APPENDIX F: ASSESSMENT OF POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

This Appendix forms the focus of the BAR. It contains a detailed assessment of the operational (or long-term) impacts as well as the construction phase impacts on the biophysical and socio-economic environments using the methodology described in **Annexure A** of this report. A summary table of the assessment of all the potential impacts is also provided.

INTRODUCTION

This Appendix describes the potential impacts on the biophysical and socio-economic environments, which may occur due to the proposed activities described in Section A. These include potential impacts, which may arise during the operation of the proposed development (i.e. long-term impacts) as well as the potential construction related impacts (i.e. short to medium term). The assessment of potential impacts will help to inform and confirm the selection of the preferred alternatives to be submitted to DEA for consideration. In turn, DEA's decision on the environmental acceptability of the proposed project and the setting of conditions of authorisation (should the project be authorised) will be informed by this chapter, amongst other information, contained in this BAR.

This section is broken down into the following potential impacts:

- Construction impacts (direct, indirect and cumulative)
  - Botany
  - Fauna
  - Avifauna
  - Freshwater ecology
  - Heritage, including palaeontology
  - Visual
  - Agriculture
  - Socio-economic
  - Transport
  - Dust
- Operation impacts (direct, indirect and cumulative)
  - Botany
  - Avifauna
  - Freshwater ecology
  - Agriculture
  - Visual
  - Economic (Energy Generation)
  - Climate change
  - Socio-economic
- Decommissioning impacts

The Alternatives considered were as follows:

Site alternatives:

- Alternative A (environmentally and technically preferred) transmission line route and associated infrastructure (including access roads)
- Alternative B transmission line route and associated infrastructure (including access roads)

Layout alternatives:

- None were considered as the layout alternatives (i.e. pylon positions) will only be determined during implementation phase and would be dependent on the IPP bid process approval as required by Eskom.

Activity alternatives:

- Transmission of Wind Energy;
- "No-go" alternative to Wind Energy transmission;

Technology alternatives:

- Single circuit Monopole 266; and
- Double circuit Monopole 277.

The standard servitude width as specified by Eskom for a 132 kV transmission line is 31 m, with a distance of 15.5 m on either side of the centre line of the powerline. As the proposed 132 kV lines will run in parallel to the existing 400 kV line, the servitude requirement will be a 21 m line separation with 15,5 m either side. The total servitude width would amount to 52 m for the section between the Maanhaarberg substation and the Hydra substation. Refer to Figure 1.

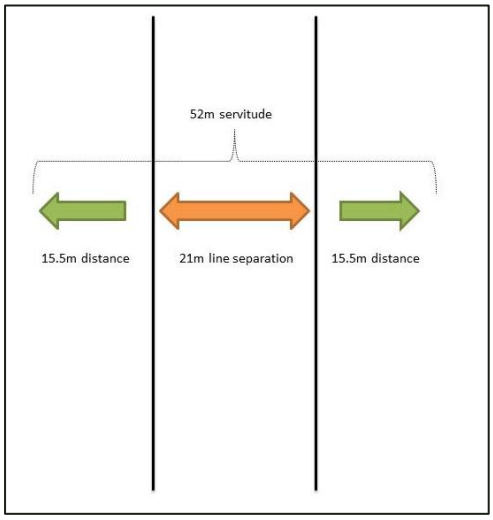

Figure 1: Servitude dimension for the North WEF 132 kV tranmision line

The Specialists have evaluated the following servitude dimensions within an assessment corridor (500 m wide):

- Servitude widths of 36 m; and
- Servitude length of 27 km Alternative A (preferred) and 25.5km for Alternative B.

NOTE:

A (+) or (-) indicates a positive or negative potential impact, respectively.

A copy of the methodology used for the assessment of potential impacts is included in this Annexure. A summary of the extent, magnitude, duration, significance, probability, confidence and reversibility is provided in Table 7 below the impact assessment table.

NOTE: The information provided below is relevant to both Alternative A (preferred) and Alternative B, unless specified.

CONSTRUCTION

DIRECT AND INDIRECT IMPACTS:

Botany

A Botanical Assessment was carried out by Dr David Hoare in March 2014 to assess the Botanical impacts resulting from the proposed transmission line. The Botanical study is included in **Annexure D1**. The findings and recommendations of the ecological study are summarised below.

Description of the environment

The study area (corridor) falls 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 two vegetation types occurring within or close to the corridor, namely Northern Upper Karoo and Besemkaree Koppies Shrubland. These vegetation type are described in more detail below.

Northern Upper Karoo: This vegetation type occurs in the northern parts of the Upper Karoo Plateau, with its southern extent ending near De Aar. It is a shrubland dominated by dwarf karoo shrubs, grasses and some low trees, including Acacia mellifera subsp. detinens (Mucina et al. 2006). There are five known endemics in this vegetation (Mucina et al. 2006), namely the succulent shrubs, Lithops hookeri and Stomatium pluridens, the low shrubs, Atriplex spongiosa and Galenia exigua and the herb, Manulea deserticola. At a national scale this vegetation type has been transformed only a small amount (approximately 4%) and none is conserved; it is considered to be a Least Threatened vegetation type (Mucina et al. 2006).

Besemkaree Koppies Shrubland: This vegetation type is found on the slopes of koppies, butts and tafelbergs within the plains of the Eastern Upper Karoo (Mucina et al. 2006a). It is a two-layered karroid shrubland. The lower (closed canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses. The upper (loose canopy) layer is dominated by tall shrubs, namely Rhus erosa, Rhus burchellii, Rhus ciliata, Euclea crispa subsp. ovata, Diospyros austro-africanus and Olea europea subsp. africana (Mucina et al. 2006a). There are five known endemics in this vegetation (Mucina et al. 2006), namely the small tree, Cussonia sp. nov., and the succulent shrubs, Euphorbia crassipes, Neohenricia sibbettii and Neohenricia spiculata. At a national scale this vegetation type is considered to be Least Threatened (Mucina et al. 2006a).

Conservation status of broad vegetation types:

The vegetation types occurring on site are not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

Table 1: Conservation status the 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)
Northern Upper Karoo	21	0	4	Least Threatened	Not listed
Besemkaree Koppies Shrubland	28	5.3	3	Least Threatened	Not listed

Critical Biodiversity Areas have been identified for all municipal areas of the Northern Cape Province and are published on the SANBI website (bgis.sanbi.org). These maps identify no areas of concern in the current study area. This is consistent with patterns identified from other sources within the current document.

Red List of plant species of the study area

There is one species incorrectly listed on this list, Protea subvestita, which is listed as Vulnerable. This species occurs along the southern and eastern Great Escarpment of the country in montane habitats, particularly highland grassland and fynbos. The record from the adjacent grid is an incorrect database record and this species does not occur anywhere near to the site. There are, therefore, no threatened, near threatened, declining or rare plant species that could occur on site.

Protected plants (National Environmental Management: Biodiversity Act)

One plant species that appears on this list that could potentially occur in the region, although it has not previously been recorded in the grid, is Hoodia gordonii. This species is currently listed in Appendix II to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which includes species not currently considered endangered but are at risk if trade is not controlled. Hoodia gordonii has a wide tolerance of growing habitats and is found in deep Kalahari sands, on dry stony slopes or flats and under the protection of xerophytic bushes. Suitable conditions do occur on site and it is considered possible that this species could occur on site. However, it was not found during the field survey.

Another protected species that could potentially occur in the region, although it has not previously been recorded in the grid, is Harpagophytum procumbens (devil's claw). This species is associated mainly with dry sandveld on deep Kalahari sand. It usually occupies plains, dune bases and interdunes. Soils are usually sandy but can be rocky. They are generally nutrient poor, often with lime. The soil conditions expected on site do not co-incide with the habitat requirements for this species and it is not considered likely that it occurs on site. It was not found during the field survey.

Protected trees

The only one that has a geographical distribution that includes the study area is Boscia albitrunca (Shepherd's Tree / Witgatboom / !Xhi). Boscia albitrunca occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. This species is usually quite common where it is found, but was not recorded on site. In the De Aar area, this species has been recorded a number

of times within specific habitats within the mountains, but never on the plains. No individuals were found in the mountain region affected by the proposed project.

Watercourses and drainage areas

Non-perennial streams and drainage lines: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal. Wetlands are protected according to the National Water Act and the NEMA.

Proposed protected area

According to the National Parks Area Expansion Strategy (NPAES), the escarpment and surrounding areas of the eastern plateau have been identified as priority areas for inclusion in future protected areas (Figure 2). The implications of this for the proposed project are unknown, but this indicates that this particular component of the landscape is considered to be of high biodiversity value by National Parks.

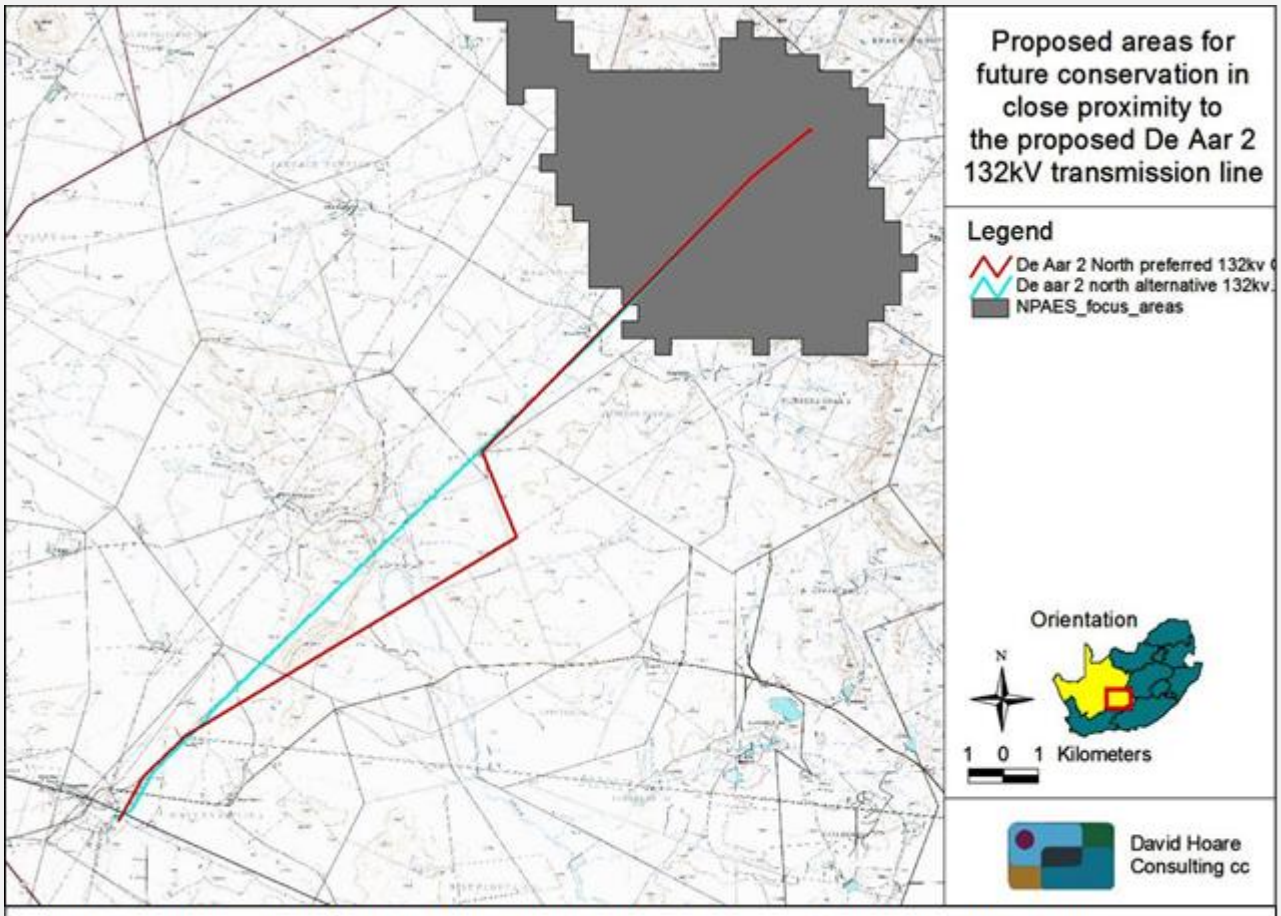

Figure 8: Areas included in the National Parks Area Expansion Strategy.

Figure 2: Areas included in the National Parks Area Expansion Strategy (Hoare, 2014)

Impact assessment

Impacts are assessed for each component of infrastructure for the proposed 132kV powerline and switching station. There is therefore a separate assessment for the 132kV powerline and switching station.

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Overhead power lines (both options)

The proposed overhead power lines will, in the case of the Preferred option, be adjacent to existing Eskom overhead power lines. For Alternative 1, a large proportion will be adjacent to existing transmission lines, whereas other parts will be in open vegetation. Both overhead powerline options will have the same relative effect on vegetation.

Impact 1: Loss or fragmentation of indigenous natural vegetation
The vegetation type on site that will be affected by construction of infrastructure is Northern Upper Karoo. Power line tower structures will affect very small, localised areas of vegetation. Access roads may affect slightly larger areas.

Extent: The impact will occur at the site of the proposed power line tower structures and access roads. The construction of the power line infrastructure potentially affects a small proportion of natural vegetation on site and is scored as ***site specific***.

Magnitude: At a site specific scale, the vegetation will be affected in localised areas. Natural functions and/or processes will therefore be slightly altered. The magnitude of the impact is therefore scored as ***low***.

Duration: The impact will occur during construction. Indications from existing power lines on site are that the base of tower structures becomes re-vegetated. The impact will therefore be ***medium-term***.

Significance: On the basis of the impact being of low magnitude at a site specific scale and of medium term duration, the impact is scored as having a significance of ***low***. Mitigation measures will reduce the magnitude to very low and the duration of the impact to short term. The significance will, therefore, be reduced to ***very low*** after mitigation measures have been implemented.

Probability: According to the provided layout, it is ***probable*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that is long term. The impact is therefore considered to be ***irreversible***.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the tower structures and/or the servitude of the power line.
2. Existing access roads must be used, where possible.
3. Service roads in the servitude must be properly maintained to avoid erosion impacts.

Impact 2: Establishment and spread of declared weeds and alien invader plants
There are existing infestations of weeds on site and in immediately adjacent areas. There is therefore the potential that activities on site could promote the spread of these onto the site and/or into other natural areas.

Extent: The impact will occur at the site of the proposed transmission line corridor and in surrounding areas, but could potentially spread into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact is therefore scored as ***local***.

Magnitude: At a local scale, natural functions and/or processes will possibly be notably altered. The magnitude of the impact is therefore scored as ***medium***.

Duration: The impact will occur during construction, but cause effects that will last longer than 15 years, if not controlled. It is therefore scored as ***long term***.

Significance: On the basis of the impact being of medium magnitude at a local scale and of long term duration, the impact is scored as having a significance of ***medium***. Mitigation measures will reduce the extent to site specific, the magnitude to very low and the duration of the impact to short term. The significance will, therefore, be reduced to ***very low*** after mitigation measures have been implemented.

Probability: On the basis of known patterns of alien invasions, it is ***probable*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that could be reversed, if identified and managed. Impacts are possibly reversible within 2 years after the cause or stress is removed. The impact is therefore considered to be ***reversible***.

Mitigation measures:

1. Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.
2. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.
3. Any alien plants within the control zone of the company must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.
4. An on-going monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Eskom switching / metering station

The proposed switching / metering station will be adjacent to existing Eskom overhead power lines. The switching / metering station is within the 200 x 100m area that includes the substation / control building. The substation / control building were assessed in the previous EIA / amendment application and the switching station forms part of this assessment.

Impact 1: Loss or fragmentation of indigenous natural vegetation

The vegetation type on site that will be affected by construction of infrastructure is Northern Upper Karoo. The substation / control building and switching / metering station will affect very small, localised areas of vegetation.

Extent: The impact will occur at the site of the proposed substation / control building and switching / metering station. The construction of the infrastructure potentially affects a small proportion of natural vegetation on site and is scored as ***site specific***.

Magnitude: At a site specific scale, the vegetation will be affected in localised areas. Natural functions and/or processes will therefore be slightly altered. The magnitude of the impact is therefore scored as ***low***.

Duration: The impact will occur during construction, but will result in localised permanent loss of vegetation. The impact will therefore be ***long-term***.

Significance: On the basis of the impact being of low magnitude at a site specific scale and of long term duration, the impact is scored as having a significance of ***low***. Mitigation measures are unlikely to reduce the magnitude or the duration of the impact. The significance will, therefore remain as ***low*** after mitigation measures have been implemented.

Probability: According to the provided layout, it is ***definite*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that is long term. The impact is therefore considered to be ***irreversible***.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the switching station.
2. Adjacent areas must be properly maintained to avoid erosion impacts.

Impact 2: Establishment and spread of declared weeds and alien invader plants

There are existing infestations of weeds in adjacent areas. There is therefore the potential that activities on site could promote the spread of these onto the site and/or into other natural areas.

Extent: The impact will occur at the site of the proposed switching station, but could potentially spread into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact is therefore scored as ***local***.

Magnitude: At a local scale, natural functions and/or processes will possibly be notably altered. The magnitude of the impact is therefore scored as ***medium***.

Duration: The impact will occur during construction, but cause effects that will last longer than 15 years, if not controlled. It is therefore scored as ***long term***.

Significance: On the basis of the impact being of medium magnitude at a local scale and of long term duration, the impact is scored as having a significance of ***medium***. Mitigation measures will reduce the extent to site specific, the magnitude to very low and the duration of the impact to short term. The significance will, therefore, be reduced to ***very low*** after mitigation measures have been implemented.

Probability: On the basis of known patterns of alien invasions, it is ***probable*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that could be reversed, if identified and managed. Impacts are possibly reversible within 2 years after the cause or stress is removed. The impact is therefore considered to be ***reversible***.

Mitigation measures:

1. Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.
2. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.

3. Any alien plants within the control zone of the company must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.
4. An on-going monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Cumulative impacts

The proposed overhead power lines will add to an existing network of transmission lines as well as future proposed transmission lines for the area. The cumulative impact on indigenous natural vegetation and due to spread of alien plants of all these transmission lines is assessed below.

Impact 1: Loss or fragmentation of indigenous natural vegetation
The vegetation type on site that will be affected by construction of infrastructure is Northern Upper Karoo. The overhead transmission lines will, in total, affect small, localised areas of vegetation, but over a fairly wide area.

Extent: The impact will occur at the site of the transmission lines, which cover an area around De Aar in excess of 10 km from any single point, and is scored as ***regional***.

Magnitude: At a regional scale, the vegetation will be affected in localised areas only. Natural functions and/or processes will therefore be neglibly altered. The magnitude of the impact is therefore scored as ***very low***.

Duration: The impact will occur during construction, but will result in localised permanent loss of vegetation. The impact will therefore be ***long-term***.

Significance: On the basis of the impact being of very low magnitude at a regional scale and of long term duration, the impact is scored as having a significance of ***low***.

Probability: It is ***definite*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that is long term. The impact is therefore considered to be ***irreversible***.

Impact 5: Establishment and spread of declared weeds and alien invader plants
There are existing infestations of weeds in the general area around De Aar. There is therefore the potential that activities over a wide area could promote the spread of these into other natural areas, especially into drainage lines.

Extent: The impact will occur at the site of the transmission lines, which cover an area around De Aar in excess of 10 km from any single point, and is scored as ***regional***.

Magnitude: At a regional scale, natural functions and/or processes will possibly be notably altered. The magnitude of the impact is therefore scored as ***medium***.

Duration: The impact will cause effects that will last longer than 15 years, if not controlled. It is therefore scored as ***long term***.

Significance: On the basis of the impact being of medium magnitude at a regional scale and of long term duration, the impact is scored as having a significance of ***high***.

Probability: On the basis of known patterns of alien invasions, it is ***probable*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that could be reversed, if identified and managed. Impacts are possibly reversible within 2 years after the cause or stress is removed. The impact is therefore considered to be ***reversible***.

Mitigation measures (alternative A and B)

- Unnecessary impacts on surrounding natural vegetation must be avoided.
- The construction impacts must be contained to the footprint of the tower structures, the servitude of the power line and switching station.
- Adjacent areas and service roads in the servitude must be properly maintained to avoid erosion impacts.
- Existing access roads must be used, where possible.
- If possible, place infrastructure (tower structures) a minimum of 30 m outside watercourses.
- Where possible, use existing roads as service roads. Service roads in the servitude must be properly maintained to avoid erosion impacts.
- If not possible to avoid watercourses, there is a legal obligation to apply for a Water Use Licence for any watercourses that may be affected, since they are classified in the National Water Act as a water resource.
- Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.
- Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.
- Any alien plants within the control zone of the company must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.

Fauna

Red List and protected animal species of the study area

There is one mammal species of low conservation concern that could occur in available habitats in the study area. This is a species classified nationally as near threatened (NT), but globally as Least Concern, namely Geoffroy's Horseshoe Bat. This is a cave-dwelling species that emerges in the evening to catch flying insects. There are small rock crevices on the ridge of the plateau, but no caves were found on site or nearby. Based on the proposed distribution of infrastructure and the habitat preferences of this species (ridges), it was assessed as unlikely that this species would be affected by construction or operation of the proposed project. The species may forage over the site (low likelihood), but it will not roost there.

There are two small mammal species that could potentially occur on site that are protected under the NEMBA and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. These are the Black-footed Cat and the Cape Fox. It was assessed that it was possible that these species may traverse the site while foraging, but that it was unlikely that they would be permanently affected by the proposed project.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which

could occur on site. This species is classified as Least Concern globally and Near threatened in South Africa and is protected under the NEMBA. No individuals or favourable breeding habitats were found on site. Communication with a number of farmers in the area did not identify any local knowledge of the species occurring there. It was therefore assessed that there was a low probability of it occurring on site.

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

There are therefore no threatened, near threatened or protected species of potential concern that are likely to occur on site and/or to be affected by the proposed project.

Avifauna

An Avifauna Impact Assessment was undertaken by Chris van Rooyen of Chris van Rooyen Consulting in March 2014 to assess the impacts which the proposed transmission line would have on bird populations. The Avifauna Specialist Report is included in **Annexure D5**. A summary of the Avifauna Impact Assessment is provided below.

Description of the environment

The study area is situated within the Platberg – Karoo Conservancy which is classified as an Important Bird Area (IBA) (SA037). The conservancy covers the entire districts of De Aar, Philipstown and Hanover in the southeastern portion of the Northern Cape Province. Although the land in the IBA is primarily used for grazing and agriculture, it includes the towns of De Aar, Philipstown, Petrusville and Hanover. This huge area lies in the plains of the central Great Karoo, forming part of the South African plateau. The conservancy consists primarily of open plain-country, locally interrupted by dolerite hills and small mountain ranges which rise 200–300 m above the surrounding plateau, which varies from 1 100–1 400 m above sea level.

The IBA holds vitally important populations of two globally threatened species, several biome-restricted assemblage species and important populations of other arid-zone birds. The lowland karroid plains are particularly good for Secretarybird, Ludwig's Bustard, Kori Bustard, large numbers of Karoo Korhaan, Rufous-eared Warbler Malcorus pectoralis, Karoo Lark Certhilauda albescens, Karoo Chat Cercomela schlegelii, Tractrac Chat Cercomela tractrac, Sickle-winged Chat Cercomela sinuata, Lark-like Bunting Emberiza impetuani and the Karoo Long-billed Lark Certhilauda (curvirostris) subcoronata.

In the grassier areas Blue Korhaan Eupodotis caerulescens are common. Black Harrier Circus maurus are occasionally seen quartering the plains where huge numbers of Blue Cranes regularly congregate. Tawny Eagle and Martial Eagle breed on the powerlines in the area. The belts of riverine Acacia karroo woodland and the thicket and scrub on the slopes provide food, shelter and breeding habitat for many species including Namaqua Warbler Phragmacia substriata, Layard's Titbabbler Sylvia layardi and Grey Tit Parus afer. The belts of riverine Acacia woodland are of particular interest in the Karoo because they act as corridors along which many species are able to move in otherwise unsuitable terrain.

The Pale-winged Starling Onychognathus nabouroup and African Rock Pipit occur in rocky gorges and kloofs. Other arid-zone species occurring within the conservancy are Pale Chanting Goshawk Melierax canorus, Pririt Batis Batis pririt, Fairy Flycatcher Stenostira scita and White-throated Canary Serinus albogularis. The cliffs hold Black Stork, which breed during wetter periods, Booted Eagle Hieraaetus

pennatus and Verreaux's Eagle.

Lesser Kestrels Falco naumanni have roosts throughout the area, including large roosts in the towns of De Aar, Hanover and Philipstown; they are frequently seen foraging in the conservancy in summer. The Nuwejaarsfontein Dam has been known to occasionally hold Greater Flamingos and important numbers of South African Shelduck Tadorna cana. Some of the dams are important roosts and during summer 1996/97 more than 850 Blue Cranes were counted on a dam in the area.

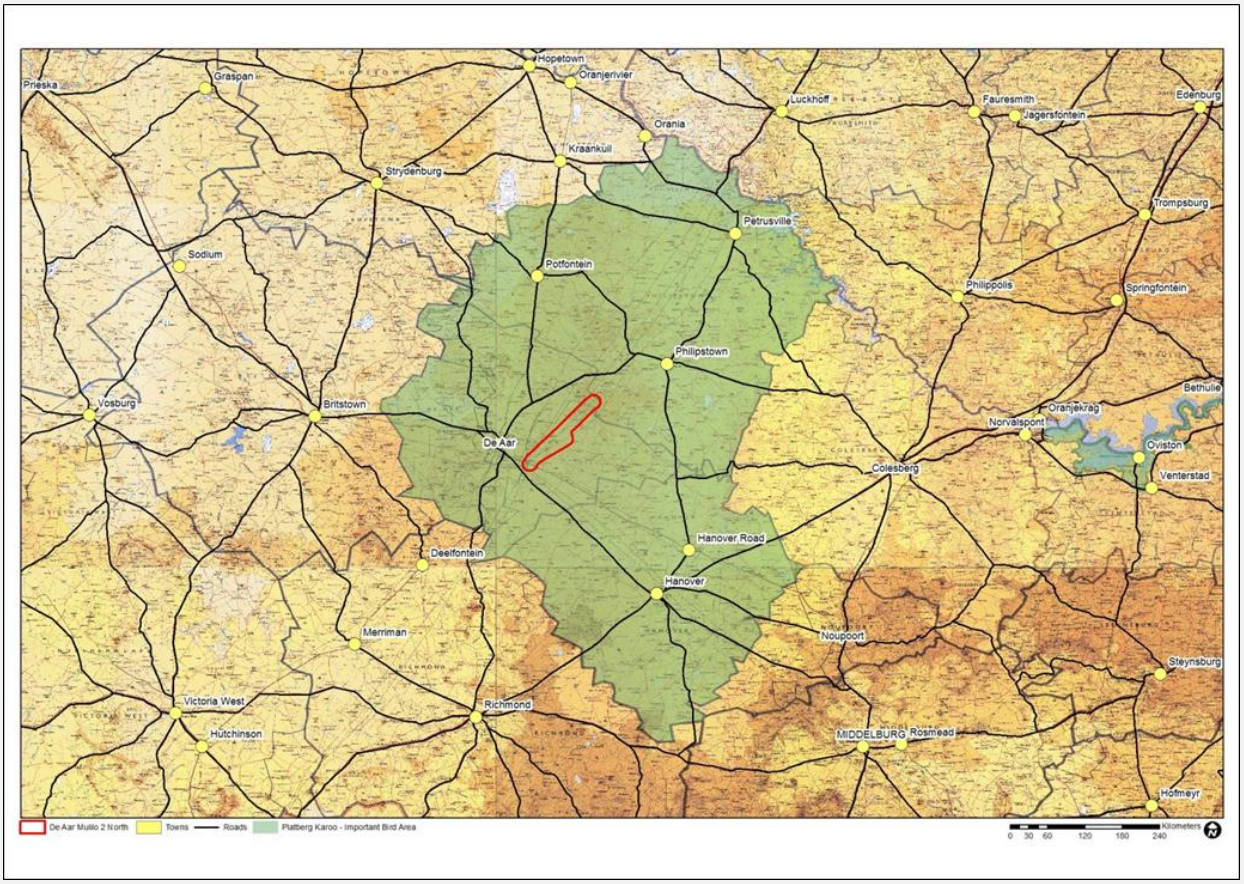

Figure 3: The location of the study area within the Platberg – Karoo Conservancy IBA. (Chris van Rooyen Consulting, 2014)

Bird populations

A total of 160 species were recorded in 3024CA by SABAP2, with 11 classified as Red Data species. Reporting rates are an indication of the relative density of a species on the ground in that it reflects the number of times that a species was recorded relative to the total amount of cards that were completed for the square. As mentioned earlier, the QDGC was not particularly well covered by SABAP2, which means reporting rates should merely by taken as a guideline of the actual chances of encountering a species.

Table 1 provides a guideline of the Red Data species that could potentially be encountered in the study area, and the habitat type where they are most likely to be found. The potential of the proposed infrastructure impacting negatively on the species (displacement and collisions) are also covered.

Table 1: Species of conservation concern potentially occurring in the study area

NT = Near threatened
VU = Vulnerable

Table 1: Species of conservation concern potentially occurring in the study area

Name	Scientific name	Conservation status (Taylor 2014)	Karoo	Ridges and mountains	Waterbodies	Agricultural lands	Collisions	Displacement through disturbance	Displacement through habitat destruction
Blue Crane	*Anthropoides paradiseus*	NT	x	-	x	x	x	-	-
Kori Bustard	*Ardeatis kori*	NT	x	-	-	x	x	-	-
Lanner Falcon	*Falco biarmicus*	VU	x	x	x	x	x	-	-
Ludwig's Bustard	*Neotos ludwigii*	EN	x	-	-	x	x	-	-
Martial Eagle	*Polemaetus bellicosus*	EN	x	-	x	-	x	x	-
African Rock Pipit	*Anthus crenatus*	NT	-	x	-	-	-	-	-
Verreaux's Eagle	*Aquila verreauxii*	VU	-	x	-	-	x	x	-
Karoo Korhaan	*Eupodotis vigorsii*	NT	x	-	-	-	x	-	-
Black Stork	*Ciconia nigra*	VU	-	x	x	-	x	-	-
Secretarybird	*Sagittarius serpentarius*	VU	x	-	-	-	x	-	-
Greater Flamingo	*Phoenicopterus ruber*	NT	-	-	x	-	x	-	-
Tawny Eagle	*Aquila rapax*	VU	x	-	x	-	x	x	-

Impact assessment

Negative interactions between wildlife and electricity structures take many forms but two common problems in southern Africa are electrocution or collision with power lines and disturbance and/or habitat destruction during construction and maintenance activities specifically around roosting or breeding activities.

Table 2: Displacement due to habitat destruction and disturbance caused by the construction of the 132kV power line: Preferred and alternative routes

IMPACT TABLE 1	
Environmental Parameter	*Avifauna*
Issue/Impact/Environmental Effect/Nature	*Displacement due to habitat destruction and disturbance*
Extent	*The impact will only affect the site.*
Probability	*Possible.*
Reversibility	*Completely reversible. The construction activities associated with the power line will inevitably cause temporary displacement of some 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 once the vegetation recovers sufficiently.*
Irreplaceable loss of resources	*Marginal loss of resources in the case of the power line.*

Duration	*Short term for the power line. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should re-colonise the areas which have not been transformed by the footprint of the power line.*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Low significance. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, most species should re-colonise the areas which have not been transformed by the footprint.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-20 (low negative)	-9 (low negative)
Mitigation measures	*It is important that the construction activities, vehicle and pedestrian movement are restricted a much as possible to the actual servitude of the proposed power line. Maximum use should be made of existing roads. Vehicle traffic in and out of the area should be restricted to what is absolutely necessary for the construction process. This is especially important where the line crosses the escarpment, as this area is the most sensitive area as far as potential disturbance of breeding Verreaux's Eagles are concerned (see Figure 6).*	

Table 3: Displacement due to habitat destruction and disturbance: switching station

IMPACT TABLE 2	
Environmental Parameter	*Avifauna*
Issue/Impact/Environmental Effect/Nature	*Displacement due to habitat destruction and disturbance*
Extent	*The impact will only affect the site.*
Probability	*Probable, but should only affect non Red Data species.*
Reversibility	*Barely reversible. The displacement due to habitat transformation associated with the construction of the substation/switching station could be reversed only if the substation is dismantled and the area rehabilitated.*
Irreplaceable loss of resources	*Complete loss of resources in the case of the substation/switching station..*
Duration	*Permanent for the substation/switching station due to extensive habitat transformation.*
Cumulative effect	*Low cumulative impact due to the low likelihood of impacts on Red Data species.*

Intensity/magnitude	*Medium*	
Significance Rating	*Low significance. No Red Data species expected to be impacted by the substation/switching station site.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	3	3
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-17 (low negative)	-17 (low negative)
Mitigation measures	*Maximum use should be made of existing roads. Vehicle traffic in and out of the area should be restricted to what is absolutely necessary for the construction process.*	

Table 4: Collisions with the earthwire of the proposed 132kV line: Preferred and alternative routes

IMPACT TABLE 3		
Environmental Parameter	*Avifauna*	
Issue/Impact/Environmental Effect/Nature	*Collisions with the earthwire of the proposed 132kV line*	
Extent	*Regional*	
Probability	*Possible*	
Reversibility	*Barely reversible. It will require the dismantling of the line if it is de-commissioned.*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium*	
Intensity/magnitude	*High*	
Significance Rating	*Medium*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	3	3
Probability	2	2
Reversibility	3	3
Irreplaceable loss	2	2

Duration	4	4
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-32 (medium negative)	-15 (low negative)
Mitigation measures	*All the spans, except those located adjacent to two or more existing high voltage lines, should be marked with Bird Flight Diverters on the earth wire of the line, ten metres apart, alternating black and white. APPENDIX B indicates the preferred Bird Flight Diverters to be used.*	

The construction of the proposed new 132kV power line will pose a limited threat to the birds occurring in the vicinity of the new infrastructure. The power line poses a **medium** collision risk, but a **negligible** electrocution risk, irrespective of which alternative is used. With the implementation of appropriate mitigation measures, the collision risk could be reduced to **low**. The habitat transformation and disturbance associated with the construction of the power line should have a **low** impact, provided appropriate mitigation is implemented. The impact of habitat transformation associated with the switching station site should be **low** and should only affect a few non-Red Data species at a local level.

Indirect impacts (alternative A and B)

No indirect impacts were identified.

Cumulative impacts (alternative A and B)

Cumulative avifauna impacts are discussed in the operational phase.

Mitigation measures (alternative A and B)

- It is important that the construction activities, vehicle and pedestrian movement are restricted a much as possible to the actual servitude of the proposed power line. Maximum use should be made of existing roads. Vehicle traffic in and out of the area should be restricted to what is absolutely necessary for the construction process. This is especially important where the line crosses the escarpment, as this area is the most sensitive area as far as potential disturbance of breeding Verreaux's Eagles are concerned (see Figure 6).
- Immediately prior to construction commencing, an inspection should be conducted by the avifaunal specialist to record any large raptor nests on the existing transmission lines running parallel to the proposed 132kV line, that could be impacted by the construction of the proposed line.
- Should any nests be recorded, it would require management of the potential impacts on the breeding birds once construction commences, which would necessitate the involvement of the avifaunal specialist, and the Environmental Control Officer. An effective communication strategy should be implemented whereby the avifaunal specialist is provided with a construction schedule which will enable him/her to ascertain when and where breeding Red Data raptors could be impacted by the construction activities. This could then be addressed through the timing of construction activities during critical periods of the breeding cycle, once it has been established that a particular nest is active. the new transmission line should be marked with bird flight diverters along its entire length (Jenkins et al. 2010) and that all new power line infrastructure is adequately insulated and of a configuration that is bird friendly (Lehman et al. 2007).
- All the spans, except those located directly adjacent to existing high voltage lines, should be marked with Bird Flight Diverters on the earth wire of the line, ten metres apart, alternating black and white. Appendix B indicates the preferred Bird Flight Diverters to be used.

Freshwater ecology

An Aquatic Ecosystem Health assessment was carried out by Toni Belcher to determine the ecological condition and the ecological importance and sensitivity of the river and wetland systems, which may be impacted upon by the proposed transmission line. The assessment was informed by a combination of desktop assessment of existing freshwater ecosystem information for the study area and catchment, as well as a detailed assessment of the freshwater features at the proposed site. The river health and wetland health assessments were carried out using South African Department of Water Affairs developed methodologies. A summary of the findings of the study are provided below and the full Freshwater Ecology Impact Assessment is included in **Annexure D2**.

The main aquatic features within the study area are the Brak River (Figure 4), a seasonal tributary within the Orange River System and a number of its tributaries. The Brak River flows in a north westerly direction along the southern boundary of the study area with a number of its tributaries crossing the site as they flow in a southerly direction. The Brak River joins the Orange River east of Prieska. The two larger tributaries of the Brak River that will also be crossed by the proposed transmission line route are the Vet Laagte and the Maatjes Fountain streams. The Vet Laagte River drains the low lying cultivated areas to the west of the Brak River while the Maatjes Fountain River drains the western face of the plateau to the east of De Aar and the Brak River. These larger tributaries of the Brak River have well defined channels and some associated vegetation.

Most of the smaller tributaries within the study area are ephemeral and are discernible only as slightly shallow depressions with no clear associated vegetation and slightly clayey soils. Small, shallow instream dams have been constructed within many of these drainage channels. These rivers, streams and drainage channels are discussed in more detail in the following section.

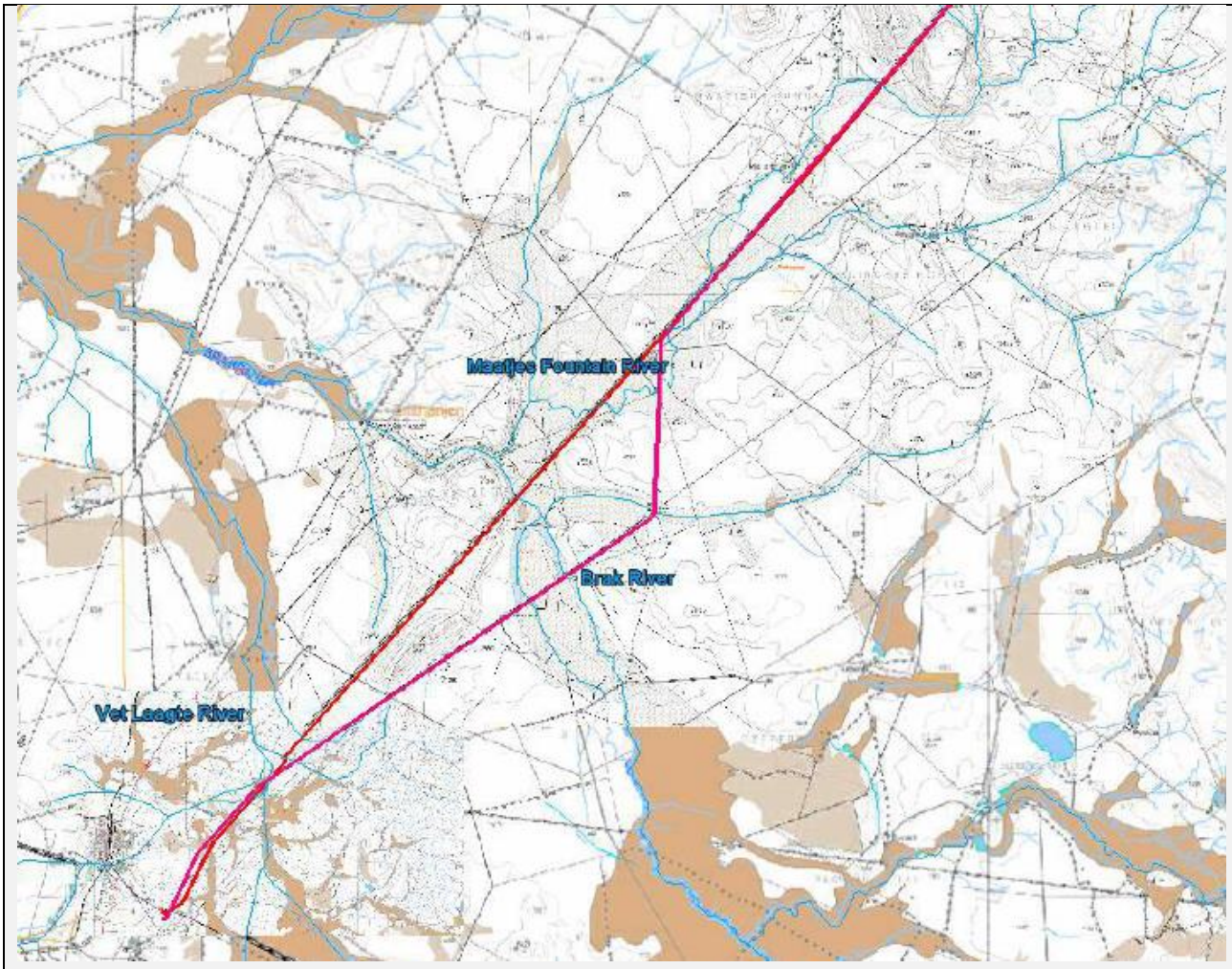

Figure 4: Water features in the study area (Belcher, 2014)

Description of the environment

The proposed power line between the Hydra and the 132kV substation north east of De Aar will potentially impact on the following freshwater features:

- Brak River which is considered to be in a moderately modified condition and of a moderate ecological importance and sensitivity
- Vet Laagte River, a tributary of the Brak River which is considered to be in a moderately modified condition and of a low ecological importance and sensitivity;
- Maatjes Fountain River, a tributary of the Brak River which is considered to be in a largely natural condition and of a moderate ecological importance and sensitivity; and
- Minor ephemeral tributaries of the Brak River System which are generally considered to be in a largely natural condition and of a low ecological importance and sensitivity.

Both tributaries of the Brak River within the study area have been identified as upstream catchments to the downstream reach of the Brak River, which is a FEPA river. In upstream catchments it is important that the rivers be managed in such a manner to ensure no degradation occurs in the downstream FEPA river. The Brak River both upstream and downstream of the study area contains wetland areas within its floodplain that have been mapped as wetland clusters. The proposed activities take place outside of these areas.

Construction Phase Activities

Nature of Impact: Construction activities would include the construction of concrete foundations for each monopole structure as well as possible jeep track surface access roads alongside the line where roads do not already exist. Activities during the construction phase of the project could thus be expected to result in some disturbance of vegetation cover along the proposed route and where, access routes need to cross freshwater features, some disturbance to the bed and banks of the river, stream or drainage features.

Significance of impacts without mitigation: Due to the existing disturbance caused by the power lines already crossing this floodplain, the significance of the construction of the transmission line along the proposed route would be medium to low.

Proposed mitigation: The new line should be located as close as possible to the existing lines and the increase in the footprint of these lines within floodplain is minimised as far as possible. It is recommended that, due to the wide and erosive nature of the Brak River, the proposed transmission line be located as far north of the river channel as possible and specifically downstream of the existing erosion control wall in the river. The disturbed area should be rehabilitated after construction is completed.

Significance of impacts after mitigation: A localized, short-term impact will still occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be low.

Operation Phase Activities

Nature of Impact: An impact of very limited significance is expected on the drainage characteristics of the Brak River and its tributaries along the proposed power line route after the construction phase provided that the recommendations provided for the Construction and Operation Phase of the project are implemented.

Significance of impacts without mitigation: A localized longer term impact of very low intensity that is expected to have a low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Significance of impacts after mitigation: A localized, long-term impact will still occur during the operation phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low.

Construction Phase Activities

Nature of Impact: A short term impact of low significance is expected at the access route crossings over the identified rivers, streams or drainage channels during the construction phase. The major impacts associated with the possible access roads relate to loss of habitat within drainage channels and riparian areas, loss of indigenous vegetation within riparian zones and possible invasive alien plant growth as well as the potential for flow and water quality impacts and the direct impacts on the soil (erosion of river and drainage channels).

Significance of impacts without mitigation: A localized shorter term impact of medium to low intensity that is expected to have a low to very low overall significance in terms of its impact on the identified aquatic

ecosystems in the area, depending on the amount of new roads that would need to be constructed within the freshwater features.

Significance of impacts after mitigation: A localized, short-term impact will occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low impact.

Operation Phase Activities

Nature of Impact: An impact of limited significance is expected at the access route river crossings of rivers, streams or drainage lines after the construction phase. The major impacts associated with the access roads during the operation phase relate to disturbance to the instream and riparian habitat of the freshwater ecosystems along the designated routes and the associated erosion potential.

Significance of impacts without mitigation: A localized longer term impact of low intensity that is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Significance of impacts after mitigation: A localized, longer-term impact will occur during the operation phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low.

Indirect impacts (Alternative A and B)

Indirect factors include flow and water quality modification, erosion and invasive plant growth.

Cumulative impacts (Alternative A and B)

Erosion and sedimentation from the project activities, together with a potential for invasive alien plant growth and the possible modification of surface water runoff and water quality may lead to additional impacts on the freshwater habitats within the study area. These impacts can however be monitored and easily mitigated.

Mitigation measures (Alternative A and B)

- The new line should be located as close as possible to the existing lines and the increase in the footprint of these lines within floodplain should be minimised as far as possible.
- Due to the wide and erosive nature of the Brak River, the proposed transmission line should be located as far north of the river channel as possible and specifically downstream of the existing erosion control wall in the river.
- The existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project, specifically within the floodplain areas and stream channels.
- Where access routes need to be constructed within the stream channels, disturbance of the channels should be limited and all crossings within the drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. Any disturbed areas should be rehabilitated to ensure that these areas do not become subject to erosion or invasive alien plant growth.
- To reduce the risk of erosion, particularly within the Maatjes Fountain tributary on the hill side of the plateau, any new service/ access roads should be contoured along the steep slope or erosion protection walls constructed. Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring within the freshwater features and drainage lines.

- It is recommended that there be minimal disturbance specifically within the river channel and that no poles/towers be placed within 30m of the top of bank of the well-defined Brak and Maatjes Fountain river channels and 30m from the centre of the channel for the less defined stream crossings (Vet Laagte River and tributaries of the Maatjes Fountain River).
- Any contaminated runoff from the construction sites should be prevented from entering the rivers/streams. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the river/stream systems and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Plan for the construction phase.
- All crossings over drainage channels or stream beds after the construction phase should be rehabilitated such that the flow within the drainage channel is not impeded.
- Maintenance of infrastructure related to the project should only take place via the designated access routes.
- Disturbed areas along the access routes should be monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Heritage including Palaeontology

A Heritage Impact Assessment was undertaken by PGS Heritage & Grace Relocation Consultants (PGS) in March 2014 to determine the potential heritage and paleontological resources that might occur within the corridor for the proposed transmission lines. A summary of the Heritage Impact Assessment (HIA) is provided below. The full HIA is included in **Annexure D6**.

Historical archaeology and local history

De Aar Junction played key strategic role during the South Africa War (Anglo-Boer War) and specifically two battles: the Battle of Stormberg and the Battle of Colenso. It acted as both the supply strategic place between Cape Town and the west central regions of South Africa through the Karoo, which remained devoid of any battles during the war. It is located central western region of the country, South Africa.

The town of De Aar was established just after the South African War after two Friedlander brothers, Isaac and Wolf, surveyed the land on farm De Aar which they had purchased during the construction of a junction in the late 1800's when the railway line between Cape Town and Kimberley was built. The site for the construction of the junction was first identified in 1881 and by 1899 the Friedlander brothers were already operating a trading store and a hotel at the junction. It is during this time that they purchased the farm De Aar which the later built the town of De Aar in 1900. However, it took another 5 years after the war had ended (1902) and 6 years after the creation of the town municipality (1900) for the town to elect its first municipal mayor in 1907. The name, De Aar, means 'Artery' after the underground water supply and is the second most important South African rail junction.

Archaeological sites

Utilising the archival study completed for the HIA as a guide, a field work component was completed to identify any possible heritage resources. The field work identified no archaeological find spots on the alignment provided.

The HIA has focused on a 500 meter assessment corridor of the route provided and the archaeological component on the centre alignment of the 500 meter corridor. Because of subsurface and localised nature of archaeological remains, any deviation or changes within the corridor to the initial layout alignment will require an archaeological walkdown of the new alignment after pylons placement positions have been to identify any possible archaeological and heritage structures and sites before construction commence.

Palaeontology

The study area is mainly underlain by Permian sedimentary rocks of the Karoo Supergroup (Figure 9). These Permian sedimentary rocks are classified as the Tierberg Formation (Pt) of the Ecca Group of the Karoo Supergroup and the Abramskraal Formation (Pa) of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite (Jd) sills dominate the hilltops while the low laying areas consist of recent Quaternary (^^) Alluvium deposits. (Figure 5).

There is a high and moderate possibility that fossils could be encountered during excavation of the Abramskraal (high palaeontology sensitivity) and Tierberg (moderate palaeontology sensitivity) Formations respectively . These fossil founds would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact. The potential impact on palaeontological resources was deemed to have a **high (-)** impact (Alternative A and B). The appointment of a qualified palaeontologist for excavation would reduce the significance of this impact to **low (-).**

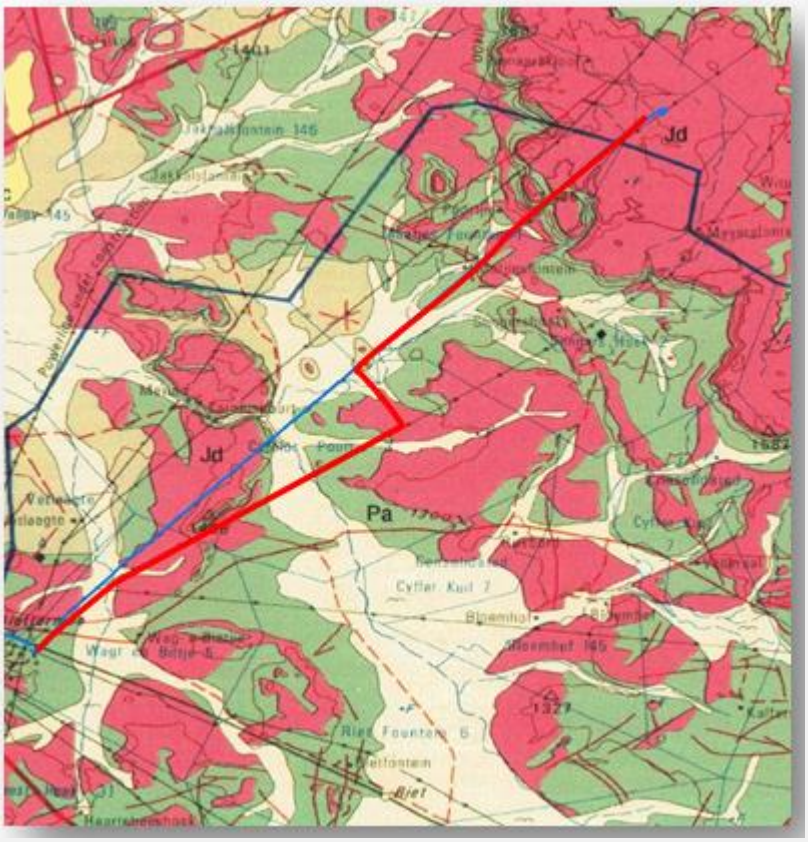

Figure 5: Geology of the study area at De Aar (PGS, 2014)

Cultural Landscape

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that are known to have added to the cultural fabric of a place or area.

Views in the region are extensive and unobstructed for kilometres. The Pienaarskloof Mountains in the western section of the alignment makes way for a large open landscape with low vegetation towards De Aar. The open landscape is however already broken with numerous 132kV and 400kV lines coming from the north through the study are towards the Hydra Substation. This proposed alignment follows one of the existing Eskom servitudes in to the Eskom Hydra Substation.

The evaluation of the alignment and a 500 meter buffer around the centre line has shown no farmsteads to be of concern with regards to alignments.

Cumulative impacts (Alternative A and B)

No cumulative impacts were identified.

Mitigation measures (Alternative A and B)

Walkdown of the proposed route

- The HIA has focused on a 500 meter assessment corridor of the route provided and the archaeological component on the centre alignment of the 500 meter corridor. Because of subsurface and localised nature of archaeological remains, any deviation or changes within the corridor to the initial layout alignment will require an archaeological walkdown of the new alignment after pylons placement positions have been to identify any possible archaeological and heritage structures and sites before construction commence.

Mitigation measures (Alternative A and B)

Palaeontological mitigation measures

- A Palaeontologist be appointed as part of the Environmental Construction Team for preferable all identified palaeontological sensitive areas but definite for the identified high sensitive areas.
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist.
- The Palaeontologist accompany the surveyor and foundation teams during the pylon construction phase to move pylons where possible from potential fossil bearing areas or rescue any fossils from construction footprint.
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

Handling of chance finds

- A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction employees.
- If a possible heritage site is discovered during construction activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process,

documentation of structures or archaeological excavations.

Visual

A Visual Impact Assessment (VIA) was undertaken by Mrs Karen Hansen, a Landscape Architect, to assess the potential visual impacts that might occur as a result of the proposed transmission line. The VIA included a desktop survey using 1:50,000 topographical survey maps to assess the site setting, to identify landform, landscape and habitation patterns and assess the viewshed. Aerial photography, Google Earth, was used to assist in this part of the study. Terrain analysis software, Global Mapper, was used to start the visual envelope definition process. Adobe Photoshop and CAD software were used to manipulate some images to test the visual effect of the proposed infrastructure. A photographic survey of the servitude and the surrounding area was then conducted in the week of March 2014. The full Visual Impact Assessment report is included in **Annexure D3**. A summary of the findings is included below.

Landscape character[1]

The landscape character through which the preferred servitude route runs starts at the plateau uplands and continues through the open land of the lowlands. Thereafter the preferred route follows a line down the plateau and onto open land characterised by gently undulating topography and low scrub, with long views. The land is used for agriculture and transmission lines and the character is therefore industrialised rural.

View Catchment Areas

Views of greatest significance would be from transportation corridors of the N10 and the rail line, some farmsteads and from other local places of habitation and work. The viewshed envelope would be defined by views from transport corridors, existing places of habitation and employment, and by topography. The degree of visual influence within the View Catchment Area is judged to be moderate-low as the development would only influence the view and act as a visual focus, within a 2.5km radius, (locally).

For ease of reference, View Catchment Areas are illustrated in the map below Figure 6.

[1] Landscape Character is the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this pattern is perceived. It reflects particular combinations of geology, landform, soils, vegetation, river systems, land use and human settlement. It creates the definite sense of place of different areas of the landscape.

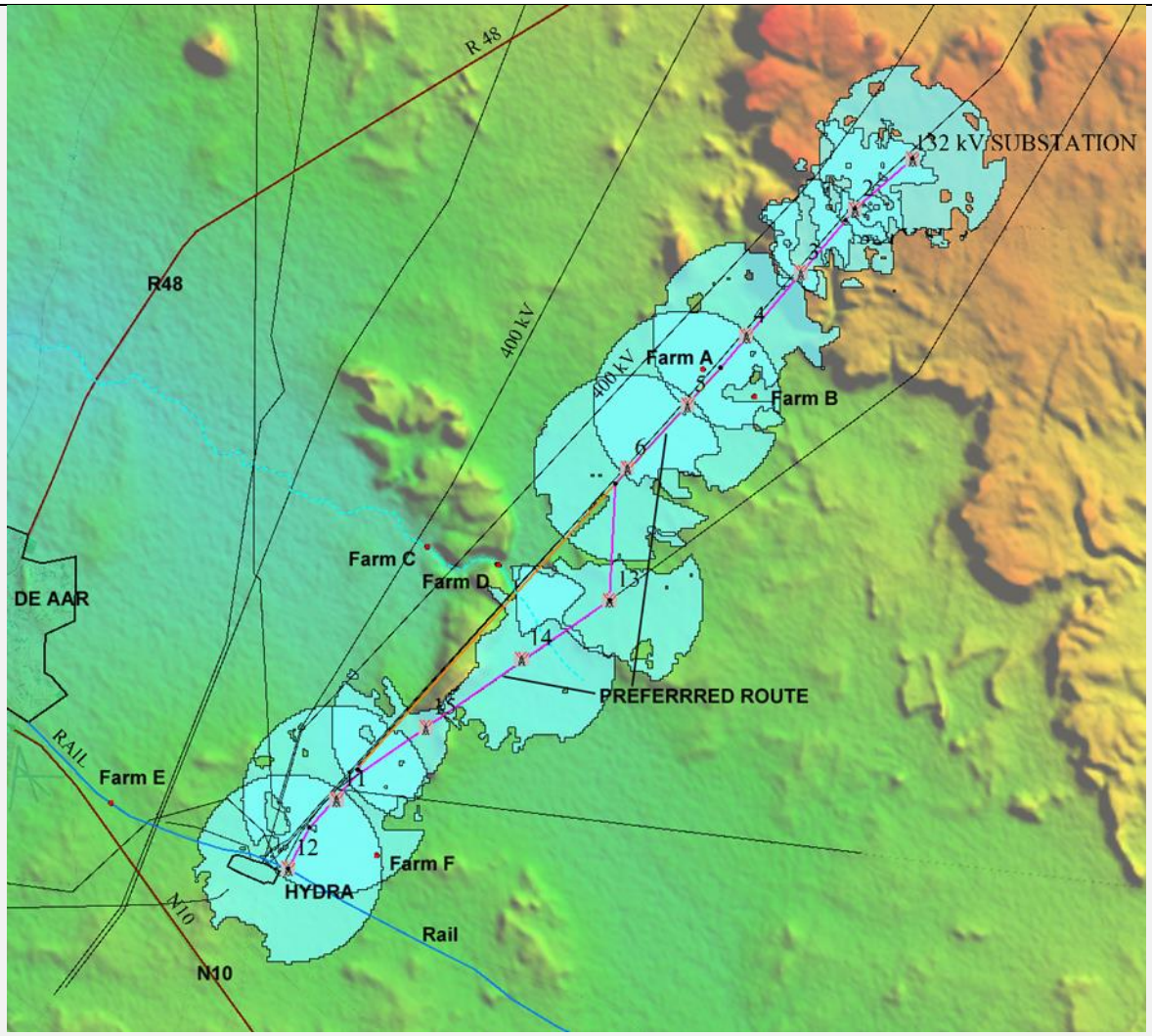

Figure 6: Viewsheds of the preferred transmission line route from the proposed WEF 132kV substation to the existing substation at Hydra, a distance of 26.5km Visual envelope calculated at a radius of 2.5km from the proposed preferred installation, using 21m poles and random points along the route indicating that the route and masts would be clearly visible; the selected points are shown in red. Also shows the locations of De Aar, transport corridors, and farmsteads. The visual envelope becomes somewhat broken up over higher ground, but more extensive in the plain. Source: Hansen 2014

Construction Period

The visual intensity is rated as medium as the access routes and access points would be visible to receptors locally and there would be many traffic movements.

Operational Period

The general area already carries many transmission corridors albeit of different specifications and therefore there is local context. The intensity of the visual impact is judged to be very low. The impact will be noticeable but negligible.

Alternatives

Layouts: The intensity of the visual impact is judged to be very low. The impact will be noticeable but negligible.

The preferred route as it traverses the higher ground of the Plateau: The visual intensity of the proposed transmission line is less than anticipated because it would relate to the WEF, a development offering much greater impact. The impact will be noticeable but there would be local context; rated very low

The preferred route as it traverses lower ground between the plateau and De Aar: The visual intensity of the proposed transmission line would be experienced in a landscape already carrying many transmission lines. The impact would be noticeable but there is local context; rated very low

Activities: The visual intensity of the No-Go Alternative would be zero because no changes to the landscape are currently anticipated.

The Intensity, or Magnitude, is summarised from the foregoing as medium during the construction period, reducing to very low thereafter

Indirect impacts (alternative A and B)

No indirect impacts were identified.

Cumulative impacts (alternative A and B)

It is not known if the proponent, or any other body, would consider further phases on this route to serve additional alternative energy projects, or to provide additional transmission lines. That would depend upon factors outside of the scope of this study. However, if De Aar continues to develop as a renewable energy hub and if future projects are approved, it would result in additional infrastructure (such as substations, roads and transmission lines) as well as solar panels and turbines being established. The local landscape character would be made more industrial. In the context of the De Aar area, with its long views, exposed sites and roads with little traffic, the cumulative impact is considered to be of moderate significance.

Mitigation measures (alternative A and B)

- Reduce the construction period through careful logistical planning and productive implementation of resources, monitor traffic and control dust.
- Lay down areas, construction camp, site offices, should be sited carefully and use temporary screen fencing to screen from the wider landscape.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Moderate the impact of the infrastructure by keeping changes of direction to a minimum and increasing the span between towers to the practical maximum.

Agriculture

The establishment of transmission lines may cause temporary or permanent loss of high value agricultural land and/or food security. A desktop Agricultural Assessment was undertaken by Mr Michael Wright of SiVEST (Pty) Ltd. The desktop evaluation included evaluating GIS data from National GIS Datasets as well as the Environmental Potential Atlas for South Africa (ENPAT) Database for the Northern Cape Province of South Africa, compiled by the Department of Environmental Affairs and Tourism (DEAT, 2001). The main purpose of ENPAT is to proactively indicate potential conflicts between development plans and critical, endangered or sensitive environments. By combining various data sources the Specialist was able to broadly assess the transmission line alternatives, receiving environment, and its ability to accept change, in the form of development. More agriculturally relevant spatial information was obtained from the AGIS Database. The

Agricultural Assessment Report is included in Appendix D4. The findings and recommendations of this study is summarised below.

Climate

The study area has a semi-arid to arid continental climate with a summer rainfall regime i.e. most of the rainfall is confined to summer and early autumn. Mean Annual Precipitation (MAP) is approximately 300mm per year, which is deemed to be low considering that a MAP 500mm is the minimum amount of rain required for sustainable dry land farming. Thus, without some form of supplementary irrigation, natural rainfall for the study area is insufficient to produce sustainable harvests. This is reflected in the lack of dry land crop production within the study area. De Aar typically experiences hot days and cold nights with the highest maximum temperature of approximately 40°C and the lowest minimum temperature of approximately -8°C. Evaporation is estimated to be in the region of 2,000mm per annum and thus the area is subjected to very severe moisture availability restrictions.

Geology

The study area is underlain by a variety of geological materials including dolerite, mudstone and shale (Figure 6). Dolerite, a basic igneous rock dominates the eastern and central-western areas of the power line corridor, which coincides with the top of the plateau and high spots.

Shale and mudstone geologic materials are found on the plains which surround the plateau, and dominate the central and southern study areas. Shale, a clastic sedimentary rock, is formed by the settling and accumulation of clay rich minerals and other sediments. Due to the settling process this parent material usually takes the form of parallel rock layers which lithifies over time.

The new avoidance alignment associated with the line is predominately underlain by mudstone. Like shale, mudstone is also clastic sedimentary rock which is formed from the lithification of deposited mud and clay. Mudstone consists of a very fine grain size of less than 0.005mm, but unlike shale it is mostly devoid of bedding.

The Alternative transmission line route is located primarily on land with the same geology as the preferred transmission line route. Hence, the same findings apply to the Alternate route.

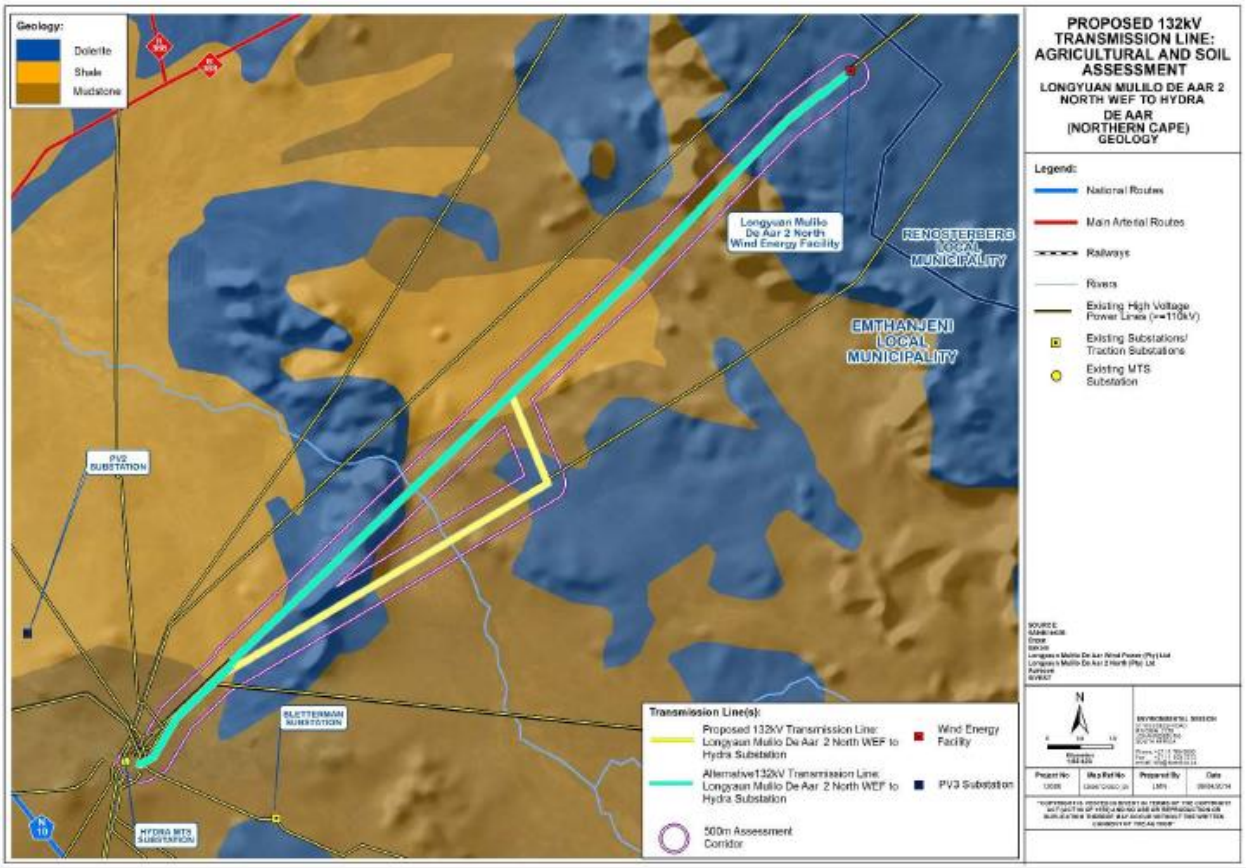

Figure 7: Geology map (SiVEST, 2014)

Slope

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

The steep cliffs, which divide the flat lower plains with the more undulating plateau, are the most prominent topographical feature. Away from these cliffs the study area is generally flat with an average gradient of less than 10% making these areas ideal for intensive agriculture with high potential for large scale mechanisation.

The Alternative transmission line route is located on terrain with the same slopes as the preferred transmission line route, however, a larger portion of it is positioned on the flat lower plains. Hence, very similar findings apply to the Alternate route.

Land use

According to the ENPAT Database and 2010 land cover data the study area consists of a mix of natural veld and unimproved shrubland which is used as grazing land for sheep, goats and cattle. Vast un-improved grazing land is interspersed by non-perennial stream beds and seasonal pans dot the landscape. According to the spatial databases there are no cultivated fields or irrigated lands which could be detrimentally impacted upon by the proposed development corridor alternatives.

The Alternative transmission line route is located on land with the same land use classification as the

preferred transmission line route. Hence, the same findings apply to the Alternate route.

Soils Characteristics and Soil Potential

The ENPAT spatial dataset for the Northern Cape Province provides details pertaining to the broad soil type and approximate agricultural potential for the study area. Figure 11 provides a spatial characterization of the major soil groups which underlie the study area. This characterization allows the study area to be divided into two broad soil group areas.

The study area is characterized by a mix of rocky areas in combination with Glenrosa and Mispah soil forms. These forms are associated with shallow soils, where parent rock is found close to the land surface. These soils have an inherently low agricultural potential due to a prohibitive rooting depth. As expected shallow, rocky soils correspond to the steeper slopes which give rise to the eastern plateau.

The entire study area is classified as having an effective soil depth, depth to which roots can penetrate the soil, of less than 0.45 m deep which is a limiting factor in terms of sustainable crop production. According to the AGIS database the project area is associated with soils with low organic matter content and an average pH of between 7.5 and 8.4 (basic).

Agricultural potential

By taking all the corridor characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the majority of the study area is classified as being extremely low for crop production while moderate to moderately low for grazing. The grazing carrying capacity for the general area within which the corridor is situated is 26-30 animal units per hectare. The power line will not have a significant reduction of animal unit carrying capacity due to the fact that only the pole footprint will impact on vegetation and grazing plant material. This poor agricultural potential rating is primarily due to restrictive climatic characteristics and soil depth limitations.

The generally poor soils and restrictive climate characteristics are reflected in the lack of active agricultural fields within the provided assessment corridor. The steeper slopes, giving rise to the eastern plateau, are not suitable for agriculture, grazing or forestry due to rocky soils and extreme topography. The affected area is not classified as high potential nor is it a unique dry land agricultural resource.

Significance of the agricultural impact

The land influenced by the 500m power line corridors is classified, at best, as moderate potential grazing land. This grazing land is classified as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development. This is due to the fact that livestock grazing, the dominant agricultural activity; can continue within the power line servitude. The only loss of grazing land will be under the towers themselves, which is also minimized by the proposed monopole tower design. This direct loss of agricultural land is considered inconsequential within the context of this assessment. Care must therefore be taken that the power line poles footprint be placed outside drainage lines and a 10 meters horizontally line outside them in order to prevent damage to vegetation that may result in the impact on the surrounding agricultural resources. Alternative A (Transmission Line) is recommended as it runs parallel to an existing Eskom servitude and transmission lines that already impact on the agricultural activities on site.

There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed developments, and as such, there are no fatal flaw areas for the assessment corridor.

In terms of line routing, there is no significant variance between agricultural characteristics within the width of

500 m corridor and as such, from an agricultural perspective, the lines may be routed anywhere within the selected assessment corridor.

Indirect impacts (alternative A and B)

No indirect impacts were identified.

Cumulative impacts (alternative A and B)

No cumulative impacts were identified.

Mitigation measures (alternative A and B)

Due to the overarching site characteristics, and the nature of the proposed development, viable mitigation measures are limited and will most likely revolve around erosion control:

- Clearing activities should be kept to a minimum.
- In the unlikely event that heavy rains are expected, activities should be put on hold to reduce the risk of erosion.
- If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should be armoured with fascine like structures. A fascine structure usually consists of a natural wood material and is used for the strengthening of earthen structures or embankments.
- If earth works are required then storm water control and wind screening should be undertaken to prevent soil erosion.
- Interact with landowners to discuss where they would ideally like to see the power lines situated on their property.
- Ensure adequate compensation is paid to land owners where necessary.
- No pole structures are placed within drainage lines and their 10 meter buffer areas.

Socio-economic

The establishment of the transmission lines would facilitate the evacuation of electricity generated at the North and South WEF sites. The establishment of the proposed transmission lines together with the WEFs would provide a number of direct, indirect and induced jobs. The proposed project would also result in a large amount of expenditure in South Africa, in terms of procuring services and materials.

Lack of employment opportunities has been identified as a challenge within the DM. There is a high rate of unemployment in the LM which is 27.9%. This is slightly lower than the DM unemployment rate at 28.3%, the rate in the province 28.1% and the national rate of 39% (Census, 2011). The annual average household income is R88,244 which is slightly higher than the DM at R75,237 and the province at R86,185, although still lower than the national average at over R100,000.

According to the Pixley ka Seme DM IDP (2011), the economy of the District is founded on community services, agriculture, transport and tourism. Small towns function primarily as agricultural service centres, and the main economic activities are located in the main urban areas of De Aar, Colesberg, Victoria-West and Carnarvon. De Aar is the main town within the DM serving a total of 24 other towns and is a potential industrial growth point with favourable conditions for industry and its strategic location. The economy of the LM is dominated by agriculture which accounts for the majority of the labour force (Emthanjeni LM, 2012).

Other economic sectors on which the LM depends include the services sector (government institutions, Non-Governmental Organisations, Community-based Organisations and Non-profit Organisations as well as banks); manufacturing (stone crushing and abattoirs); retail (Checkers, Shoprite etc); agriculture (game farming and sheep, goat, pig and cattle farming); transport (road and rail infrastructure); and tourism (recognised for its potential) (Emthanjeni LM, 2012).

In terms of agriculture, wheat, maize and lucerne are key crops, and irrigation farming also supports the production of peanuts, grapes, dry beans, soya beans, potatoes, olives, pecan nuts, pistachio nuts and cotton (Pixley ka Seme DM, 2011). Small stock farming is widespread and focusses on sheep and goats, with sheep farming producing mutton and wool. The LM specifically, is increasingly becoming the key centre for supplying the rest of South Africa with "Karoo" mutton and there are several abattoirs in De Aar. The IDP highlights that there are opportunities for benefaction of resources which are currently being lost as products are sent to other areas for processing (Pixley ka Seme DM, 2011 and Emthanjeni LM, 2012).

The District is well connected, with De Aar being the institutional capital of the LM and DM (Emthanjeni website, 2013). The DM is located along some of the major transport routes including:

- The N1 from the Northern Province, Pretoria and Johannesburg to Cape Town;
- The N9 from Colesberg joining the N10 to Port Elizabeth and the Eastern Cape; and
- The N12 from Johannesburg via Kimberley to Cape Town; and the N10 from Namibia via Upington linking Namibia to the Eastern Cape.

Furthermore, the railway network around De Aar is well developed and one of the largest in South Africa (Pixley ka Seme DM, 2011).

According the Emthanjeni Tourist Strategy, there is 'immense untapped potential' for tourism in the LM (Creative Harvest, 2010). De Aar as the principal town in the LM and DM has a number of attractions including war memorials and features such as the Garden Of Remembrance and associated Memorial Cemetery, the De Aar Town Hall and cannon and the St Pauls Anglican Church used during the war. As mentioned in Section 4.7.5, the Olive Schreiner Monument and the House of Oliver Schreiner (24 March 1855 to 11 December 1920), who was a South African feminist and socialist author, is based in the town (Creative Harvest, 2010). The De Aar railway station used to be the second most important railway junction in the Southern hemisphere and the Railway Station and the Steam Trains are a tourist attraction which could be expanded through the development of a Museum. De Aar hosts a weather station which is considered a major but not well known tourist attraction and there is a paragliding school and facility that attract international visitors (Creative Harvest, 2010). In the more rural areas there is Khoisan Rock Art and hunting of game such as Springbok that are an attraction to outsiders.

In terms of the economy, the economic growth of the district was 0.6% in 2005, which was below the national average of 4% in 2007 (Pixley ka Seme DM, 2011). Key challenges faced include:

- The lack of diversification of the district economy;
- lack of investment in the region;
- lack of employment;
- opportunities; lack of skills;

- lack of entrepreneurship;
- small number of Small, Medium and Micro Enterprises active in the region;
- underutilization of the regions natural resources and economic opportunities; and
- Lack of water for irrigation farming (Pixley ka Seme DM, 2011).

Specific opportunities identified for growth and development include manufacturing, agro-processing, mining and semi-precious stones. It is also recognised that in order to attract investors to the district, the municipalities should focus on critical development activities that are taking place nationally and internationally (Pixley ka Seme DM, 2011). There is a recognition that sustainable projects must be identified that would enhance economic growth and long term job creation.

A critical factor affecting quality of life is the standard of education within a community. According to Census (2011), the population of the LM has a low level of education. As many as 11% of the population aged 20 and older have no schooling, 17% have some primary schooling, 7% have completed primary schooling and 34% have some secondary schooling. Only 25% have completed matric, with 7% completing some form of higher education as indicated in **Figure 8**.

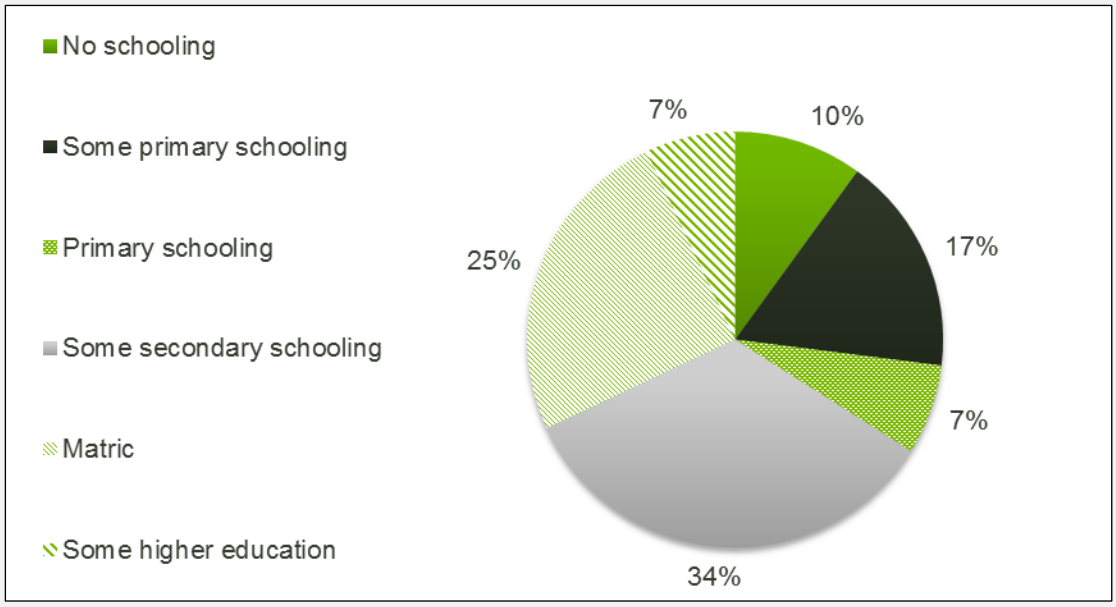

Figure 8 | Level of education of De Aar

This is slightly more favourable than the province which has 23% with a matric and the same portion (7%) with a higher education, but slightly less favourable than the national average at 28% with a matric and 12% with a higher education.

Socio-economic impact assessment

The establishment of the transmission lines together with the WEF sites would provide a large number of direct and indirect job opportunities. It is estimated that 35 job opportunities would be created for the construction period of the transmission lines and approximately 336 job opportunities would be created for the construction period of the WEF sites. It should be borne in mind that the construction phase jobs for the

transmission lines will only be for a short period (6 months). However, the transmission lines should not be viewed in isolation – they should be viewed together with the WEFs, which are a long-term investment in the De Aar region.

Table 5: Employment and social opportunities of the proposed transmission line in combination with the WEF

Anticipated CAPEX value of the project on completion	**Transmission line: R42 800 000 (ex VAT)**
What is the expected annual income to be generated by or as a result of the project?	**Transmission line: 0** ***WEF: R 402'000'000***
New skilled employment opportunities created in the construction phase of the project	**Transmission line: 25** ***WEF: 230***
New skilled employment opportunities created in the operational phase of the project	**Transmission line: 2** ***WEF: 19***
New un-skilled employment opportunities created in the construction phase of the project	**Transmission line: 10** ***WEF: 106***
New un-skilled employment opportunities created in the operational phase of the project	**Transmission line: 2** ***WEF: 40***
What is the expected value of the employment opportunities during the operational and construction phase?	**Transmission line: Construction: R 6'000'000 & Operation: R 7'000'000** ***WEF: Construction: R100'000'000 & Operation: R150'000'000***
What percentage of this value that will accrue to previously disadvantaged individuals?	**Transmission line: 93 %**
The expected current value of the employment opportunities during the first 10 years	**Transmission line: R 9'500'000** ***WEF: R147'000'000***
What percentage of this value that will accrue to previously disadvantaged individuals?	**Transmission line: 93.5 %**

The no-go alternative consists of the status quo and would have a significant impact on the viability of the WEF sites. Should the transmission lines not be authorised, it would not be possible to evacuate the electricity generated at the wind energy facility to the national grid. The no-go alternative is thus deemed to have a high (-) impact.

Indirect Impacts

The impact of indirect jobs and expenditure has been assessed in the direct impacts above.

Cumulative Impacts

A number of other renewable energy developments are planned for the Northern Cape in addition to this project. The cumulative impacts of these would be positive on both local and regional societies and economies. Cumulatively the impacts of renewable energy would be greatest on employment, and regional development, in the form of new business sales and regional GDP. This cumulative impact is considered to be of **high (+)** significance.

Mitigation measures

- It is recommended that the local employment policy, as stated by the proponent, be implemented, audited and accompanied by a training programme. The policy must be based on a 'local's first' policy, specifically for low skilled jobs and should aim to recruit at least 20% of the jobs from the local community. This should also apply to all contracting firms.
- Implement a policy of "no employment at the gate" to prevent loitering.
- The site should be secured.
- A comprehensive employee induction programme would cover land access protocols and fire management. This was addressed in the LEMP.
- A comprehensive employee induction programme would address issues such as HIV/ AIDS and Tuberculosis, as well as alcohol and substance abuse. The induction should also address a code of behaviour for employees that would align with community values.
- The LEMP also addressed noise and dust control. A 24 hour system for receiving and addressing complaints should be established before the commencement of the construction phase. Local farmers and residents should be informed of the contact number.
- Housing has to be restricted to the approved laydown areas
- Source local businesses resources for supply, where possible.
- Compile relevant and clearly defined procurement standards to govern choices of suppliers, products and the methods and procedures that are to be used to communicate with pertinent suppliers. These standards need to be carefully defined and analysed by the applicant, for quality and sustainability purposes, as well as for monitoring and evaluation of the suppliers and service providers.
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.
- Base recruitment on sound labour practices and keeping gender equality in mind.
- It is recommended that the local employment policy as stated by the proponent is implemented, audited and accompanied by a training programme. The policy must be based on a 'local's first' policy, specifically for low skilled jobs and should aim to recruit at least 20% of the jobs from the local community. This should also apply to all contracting firms.
- It is recommended that the developer adopts a local procurement policy which would maximise the benefit to the local economy and minimise leakage.
- It is recommended that the developer forfills commitments under their REIPPPP bid agreement for Economic Development within the local community.

Transport

Construction vehicles are likely to make use of the existing roads, including the R389 and R48, to transport equipment and material to the construction site. Few construction trucks would be required as most of the work would be done on site. The few trucks transporting building materials would not increase the traffic load in a measurable way.

The potential impact of the proposed project (alternative A and B) on transport is considered to be of low magnitude, local extent and short term and therefore of **low (-)** significance, with or without mitigation for the proposed project. The implementation of the recommended mitigation measures would however decrease the probability of the impact occurring.

Indirect impacts (alternative A and B)

No indirect impacts were identified.

Cumulative impacts (alternative A and B)

The cumulative potential impact of transmission lines and wind energy project on transport is considered to be of high magnitude, regional extent and short term and therefore of **medium (-)** significance, with or without mitigation.

Mitigation measures (alternative A and B)

- Implement traffic control measures where necessary;
- Transport components overnight as far as possible; and
- Adhere to speed limits.

Dust

Activities which could potentially cause dust problems include construction vehicles, which are likely to make use of the existing farm roads to transport equipment and material to the construction site, and earthworks.

This impact (alternative A and B) is considered to be of local extent and short term (6 months) and is therefore deemed to have **low (-)** significance without mitigation and **very low (-)** significance with mitigation.

Indirect impacts (alternative A and B)

No indirect impacts were identified.

Cumulative impacts (alternative A and B)

As the project are being developed in a rural setting relatively far from civilisation and combined with the short period of construction it is anticipated that the cumulative impacts of the dust from the various project together will have only a nominal effect on the receiving environment.

Mitigation measures (alternative A and B)

- Implement dust control measures identified in the EMP, which includes procedures for dealing with dust pollution events, include watering of roads, etc.

OPERATION

DIRECT AND INDIRECT IMPACTS:

Botany

Impacts are compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of transmission lines on vegetation. The major expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual organisms or on ecosystems as a whole.

Impact: Establishment and spread of declared weeds and alien invader plants

There are existing infestations of weeds on site and in immediately adjacent areas. There is therefore the potential that activities on site could promote the spread of these onto the site and/or into other natural areas.

Extent: The impact will occur at the site of the proposed transmission line corridor and in surrounding areas, but could potentially spread into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact is therefore scored as ***local***.

Magnitude: At a local scale, natural functions and/or processes will possibly be notably altered. The magnitude of the impact is therefore scored as ***medium***.

Duration: The impact will occur during construction, but cause effects that will last longer than 15 years, if not controlled. It is therefore scored as ***long term***.

Significance: On the basis of the impact being of medium magnitude at a local scale and of long term duration, the impact is scored as having a significance of ***medium***. Mitigation measures will reduce the extent to site specific, the magnitude to very low and the duration of the impact to short term. The significance will, therefore, be reduced to ***very low*** after mitigation measures have been implemented.

Probability: On the basis of known patterns of alien invasions, it is ***probable*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that could be reversed, if identified and managed. Impacts are possibly reversible within 2 years after the cause or stress is removed. The impact is therefore considered to be ***reversible***.

Indirect impacts (alternative A and B)

No indirect impacts were identified.

Cumulative impacts (alternative A and B)

The proposed overhead power lines will add to an existing network of transmission lines as well as future proposed transmission lines for the area. The cumulative impact on indigenous natural vegetation and due to spread of alien plants of all these transmission lines is assessed below.

Impact: Establishment and spread of declared weeds and alien invader plants

There are existing infestations of weeds in the general area around De Aar. There is therefore the potential that activities over a wide area could promote the spread of these into other natural areas, especially into drainage lines.

Extent: The impact will occur at the site of the transmission lines, which cover an area around De Aar in excess of 10 km from any single point, and is scored as ***regional***.

Magnitude: At a regional scale, natural functions and/or processes will possibly be notably altered. The magnitude of the impact is therefore scored as ***medium***.

Duration: The impact will cause effects that will last longer than 15 years, if not controlled. It is therefore scored as ***long term***.

Significance: On the basis of the impact being of medium magnitude at a regional scale and of long term duration, the impact is scored as having a significance of ***high***.

Probability: On the basis of known patterns of alien invasions, it is ***probable*** that the impact will occur.

Confidence: There is a reasonable to high amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. The confidence in the

assessment is therefore rated as ***sure***.

Reversibility: The activity will lead to an impact that could be reversed, if identified and managed. Impacts are possibly reversible within 2 years after the cause or stress is removed. The impact is therefore considered to be ***reversible.***

Mitigation measures (alternative A and B)

- An on-going monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Avifauna

Please see the description of the avifauna baseline under the avifauna section in the construction phase impacts above.

The potential operational phase impacts of the proposed transmission lines (alternative A and B) on the birdlife of the study area include disturbance and displacement due to noise and movement during transmission line maintenance activities and mortality due to collisions with the new transmission lines and electrocution on new power line infrastructure.

- *Displacement through habitat transformation and disturbance*

Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through transformation of habitat, which could result in temporary or permanent displacement. In the present instance, the risk of displacement of Red Data species due to habitat destruction is likely to be fairly limited, given the nature of the habitat. Apart from direct habitat destruction, the maintenance activities also impact on birds through disturbance, particularly during breeding activities. This could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle.

- *Collisions with the proposed power line*

The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

- *Mortality due to electrocutions on new transmission lines*

A mono-pole steel pole will be used for the new 132kV lines. Clearance between phases on the same side of the pole structure is normally around 2.2m for this type of design, and the clearance on strain structures is 1.8m. This clearance should be sufficient to prevent phase – phase electrocutions of birds on the towers. The

length of the stand-off insulators is likely to be a maximum of 1.5 metres. This is relevant as large birds (eagles, vulture and storks) are able to touch both the conductor and the earthed pole simultaneously potentially resulting in a phase – earth electrocution.

A factor that further reduces the already minimal risk of electrocution is the fact that the proposed alignment is situated next to transmission lines which are higher with large lattice towers, and therefore is more likely to be used for perching and roosting than the smaller, lower 132kV steel poles. Taking all the relevant factors into account, it can be concluded that the new 132kV line will pose a negligible risk of electrocution and it can therefore be discounted as a potential impact.

Indirect impacts (alternative A and B)
No indirect impacts were identified.

Cumulative impacts (alternative A and B)
When the current proposed construction of 132kV transmission lines is viewed in isolation, the project may pose only a limited threat to the avifauna of the area. However, several renewable energy facilities and associated infrastructure are being proposed for the De Aar area, including a number of solar energy Facilities which would be located near the Hydra substation a number of solar energy facilities are proposed and towards the south west of De Aar there are proposed WEFs. The cumulative impact of these projects in the larger region may result in:

- significant movement barriers being formed over the landscape. These barriers may result in local and regional bird populations commuting less energy-efficient to and from roosting and/or feeding areas.
- significant areas of habitat loss and disturbance with the added hazards of power infrastructure. These will compound the effects of power infrastructure on the local and regional avifauna and may result in significant numbers of mortalities through collisions and/or electrocution.

Mitigation measures (alternative A and B)

- In the operation phase of the project, maintenance should be carried out in less sensitive time frames – e.g. outside of breeding seasons for the species sensitive to disturbance listed in Table 1 of Appendix D5.
- All the spans, except those spans that are located adjacent to two or more high voltage lines, should be marked with Bird Flight Diverters on the earth wire of the line, ten metres apart, alternating black and white. APPENDIX B of the Avifaunal study indicates the preferred Bird Flight Diverters to be used.

Freshwater ecology

Please see the description of the freshwater ecology section under the construction phase impacts above.

Impact Assessment (Alternative A and B)
The proposed power line between the Hydra and the 132kV substation north east of De Aar will potentially impact on the following freshwater features:

- Brak River which is considered to be in a moderately modified condition and of a moderate ecological

importance and sensitivity
- Vet Laagte River, a tributary of the Brak River which is considered to be in a moderately modified condition and of a low ecological importance and sensitivity;
- Maatjes Fountain River, a tributary of the Brak River which is considered to be in a largely natural condition and of a moderate ecological importance and sensitivity; and
- Minor ephemeral tributaries of the Brak River System which are generally considered to be in a largely natural condition and of a low ecological importance and sensitivity.

Alternatives

The two alternative transmission line routes will have very similar potential impacts on the Maatjes Fountain River system. The proposed transmission line route is likely to have a lesser impact on the Brak River and its associated floodplain than the alternative route as it crosses the river where the floodplain is narrower and downstream of an erosion control wall in the river. Either of the proposed transmission line routes will not have a substantial difference in terms of the potential impact on the Vet Laagte River and its associated floodplain.

The potential impacts to the freshwater features in the area would be similar for both transmission routes assessed. The proposed transmission line route and the alternative route will largely follow routes of existing power lines. In addition, the freshwater features that would be crossed by the proposed line, as well as the alternative route, are small and of a low ecological significance. Thus expected impacts of the proposed activities for both transmission line routes considered, with mitigation, are likely to be of a **very low** significance and will be mostly limited to the proposed monopole placing's and any new access roads if required.

Indirect impacts (Alternative A and B)

No indirect impacts were identified.

Cumulative impacts (Alternative A and B)

Cumulative impacts are discussed in the freshwater ecology section under the construction phase impacts above.

Mitigation measures (Alternative A and B)

- Maintenance of infrastructure related to the project should only take place via the designated access routes. Disturbed areas along the access routes should be monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Heritage

Refer to the construction phase heritage impacts, discussed above, for a description of the cultural, archaeological and palaeontological environment.

Impact on Cultural Landscapes

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that are known to have added to the cultural fabric of a place or area.

Views in the region are extensive and unobstructed for kilometres. The Pienaarskloof Mountains in the western section of the alignment makes way for a large open landscape with low vegetation towards De Aar. The open landscape is however already broken with numerous 132kV and 400kV lines coming from the north through the study are towards the Hydra Substation. This proposed alignment follows one of the existing Eskom servitudes in to the Eskom Hydra Substation.

The evaluation of the alignment and a 500 meter buffer around the centre line has shown no farmsteads to be of concern with regards to alignments. The significance of the impact on the cultural landscape (alternative A and B) was considered to be of **low (-)** significance and the heritage significance was rated as Grade 4c.

Cumulative impacts (alternative A and B)
No cumulative impacts were identified.

Mitigation measures (alternative A and B)
No cumulative impacts were identified.

Visual

Refer to the construction phase visual impacts for a description of the visual environment. Of note is that the majority of visual impacts would occur during the construction phase.

Overall, this potential impact (alternative A and B) is considered to be of low magnitude, local extent and long term and therefore of **low (-)** significance.

The preferred route is marginally longer than the alternative, and their visual impacts are rated individually as low due to the few, and distant receptors and also due to their sharing existing transmission line corridors. The no-go alternative was also assessed.

Indirect impacts (alternative A and B)
No indirect impacts were identified.

Cumulative impacts (alternative A and B)
Pylons are intrusive in any landscape but De Aar has been associated with these transmission lines for a long time; this industrialisation of the landscape is part of the existing visual context. Towers of the solid pole design make a somewhat stronger visual statement than lattice or timber pylons. And also they are not so effectively backgrounded which could increase their impact within 1km. Changes of direction may require more guyed suspension towers. The visual impact of these proposed changes in route direction could be moderated by keeping changes of direction to a minimum and increasing the span between towers to the practical maximum.

The proximity of the development to a few farmsteads is noted; this concern is moderated and contextualised by existing transmission lines. There are few other local receptors.

No visual concerns were identified, no red flags, no potential risks to the receiving environment.

Mitigation measures (alternative A and B)
No mitigation measures relating to the operational phase were identified.

Agriculture

Refer to the construction phase agricultural impacts for a description of the agricultural baseline.

No impacts are anticipated on agriculture (alternative A and B). This is due to the fact that livestock grazing, the dominant agricultural activity, can continue within the power line servitude. The only loss of grazing land will be under the towers themselves, which is also minimised by the proposed monopole tower design. This direct loss of agricultural land is considered inconsequential within the context of this assessment. The agricultural impact was deemed to be negligible.

Indirect impacts (alternative A and B)
No indirect impacts were identified.

Cumulative impacts (alternative A and B)
No cumulative impacts were identified.

Mitigation measures (alternative A and B)
No mitigation measures were proposed.

Socio-economic

Refer to the construction phase socio-economic discussion, discussed above, for a description of the socio-economic environment.

The proposed project would provide very little direct employment during the operational phase. However, the transmission lines should not be viewed in isolation – they should be viewed together with the WEF, which is a long-term investment in the De Aar region.

Potential impacts from the proposed wind energy facility include:

- Increase in GDP: The proposed WEF would contribute towards the value of all final goods and products produced during a one-year period within the boundaries of a specific area, as a direct, indirect and induced result of activities for/at the site during operational phase.
- Increase in New Business Sales (NBS): The proposed project would increase the value of all inter- and intra-sectoral business sales generated in the economy as a consequence of the operation of the wind energy facility.
- The proposed project would provide the De Aar community with an income that would allow them to manage the land sustainably into the future. Additional social benefits would accumulate to a Local Community Trust that is to be formed in accordance with the renewable energy Independent Power

Process requirements.

The impact on the socio-economic environment would be of very high to high magnitude, regional extent and short term and therefore of **medium to high (+)** significance, without or with mitigation.

The no-go alternative consists of the status quo and would have a significant impact on the viability of the WEF site. Should the transmission lines not be authorised, it would not be possible to evacuate the electricity generated at the wind energy facility to the national grid. The no-go alternative is thus deemed to have a **high (-)** impact.

Indirect Impacts (alternative A and B)
The impact of indirect jobs and expenditure has been assessed in the direct impacts above.

Cumulative Impacts (alternative A and B)
A number of other renewable energy developments are planned for the Northern Cape in addition to these proposed wind energy facility. The cumulative impacts of these would be positive on both local and regional societies and economies. Cumulatively the impacts of renewable energy would be greatest on employment, and regional development, in the form of new business sales and regional GDP. This cumulative impact is considered to be of **high (+)** significance.

Indirect Impacts (alternative A and B)
The impact of indirect jobs and expenditure has been assessed in the direct impacts above.

Cumulative Impacts (alternative A and B)
A number of other renewable energy developments are planned for the Northern Cape in addition to this project. The cumulative impacts of these would be positive on both local and regional societies and economies. Cumulatively the impacts of renewable energy would be greatest on employment, and regional development, in the form of new business sales and regional GDP. This cumulative impact is considered to be of **high (+)** significance.

Mitigation measures (alternative A and B)
No mitigation measures were proposed.

Economic (Energy Generation)

The draft IRP was published on 8 October 2010 by the National Energy Regulator of South Africa, Department of Energy and the System Operator within Eskom. The IRP sets out a 20 year electricity plan for South Africa and allows for an additional 123 000 MW of renewable energy in the electricity mix in South Africa by 2030. It also notes that there will be a shortfall of supply in the immediate future (2011 – 2017).

Assessment of impacts
There are a number of renewable energy options (including, *inter alia,* wind, solar) which are being pursued in South Africa, however many more renewable energy projects are required to meet the targets set by the

draft IRP. The benefits of renewable energy, such as is proposed, are the carbon savings of a decreased requirement for energy from non-renewable sources such as coal-fired power stations. Furthermore, the proposed project together with the WEFs would contribute towards South Africa's energy requirements. As such the potential impact of the proposed project together with the WEFs is considered to be of low intensity, national extent and long term and therefore of **low (+)** significance, without mitigation, for all alternatives. No mitigation measures are recommended.

Indirect impacts (alternative A and B)
No indirect impacts have been identified.

Cumulative impacts (alternative A and B)
A number of other renewable energy developments are planned for the Northern Cape in addition to these proposed wind energy facility. The cumulative impacts of these would be positive on both local and regional societies and economies. Cumulatively the impacts of renewable energy would be greatest on employment, and regional development, in the form of new business sales and regional GDP. This cumulative impact is considered to be of **high (+)** significance.

Mitigation measures (alternative A and B)
No mitigation measures are recommended.

Climate change

Direct impacts (alternative A and B)
No direct impacts on climate change were identified.

Indirect Impacts (alternative A and B)
The establishment of renewable energy facilities would reduce South Africa's future reliance on energy from coal-fired power stations which could in turn reduce the future volume of greenhouse gases emitted to the atmosphere, reducing the greenhouse effect on a regional, national and international scale.

Gases which contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH_4), water vapour, nitrous oxide, chloroflurocarbons (CFCs), halons and peroxyacylnitrate (PAN). All of these gases are transparent to shortwave radiation reaching the earth's surface, but trap long-wave radiation leaving the earth's surface, acting like a greenhouse. This action leads to a warming of the earth's lower atmosphere, with changes in the global and regional climates, rising sea levels and extended desertification. This is turn is expected to have severe ecological consequences and a suite of implications for humans. Total greenhouse gas emissions reported to be emitted within South Africa for the 2008 year was approximately 435 million metric tons of CO_2 equivalent (UN Statistical division, 2011).

Assessment of impacts
Greenhouse gases released from a new coal-fired power station are primarily CO_2 with minor amounts of nitrous oxide (N2O). The Medupi Power Station (4 788 MW), currently under construction near Lephalale in Limpopo, is expected to produce 29.9 million metric tons of CO_2 per annum. The emissions from Medupi

Power Station would increase South Africa's CO_2 equivalent emissions (2008) by some 7%. This is a significant increase in greenhouse gas emissions, given the aims of the Kyoto Protocol, which are to reduce overall emission levels of the six major greenhouse gases to 5% below the 1990 levels, between 2008 and 2012 in developed countries. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly.

No greenhouse gases are produced by the wind energy facility during operation, as wind drives the turbines that generate the electricity. Although wind energy facilities would not completely replace coal-fired power stations within South Africa, since these would still be required to provide base-load, they would reduce South Africa's reliance on them. This would assist in reducing future volumes of greenhouse gas emissions.

A life-cycle analysis looks at the entire chain of activities needed for electricity production and distribution, such as fuel extraction and transport, processing and transformation, construction and installation of the plant and equipment, waste disposal, as well as the eventual decommissioning. Every energy technology (wind, hydro, coal, gas, etc) has its own very distinct fuel cycle. A comparative life-cycle analysis for the current energy technologies used in Europe was conducted by AUMA (2000). The study focused mainly on emissions from the various energy technologies. Although the results of the analysis are not necessarily entirely accurate in the South African context, they offer a good proxy for a comparative assessment of coal-fired and wind energy facilities in South Africa. The results of the analysis are illustrated graphically in Figure 25 below.

It is evident from Figure 9 that small to almost negligible environmental impacts are associated with renewables, particularly wind, relative to fossil fuels such as coal, over the entire life-cycle.

While the proposed wind energy facility would not provide an equivalent amount of energy as a typical new coal-fired power station (140 MW compared to 4 788 MW), when considered with regards to climate change and given the spirit of the Kyoto Protocol, the impact is deemed to be of regional extent, very low magnitude and long term and therefore of low (+) significance, without mitigation.

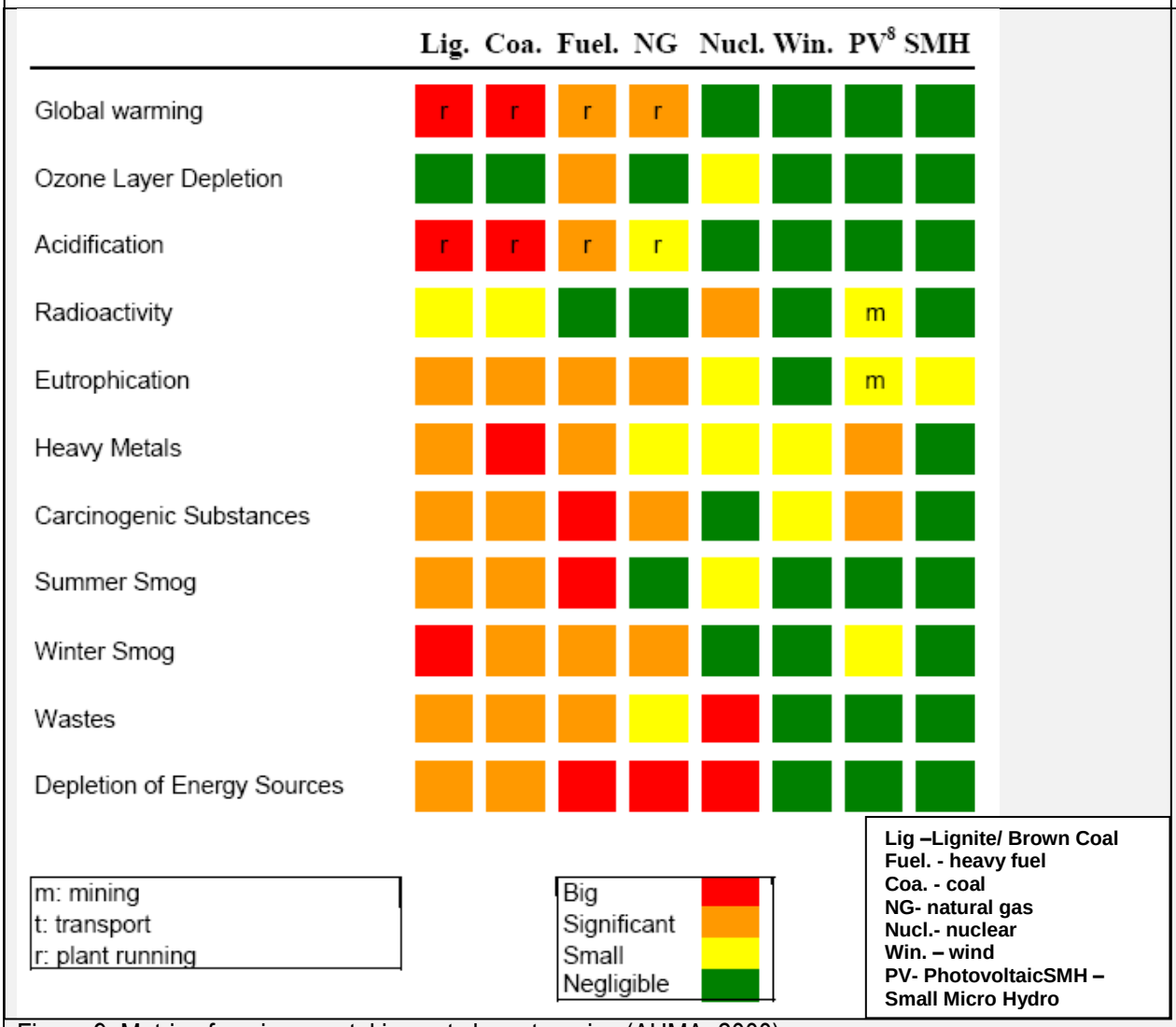

Figure 9: Matrix of environmental impacts by categories (AUMA, 2000)

It is evident from Figure 9 above that small to almost negligible environmental impacts are associated with renewables, particularly wind, relative to fossil fuels such as coal, over the entire life-cycle.

While the proposed project together with the WEFs would not provide an equivalent amount of energy as a typical new coal-fired power station (~371 – 618MW compared to 4 788 MW), when considered with regards to climate change and given the spirit of the Kyoto Protocol, the impact is deemed to be of regional extent, very low magnitude and long term and therefore of **low (+)** significance, without mitigation.

Cumulative impacts (alternative A and B)

Many renewable energy facilities are proposed throughout the Northern Cape and South Africa. Although not all those proposed would be constructed, a large number would be operating in the next few years. Given the number of renewable energy facilities proposed across the country, the potential cumulative impacts of the proposed project on the potential reduction in future greenhouse gas emissions is considered to be of regional extent, low magnitude and long term, and therefore of **medium (+)** significance.

Mitigation measures (alternative A and B)

No mitigation measures are recommended.

DECOMMISSIONING IMPACTS

Decommissioning is not anticipated, however this would be directly reliant on the wind energy facility continued operation after its component lifecycle as described below. This includes a description of how the facility as well as associated infrastructure as well as transmission lines would be decommissioned.

Decommissioning of the proposed wind energy facility and associated infrastructure:

The proposed WEF has a project lifespan of 20 years, based on the mechanical characteristics of the turbines. However, as all the infrastructure, such as roads, transmission, substations and foundations would already be established, and the energy source (wind) is a renewable one, the proposed project would most likely continue to be operated after 20 years. Turbines would be upgraded to make use of the latest technology available. All redundant equipment that was replaced would be removed from site and would be sold off.

The following activities would form part of any decommissioning:

1. Site preparation activities would include confirming the integrity of the access to the site to accommodate the required equipment and lifting cranes, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.
2. A large crane would be brought on site to disassemble the turbine and tower sections. These components would be reused, recycled and disposed of in accordance with regulatory requirements. All parts of the turbines would be considered reusable or recyclable, except for the blades.

If the facility is decommissioned then the site would be fully rehabilitated in accordance with requirements in terms of relevant legislation such as the National Environmental Management Act. The concrete bases of the turbines, transformers and transmission lines could be removed, but would most likely be left under the ground, to avoid disturbing rehabilitated areas once more. The turbines would be removed as described above. All roads would be left on site, as it would assist the farmer in accessing his land.

A rehabilitation cost of R52 million has been budgeted for decommissioning of the plant which would include transmission lines.

Table 6: Summary of Operational and Construction Impacts

Alternative A:

Potential impact	No mit/Mit[2]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[3]	Reversibility
OPERATIONAL PHASE								
Impact on Botony	No mit	Local	Very-Low	Long term	***Very-Low (-)***	Definite	Sure	Irreversible
	Mit	Local	Very-Low	Long term	***Very Low (-)***	Probable	Sure	Irreversible
Impact on Fauna	No mit	Local	Very-Low	Long term	***Very-Low (-)***	Probable	Sure	Irreversible
	Mit	Local	Very-Low	Long term	***Very Low (-)***	Probable	Sure	Irreversible
Impact on Avifauna	No mit	Local	Medium	Long term	***Medium (-)***	Probable	Sure	Irreversible
	Mit	Local	Low	Long term	***Low (-)***	Probable	Sure	Irreversible
Impact on Freshwater ecology	No mit	Local	Very-Low	Long term	***Very-Low (-)***	Probable	Low	Reversible
	Mit	Local	Very-Low	Long term	***Very Low (-)***	Probable	Low	Reversible
Impact on climate change	No mit	Regional	Very Low	Long Term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Very Low	Long Term	***Low (+)***	Probable	Sure	Reversible
Visual	No mit	Regional	Low	Long term	***Low (-)***	Definite	Sure	Reversible
	Mit	Regional	Low	Long term	***Low (-)***	Definite	Sure	Reversible
Impact on energy production	No mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on Agriculture	No mit	Local	Low	Long term	***Very Low (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Long term	***Very Low (-)***	Probable	Sure	Reversible
No-go alternative	No mit	Regional	Low	Long term	***Medium (-)***	Probable	Sure	Irreversible
	Mit	Regional	Low	Long term	***Medium (-)***	Probable	Sure	Irreversible
CONSTRUCTION PHASE								
Impacts on Botany	No mit	Local	Low-Medium	Medium term	***Low-Medium (-)***	Probable	Sure	Reversible
	Mit	Local	Very-Low	Medium term	***Very Low (-)***	Probable	Sure	Reversible
Impacts on Fauna	No mit	Local	Medium	Medium term	**Medium (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Medium term	**Very Low (-)**	Probable	Sure	Reversible
Impacts on Avifauna	No mit	Local	Medium	Medium term	**Medium (-)**	Probable	Sure	Reversible

[2] Note that this refers to No mitigation and Mitigation.
[3] Conf.=Confidence in the assessment of the potential impact.

Potential impact	No mit/Mit[2]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[3]	Reversibility
	Mit	Local	Low	Medium term	**Low (-)**	Probable	Sure	Reversible
Sedimentation and erosion	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Impact on heritage resources: Archaeology	No mit	Local	Low	Long term	**Low (-)**	Definite	Low	Irreversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Palaeontology	No mit	Local	High	Long term	**High (-)**	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Cultural Heritage	No mit	Local	Low	Long term	**Low (-)**	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Visual	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
Impact on Transport	No mit	Regional	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Regional	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
Noise pollution	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Storage of hazardous substances on site	No mit	Local	High	Short term	**Low (-)**	Probable	Sure	Irreversible
	Mit	Local	High	Short term	**Low (-)**	Unlikely	Sure	Irreversible
Impact of dust	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

Alternative B (Preferred):

Potential impact	No mit/Mit[4]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[5]	Reversibility
OPERATIONAL PHASE								
Impact on Botany	No mit	Local	Very-Low	Long term	***Very-Low (-)***	Definite	Sure	Irreversible
	Mit	Local	Very-Low	Long term	***Very Low (-)***	Probable	Sure	Irreversible
Impact on Fauna:	No mit	Local	Very-Low	Long term	***Very-Low (-)***	Definite	Sure	Irreversible
	Mit	Local	Very-Low	Long term	***Very Low (-)***	Probable	Sure	Irreversible
Impact on Avifauna	No mit	Local	High	Long term	***Medium(-)***	Probable	Sure	Irreversible

[4] Note that this refers to No mitigation and Mitigation.
[5] Conf.=Confidence in the assessment of the potential impact.

Potential impact	No mit/Mit[4]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[5]	Reversibility
	Mit	Local	Medium	Long term	***Low (-)***	Probable	Sure	Irreversible
Impact on Freshwater	No mit	Local	Low	Long term	***Low (-)***	Probable	Low	Reversible
	Mit	Local	Low	Long term	***Very Low (-)***	Probable	Low	Reversible
Impact on climate change	No mit	Regional	Very Low	Long Term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Very Low	Long Term	***Low (+)***	Probable	Sure	Reversible
Visual	No mit	Regional	Low	Long term	***Low (-)***	Definite	Sure	Reversible
	Mit	Regional	Low	Long term	***Low (-)***	Definite	Sure	Reversible
Impact on energy production	No mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on agricultural land	No mit	Local	Low	Long term	***Very Low (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Long term	***Very Low (-)***	Probable	Sure	Reversible
No-go alternative	No mit	Regional	Low	Long term	***Medium (-)***	Probable	Sure	Irreversible
	Mit	Regional	Low	Long term	***Medium (-)***	Probable	Sure	Irreversible
CONSTRUCTION PHASE								
Impacts on Botany, fauna	No mit	Local	Medium	Medium term	***Medium (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Medium term	***Very Low (-)***	Probable	Sure	Reversible
Impacts on Avifauna	No mit	Local	Medium	Medium term	***Medium (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Medium term	***Low (-)***	Probable	Sure	Reversible
Sedimentation and erosion	No mit	Local	Medium	Short term	***Low (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Short term	***Very Low (-)***	Probable	Sure	Reversible
Impact on heritage resources: Archaeology	No mit	Local	Low	Long term	***Low (-)***	Definite	Low	Irreversible
	Mit	Local	Low	Long term	***Low (-)***	Probable	Sure	Irreversible
Palaeontology	No mit	Local	High	Long term	***High (-)***	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	***Low (-)***	Unlikely	Sure	Reversible
Cultural Heritage	No mit	Local	Low	Long term	***Low (-)***	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	***Low (-)***	Unlikely	Sure	Reversible
Visual aesthetics	No mit	Local	Medium	Short term	***Low (-)***	Probable	Sure	Reversible
	Mit	Local	Medium	Short term	***Low (-)***	Probable	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
Impact on transport	No mit	Regional	Medium	Short term	***Low (-)***	Probable	Sure	Reversible

Potential impact	No mit/Mit[4]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[5]	Reversibility
	Mit	Regional	Medium	Short term	***Low (-)***	Probable	Sure	Reversible
Noise pollution	No mit	Local	Low	Short term	***Very Low (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Short term	***Very Low (-)***	Probable	Sure	Reversible
Storage of hazardous substances on site	No mit	Local	High	Short term	***Low (-)***	Probable	Sure	Irreversible
	Mit	Local	High	Short term	***Low (-)***	Unlikely	Sure	Irreversible
Impact of dust	No mit	Local	Medium	Short term	***Low (-)***	Probable	Sure	Reversible
	Mit	Local	Low	Short term	***Very Low (-)***	Probable	Sure	Reversible

Annexure A