistent supply.

However, although the EAP is of the opinion that the proposed project should be granted authorisation, it suggested that the proposed Terra Wind Energy Golden Valley Project only be approved subject to a final layout plan being provided to the competent authority. The turbine layout used to assess the environmental impacts of the Terra Wind Energy-Golden Valley Project is a preliminary layout. Terra Wind Energy-Golden Valley will take into consideration the findings of the specialist reports and revise the turbine, road, substation and electrical cable layout so as to minimise the impacts on the receiving environment. The EAP recommends that the competent authority grants authorisation for the preliminary layout, on the condition that the applicant will provide a final layout prior to commencement of construction activities on site.

The revised and final layout plan should take into consideration the noise and visual sensitive receptors identified by the specialists.

In addition to the above, the EAP recommends that the project only be granted authorisation under certain conditions, in order to address those impacts with a high significance rating, and included in Chapter 10 of this report. One such condition is that the project proponent furnishes the relevant authority with a geotechnical assessment proving that the proposed facility will be structurally sound and will not pose a safety risk to surrounding structures or people.

In addition, it is recommended that all project proponents for the respective wind farm proposals in the general Cookhouse area collaborate in the management, mitigation and monitoring of potential avifauna and bat impacts. The this end it is suggested that a consolidated and co-operative approach to this management issue is adopted by all role-players whereby management and monitoring strategies are developed by all parties in conjunction with a suitable avifauna specialist to ensure that these actions are as comprehensive and effective as possible for the respective projects' lifespan.

Phase	Impact	Mitigation Measures
Construction	Intrusion of large and highly visible construction activity on sensitive viewers	• New road construction should be minimised and existing roads should be used where possible. • The contractor should maintain good housekeeping on site to avoid litter and minimise waste. • Clearance of indigenous vegetation should be minimised and rehabilitation of cleared areas should start as soon as possible. • Erosion risks should be assessed and minimised as erosion scarring can create areas of strong contrast which can be seen from long distances. • Laydown areas and stockyards should be located in low visibility areas (e.g. valley between the ridges) and existing vegetation should be used to screen them from views. • Night lighting of the construction sites should be minimised within requirements of safety and efficiency. See section on lighting for more specific measures. • Fires and fire hazards need to be managed appropriately.
Operation	Intrusion of large wind turbines on the existing views of sensitive visual receptors	• Turbines should not be associated with power lines and similar structures and should be as far removed from them as possible. • The power line connecting the turbine with the grid should be buried. • Maintenance of the turbine is important. A spinning rotor is perceived as being useful. If a rotor is stationary when the wind is blowing it is seen as not fulfilling its purpose and a negative impression is created (Gipe 1995). • Signs near wind turbines should be avoided unless they serve to inform the public about wind turbines and their function. Advertising billboards should be avoided. • According to the Aviation Act, 1962, Thirteenth Amendment of the Civil Aviation Regulations, 1997: "*Wind turbines shall be painted bright white to provide maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required*." • Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations. • An information kiosk (provided that the kiosk and parking area is located in a low visibility area) and trails along the wind farm can enhance the project by educating the

Phase	Impact	Mitigation Measures
		public about the need and benefits of wind power. 'Engaging school groups can also assist the wind farm proponent, as energy education is paramount in developing good public relations over the long term. Instilling the concept of sustainability, and creating awareness of the need for wind farm developments, is an important process that can engage the entire community' (Johnston 2001).
	Bat fatalities	• Turbines should be shut off during times when bats are active, low wind speeds at night is the best time (and when little electricity is being generated by the turbines). • It is recommended that bat fatalities, and their causes at the wind farm are monitored, as there is no information available for wind farms in South Africa. More applicable mitigation measures to reduce bat fatalities (see below) can be applied when there is more information. o Ultrasound broadcast can deter bats from flying into wind turbines. (Szewczak and Arnett 2007) o Minimizing turbine height will help to reduce bat fatalities (Barclay *et al*. 2007). o Turbine sites on ridges should be avoided (Brinkman *et al*. 2006). o Wind turbine operating times should be restricted during times when bat activity is high (Brinkman *et al*. 2006). Bats are at higher risk of fatality on nights with low wind speeds (Horn *et al*. 2008).

10.3 The Way Forward

The Draft EIR, together with the Specialist Volume (Volume 2) and the EMP (Volume 4), were been released for public review for a period of four weeks. The report was updated with the comments received during the public review period and public meeting held in Cookhouse. The report is now finalised for submission to DEA for Environmental Authorisation.

Upon thorough examination of the EIR, the authority will issue an Environmental Authorisation, which either authorises the project or rejects it, or requires further details to clarify certain issues. Should authorisation be granted, the Environmental Authorisation usually carries Conditions of Approval. The project proponent is obliged to adhere to these conditions.

Within a period determined by the competent authority, all registered I&APs will be notified in writing of (i) the outcome of the application, and (ii) the reason for the decision. The public will then have one month in which to appeal the decision should they wish to do so. The appeals procedure will also be communicated by the EAP. Any appeal must be submitted to the Minister of Water and Environmental Affairs.

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