EVALUATION OF POTENTIAL IMPACTS ON THE ECOLOGICAL ENVIRONMENT OF THE PROPOSED NEW ESKOM POWERLINE FROM GARONA TO ARIES, NORTHERN CAPE

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IMPACT EVALUATION

Evaluation of impact of proposed development

The objective of this part of the report was to evaluate the impacts of the proposed development of the powerline. Potential impacts are evaluated for each route alternative according to *magnitude, extent, duration* and *probability* and, based on the above, the rated significance of the impacts is given (rated "Low", "Medium" or "High"). These criteria are drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act No. 73 of 1989 and are defined as follows:

- Nature

  The nature of the impact is whether it is a negative (destructive) or positive (beneficial) impact.

- Extent of the impact

  A description of whether the impact will be: (1) local extending only as far as the development site area; or (2) limited to the site and its immediate surroundings; or (3) will have an impact on the region, or (4) will have an impact on a national scale or (5) across international borders. The criterion is scored according to the number in brackets.

- Duration of the impact

  The impact is evaluated in terms of whether the lifespan of the impact would be (1) very short term (0-1), (2) short term (2-5 years), (3) medium term (5-15 years), (4) long term (16-30 years) or (5) permanent.

- Magnitude

  The magnitude of the impacts is quantified on a scale from 0-10, where 0 is small and will have little effect (e.g. firecracker.exploding), and 10 is very large and results in complete destruction (e.g. atomic bomb exploding).

- Probability of occurrence

  The probability of the impact actually occurring is estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (low likelihood), 3 is probable

(distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

The significance is calculated by combining the criteria in an additive formula multifplied by the probability: (magnitude+duration+extent) x probability. A significance of <30 is considered to be low, 30–60 as medium, and >60 as high.

Each route is evaluated with respect to all identified impacts to facilitate a comparison between alternatives. A summary of the evaluation of each route is provided in table format at the end.

IMPACTS OF DIFFERENT PROPOSED ROUTE ALTERNATIVES

Common (central section)

This is all those parts of the route that are common to all alternatives, i.e. it is the only route option presented for these sections. These sections cover approximately 58.5 km's of habitat classified as having Low ecological sensitivity, 19.2 km's with Medium sensitivity and 1.1 km's with High sensitivity. The High sensitivity section is the crossing of the Orange River valley. This is planned to cross at the railway bridge, thus confining cumulative impacts of multiple infrastructure. The powerline is forced to cross the river at some point and this is point is preferable to a position that is currently not affected by infrastructure. The areas classified as having medium sensitivity under this route are mostly those classified as Gordonia Dunes. Other vegetation types crossed by this route are Bushmanland Arid Grassland, Bushmanland Basin Shrubland, Lower Gariep Alluvial Vegetation and Kalahari Karroid Shrubland. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low

	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid known populations of species of special concern when planning the powerline route						

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment						

	• Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route • Use water sprayers to reduce dust emmissions off road surfaces

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 14, low. With the proposed mitigation the probability of the impact drops to 1 and the potential magnitude to 3 resulting in the impact being rated 7, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	3	2	14 Low
	Yes	Negative	3	1	3	1	7 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew						

	• Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. Due to the small area of sensitive vegetation/habitat covered by this portion of the route, the magnitude is rated 3 and the probability is moderate to low and rated 2. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Loss of portions of sensitive habitats	No	Negative	2	5	3	3	30 Medium
	Yes	Negative	1	5	3	1	9 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 4. The impact will last permanently and is rated 5. The magnitude is low due to the diffuse nature of a powerline in its affect on the ground and the small area potentially affected and is rated 3 and the probability is moderate to low and rated 2. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 39, medium. With the proposed mitigation the probability of the impact drops to 1 resulting in the impact being rated 13, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Fragmentation of sensitive habitats	No	Negative	4	5	3	2	24 Low
	Yes	Negative	4	5	3	1	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance

Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low
Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment • Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas						

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disturbance to sensitive ecosystems	No	Negative	2	5	7	3	42 Medium
	Yes	Negative	2	5	5	2	24 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is

negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on populations of endemic and red data species	No	Negative	3	5	5	2	26 Low
	Yes	Negative	3	5	5	1	13 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

Option 1A

This is the north-eastern alternative that passes around the northern side of Neus se Berg. This section covers approximately 32.9 km's of habitat classified as having Low ecological sensitivity, 10.5 km's with Medium sensitivity and 1.2 km's with High sensitivity. The High sensitivity section is the crossing of the low mountain range. The vegetation along these ridges is classified as Lower Gariep Broken Veld, which from a natural vegetation perspective is considered to have a HIGH sensitivity to disturbance by the proposed development for the following reasons:

1. there is a chance that this vegetation unit would support populations of threatened plant or animal species, including *Aloe dichotoma* subsp. *dichotoma*, the Black Spitting Cobra and the Beaked Blind Snake, as well as the sensitive plant species, *Hoodia gordonii*.
2. two endemic plant species are found in this vegetation type;
3. the vegetation contains endemics belonging to the Griqualand West or Gariep Centres of Endemism (van Wyk & Smith 2001), namely.*Digitaria polyphylla* and *Crassula corallina* subsp. *macrorrhiza*
4. the vegetation structure is medium and sparse and therefore could be affected by overhead powerlines.

The areas classified as having medium sensitivity under this route are mostly those classified as Gordonia Dunes, but in areas unaffected by existing infrasturcture. This alternative would therefore potentially result in new fragmentation of these areas. Other vegetation types crossed by this route are Bushmanland Arid Grassland, Bushmanland Vloere and Lower Gariep Broken Veld. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as

many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid known populations of species of special concern when planning the powerline route						

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route • Use water sprayers to reduce dust emmissions off road surfaces						

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 24, low. With the proposed mitigation the probability of the impact drops to 2 and the potential magnitude to 3 resulting in the impact being rated 14, low.

Issue	Corrective	Nature	Extent	Duration	Magnitude	Probability	Significance

	measures						
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	4	3	24 Low
	Yes	Negative	3	1	3	2	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew • Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur						

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. The magnitude is potentially high (locally) and rated 8 and the probability is moderate and rated 3. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. This proposed route crosses a ridge defined as being sensitive and it is not possible to mitigate impacts to this ridge without changing the route alignment. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**

Loss of portions of sensitive habitats	No	Negative	2	5	8	4	60 High
	Yes	Negative	1	5	8	3	42 Medium
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 4. The impact will last permanently and is rated 5. The magnitude is moderate due to the diffuse nature of a powerline in its affect on the ground and rated 5 and the probability is high and rated 4. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 52, medium. With the proposed mitigation the probability of the impact drops to 2 resulting in the impact being rated 26, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Fragmentation of sensitive habitats	No	Negative	3	5	5	4	52 Medium
	Yes	Negative	3	5	5	2	26 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited

amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low
Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment • Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas						

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Disturbance to sensitive ecosystems	No	Negative	2	5	7	3	42 Medium
	Yes	Negative	2	5	5	2	24 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on populations of endemic and red data species	No	Negative	3	5	7	3	45 Medium
	Yes	Negative	3	5	5	1	13 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is

moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

Option 1B

This is the north-eastern alternative that passes around the southern side of Neus se Berg. This section covers approximately 31.1 km's of habitat classified as having Low ecological sensitivity, 16.3 km's with Medium sensitivity and 0.4 km's with High sensitivity. The High sensitivity section is the crossing of the low mountain range, as discussed for option 1A, but the crossing is positioned through a pass where there is already an existing road and railway line. The areas classified as having medium sensitivity under this route are mostly those classified as Gordonia Dunes, but in areas where there is already an existing road network. Other vegetation types crossed by this route are Bushmanland Arid Grassland, Bushmanland Vloere and Lower Gariep Broken Veld. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the						

	powerline route • Avoid known populations of species of special concern when planning the powerline route

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route						

	• Use water sprayers to reduce dust emmissions off road surfaces

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 24, low. With the proposed mitigation the probability of the impact drops to 2 and the potential magnitude to 3 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	4	3	24 Low
	Yes	Negative	3	1	3	2	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew • Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur						

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. The magnitude is moderate (locally) and rated 4 and the probability is moderate to low and rated 2. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. The significance of the impact is rated 22, low. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Loss of portions of sensitive habitats	No	Negative	2	5	4	2	22 Medium
	Yes	Negative	1	5	4	1	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 4. The impact will last permanently and is rated 5. The magnitude is low due to the diffuse nature of a powerline in its affect on the ground and rated 3 and the probability is low and rated 2. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 22, low. With the proposed mitigation the probability of the impact drops to 1 resulting in the impact being rated 11, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Fragmentation of sensitive habitats	No	Negative	3	5	3	2	22 Medium
	Yes	Negative	3	5	3	1	11 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low

Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment • Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disturbance to sensitive ecosystems	No	Negative	2	5	5	2	24 Low
	Yes	Negative	2	5	4	1	22 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause

consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on populations of endemic and red data species	No	Negative	3	5	4	2	24 Medium
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

Option 2A

This is the souh-western alternative that passes slightly northwards around the western side of Kenhardt. This section covers approximately 34.9 km's of habitat classified as having Low ecological sensitivity, 0.1 km's with Medium sensitivity and 0.0 km's with High sensitivity. The area classified as having medium sensitivity under this route is a small piece of Gordonia Dunes that will be affected by the Common portion of the route irrespective of whether alternative 2A or 2B is selected. The main vegetation type crossed by this route is Bushmanland Arid Grassland. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route						

	• Avoid known populations of species of special concern when planning the powerline route

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route • Use water sprayers to reduce dust emmissions off road surfaces						

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 14, low. With the proposed mitigation the probability of the impact drops to 1 and the potential magnitude to 3 resulting in the impact being rated 7, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	3	2	14 Low
	Yes	Negative	3	1	3	1	7 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew • Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur						

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. The magnitude is low (locally) and rated 3 and the probability is low and rated 2. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 9, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Loss of portions of sensitive habitats	No	Negative	2	5	3	2	20 Low
	Yes	Negative	1	5	3	1	9 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 3. The impact will last permanently and is rated 5. The magnitude is low due to the diffuse nature of a powerline in its affect on the ground and rated 2 and the probability is moderate to low and rated 2. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 1 resulting in the impact being rated 10, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Fragmentation of sensitive habitats	No	Negative	3	5	2	2	20 Low
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low

Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment • Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disturbance to sensitive ecosystems	No	Negative	2	5	4	2	22 Low
	Yes	Negative	2	5	3	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause

consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on populations of endemic and red data species	No	Negative	3	5	3	2	22 Medium
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

Option 2B

This is the souh-western alternative that passes slightly southwards around the western side of Kenhardt. This section covers approximately 29.2 km's of habitat classified as having Low ecological sensitivity, 0.1 km's with Medium sensitivity and 0.4 km's with High sensitivity. The High sensitivity section is the crossing of a low ridge west of Kenhardt, but the crossing is positioned through a pass where there is already an existing road and railway line. The area classified as having medium sensitivity under this route is a small piece of Gordonia Dunes that will be affected by the Common portion of the route irrespective of whether alternative 2A or 2B is selected. Other vegetation types crossed by this route are Lower Gariep Broken Veld. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the						

	powerline route • Avoid known populations of species of special concern when planning the powerline route

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route						

	• Use water sprayers to reduce dust emmissions off road surfaces

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 24, low. With the proposed mitigation the probability of the impact drops to 2 and the potential magnitude to 3 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	4	3	24 Low
	Yes	Negative	3	1	3	2	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew • Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur						

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. The magnitude is potentially high (locally) and rated 8 and the probability is moderate and rated 3. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Loss of portions of sensitive habitats	No	Negative	2	5	4	3	33 Medium
	Yes	Negative	1	5	4	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 4. The impact will last permanently and is rated 5. The magnitude is moderate due to the diffuse nature of a powerline in its affect on the ground and rated 5 and the

probability is moderate and rated 3. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 39, medium. With the proposed mitigation the probability of the impact drops to 1 resulting in the impact being rated 13, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Fragmentation of sensitive habitats	No	Negative	3	5	2	2	20 Low
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low
Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment						

	• Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disturbance to sensitive ecosystems	No	Negative	2	5	5	2	24 Low
	Yes	Negative	2	5	3	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be

identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Impacts on populations of endemic and red data species	No	Negative	3	5	3	2	22 Low
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance

Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

Option 2C

This is the most southerly of the south-western alternatives and passes slightly southwards around the western side of Kenhardt. This section covers approximately 36.4 km's of habitat classified as having Low ecological sensitivity, 7.0 km's with Medium sensitivity and 0.5 km's with High sensitivity. The High sensitivity section is the crossing of a low ridge west of Kenhardt. The area classified as having medium sensitivity under this route is a small piece of Bushmanland Basin Shrubland. Vegetation types crossed by this route are Bushmanland Arid Grassland, Bushmanland Basin Shrubland and a small amount of Lower Gariep Broken Veld. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route						

	• Avoid known populations of species of special concern when planning the powerline route

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route • Use water sprayers to reduce dust emmissions off road surfaces						

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 24, low. With the proposed mitigation the probability of the impact drops to 2 and the potential magnitude to 3 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	4	3	24 Low
	Yes	Negative	3	1	3	2	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew • Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur						

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. The magnitude is potentially high (locally) and rated 8 and the probability is moderate and rated 3. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Loss of portions of sensitive habitats	No	Negative	2	5	4	3	33 Medium
	Yes	Negative	1	5	4	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 4. The impact will last permanently and is rated 5. The magnitude is moderate due to the diffuse nature of a powerline in its affect on the ground and rated 5 and the probability is moderate and rated 3. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 39, medium. With the proposed mitigation the probability of the impact drops to 1 resulting in the impact being rated 13, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Fragmentation of sensitive habitats	No	Negative	3	5	2	2	20 Medium
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low

Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment • Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disturbance to sensitive ecosystems	No	Negative	2	5	3	2	20 Low
	Yes	Negative	2	5	2	1	9 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause

consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on populations of endemic and red data species	No	Negative	3	5	3	2	22 Low
	Yes	Negative	3	5	2	1	10 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

Short Route Option

This is an option that follows relatively closely the shortest route between the two end-points. This section covers approximately 116.8 km's of habitat classified as having Low ecological sensitivity, 26.6 km's with Medium sensitivity and 2.1 km's with High sensitivity. The High sensitivity sections are the crossing of the low mountain range around the northern side of Neus se Berg, the Orange River valley and a low ridge just west of Kenhardt. Other vegetation types crossed by this route are Bushmanland Arid Grassland, Bushmanland Basin Shrubland, Lower Gariep Alluvial Vegetation and Kalahari Karroid Shrubland. Potential impacts include the following:

Increased noise pollution during construction

Increased noise pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction. This may have an impact on animals in the immediate vicinity by frightening them away from the area and may be serious if these are territorial animals that are displaced due to this activity. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is difficult, but activities can be restricted to habitats that are not important for sensitive species thus reducing potentially harmful effects. It is unlikely to have a long-term negative impact on the threatened status of any organisms as many animals will move away temporarily until the noise abates. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 resulting in the impact being rated 15, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased noise pollution during construction will cause some territorial animals to be displaced	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	2	3	15 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route						

	• Avoid known populations of species of special concern when planning the powerline route

Increased dust during construction

Increased dust pollution may occur during construction due to the use of heavy machinery, transport, etc. during construction, especially hile driving along gravelm service roads. This may have an impact on animals populations and vegetqation in the immediate vicinity by causing an increase in dust particles in the air that could cause respiratory problems in animals or dust deposition on leaves of plants. For vegetation, serious dust pollution can cause plant mortality in the affected areas.The impact will only occur for the duration of constructiona and will be restricted to the site of current construction and transport activities. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings and is rated 2. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is low and rated 2 and the probability is high and rated 4. Mitigation is possible by avoiding areas defined as being sensitive and also by implementing measures o reduce dust pollution, e.g. by spraying water onto roadways that are used very often. It is unlikely to have a long-term negative impact on the threatened status of any organisms, unless it directly affects populations of threatened species, as many animals will move away temporarily until the impact abates. Vegetation may recover following rainfall. The significance of the impact is rated 20, low. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 3 resulting in the impact being rated 12, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	Negative	2	1	2	4	20 Low
	Yes	Negative	2	1	1	3	12 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning powerline route • Use water sprayers to reduce dust emmissions off road surfaces						

Increased risk of veld fires

There may be increased incidence of veld fires in areas surrounding camp and construction sites of the construction crew. This may have an impact on animals and vegetation in the immediate vicinity by causing immediate loss of habitat. Where the vegetation consists of sparse dwarf shrubs, it may not burn very easily, but any vegetation that is primarily composed of taller woody shrubs, the probability of destructive effects from fire are more likely. This may be serious if these are territorial animals that are displaced due to this activity or if populations of threatened, sensitive or protected plants are affected. The impact will only occur for the duration of constructiona and will be restricted to the site of current construction activities, but may spread further depending on the characteristics of the vegetation. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place, although it could spread more extensively and is rated 3. The impact will occur during construction and is therefore short-lived and rated 1. The magnitude is potentially high and rated 4 and the probability is moderate and rated 3. Mitigation is possible by raising awareness, by ensuring effective fire control in construction camps and by ensuring that an emergency fire-reaction system is in place to deal with possible veld fires. Potentailly harmful effects may also be minimised by avoiding constructing the powerline through sensitive areas. The significance of the impact is rated 24, low. With the proposed mitigation the probability of the impact drops to 2 and the potential magnitude to 3 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	Negative	3	1	4	3	24 Low
	Yes	Negative	3	1	3	2	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Ensure effective fire-control at camp and construction sites of construction crew • Raise awareness of necessity for fire-control • Institute management system to react to veld fires that do occur						

Loss and fragmentation of habitats

The loss and fragmentation of vegetation and habitats could possibly occur at a local scale (site of individual pylons) as well as across the entire route (access roads, construction impacts, etc.). In addition, clearing of vegetation or cutting of woody vegetation to keep it below a maximum height may lead to loss of habitat. Due to the linear nature of the proposed construction of the powerline, this may also lead to fragmentation of habitats. Due to the relatively low stature of most of the vegetation in the study area, cutting of vegetation will probably not be necessary. However, where cutting is necessary, it is usually sensitive habitats that would be affected. The impact will occur for the lifetime of the powerline and beyond. The nature of the impact is negative. Habitat loss and habitat fragmentation are assessed separately.

Loss of habitat will be restricted to the immediate area where the powerline is built, primarily the sites of the pylons and service roads and is rated 2. The impact will last permanently and is rated 5. The magnitude is potentially high (locally) and rated 8 and the probability is moderate and rated 3. Mitigation is difficult, but activities can be restricted to habitats that are not sensitive or important for sensitive species thus reducing potentially harmful effects. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the extent to 1 resulting in the impact being rated 14, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Loss of portions of sensitive habitats	No	Negative	2	5	8	3	45 Medium
	Yes	Negative	1	5	8	1	14 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • Use existing access roads as service and construction roads, where possible • Avoid medium to tall vegetation in planning the powerline route • Assess the planned pylon sites individually for sensitive features						

Fragmentation of habitat will affect areas potentailly far removed from where the powerline is built and is rated 4. The impact will last permanently and is rated 5. The magnitude is moderate due to the diffuse nature of a powerline in its affect on the ground and rated 5 and the probability is moderate and rated 3. The powerline can be routed to avoid sensitive habitats or, where necessary to cross them, to be done in such a way as to avoid fragmenting these habitats excessively thus reducing potentially harmful effects. The significance of the impact is rated 39, medium. With the proposed mitigation the probability of the impact drops to 1 resulting in the impact being rated 13, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Fragmentation of sensitive habitats	No	Negative	3	5	5	3	39 Medium
	Yes	Negative	3	5	5	1	13 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route. • If it is necessary to cross potentially sensitive areas, then attempt to do so in a manner that will cause the least amount of fragmentation. • Use existing access roads as service and construction roads, where possible						

Spread of alien species

The development activities may result in conditions that, in the long-term, favour the spread of alien species. These conditions include any disturbance to natural vegetation or the soil surface. The impact will have a long-term effect. The nature of the impact is negative. It will be restricted to the immediate area where the powerline is located and the immediate surroundings and is rated 2. The impact will have a long-term effect and rated 4. The magnitude is low and rated 3 and the probability is moderate and rated 3. Mitigation is possible by disturbing limited amounts of natural habitat, especially sensitive areas, rehabilitating disturbed areas as soon as possible and avoiding activities that introduce alien plant propagules from other areas, e.g. translocating topsoil. The significance of the impact is rated 27, low. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 2 resulting in the impact being rated 16, low.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Spread of alien species	No	Negative	2	4	3	3	27 Low
	Yes	Negative	2	4	2	2	16 Low

Corrective actions	• Use existing access • Limit disturbance to vegetation, • Avoid sensitive habitats, as defined in the sensitivity assessment • Rehabilitate disturbed areas, • Don't translocate topsoil from one area to another or bring in topsoil from other areas

Disturbance to sensitive ecosystems

Sensitive ecosystems in the study area include rivers, wetlands, seasonally wet areas as well as those vegetation types classified as sensitive. The nature of the impact is negative. It will be restricted to the immediate area where construction takes place (primarily the sites of the pylons) and the immediate surroundings and is rated 2. The impact will be permanent and rated 5. The magnitude is potentially hgih and rated 7 and the probability is moderate and rated 3. Mitigation is possible by avoiding sensitive habitats and habitats that are important for sensitive species. The significance of the impact is rated 42, medium. With the proposed mitigation the probability of the impact drops to 2 and the magnitude to 5 resulting in the impact being rated 24, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Disturbance to sensitive ecosystems	No	Negative	2	5	7	3	42 Medium
	Yes	Negative	2	5	5	2	24 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment, when planning the powerline route • Avoid populations of species of special concern, e.g. *Aloe dichotoma*, when planning the powerline route						

Impacts on populations of endemic and red data species

A number of threatened, endemic, sensitive or protected species have been identified as having the potential to occur along the proposed route of the powerline. The location of plants and animals that fall into these categories has been taken into account when defining sensitive habitats. If these habitats are disturbed or destroyed it may have serious negative consequences for populations of these species. The nature of the impact is negative. It will be restricted to the immediate area where construction is taking place and the immediate surroundings, but could cause

consequnces on a more regional scale and is rated 3. The impact will be permanent and is rated 5. The magnitude is moderate to high and rated 7 and the probability is moderate and rated 3. This can be mitigated by avoiding sensitive habitats or, where particular populations may be identified in the field, e.g. *Aloe dichotoma*, such populations can be avoided. An exception is birds that are killed by contact with powerlines, but this impact is assessed separately below. The significance of the impact is rated 45, medium. With the proposed mitigation the probability of the impact drops to 1 and the magnitude to 5 resulting in the impact being rated 13, low.

Issue	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**
Impacts on populations of endemic and red data species	No	Negative	3	5	7	3	45 Medium
	Yes	Negative	3	5	5	1	13 Low
Corrective actions	• Avoid sensitive habitats, as defined in the sensitivity assessment • Avoid populations of species of special concern, e.g. *Aloe dichotoma*						

Impacts on the movement and migration of bird and animal species

Overhead powerlines may have a potentially lethal impact on local populations of some bird species. For example, there is a high incidence of fatalities and injuries due to collisions with overhead powerlines and fences for Ludwig's Bustard, the Peregrine Falcon and the Lanner Falcon (Barnes 2000). The nature of the impact is negative and it is likely to have a long-term negative impact on the threatened status of some organisms. It will be restricted to the immediate area where the powerline is built and the immediate surroundings, but affects processes (migration) that operate at a regional, national or even international scale and is rated 5. The impact is permanent and rated 5. The magnitude is moderate to high, depending on the species of concern, and rated 8 and the probability is high and rated 4. Mitigation is difficult. Possible mitigation includes installing devices on the powerline to increase visibility, but research is ongoing to deal with such impacts. The significance of the impact is rated 72, high. With the proposed mitigation the probability of the impact drops to 3 and the magnitude to 5 resulting in the impact being rated 45, medium.

Such impacts are permanent to long-term at the regional scale and have HIGH negative significance.

Issue	Corrective measures	Nature	Extent	Duration	Magnitude	Probability	Significance
Impacts on the movement and migration of bird and animal species	No	Negative	5	5	8	4	72 High
	Yes	Negative	5	5	5	3	45 Medium
Corrective actions	Install devices on powerlines to reduce impacts/collisions and cases of electrocution						

SUMMARY OF IMPACTS FOR DIFFERENT ROUTE ALTERNATIVES

Issue	Corrective measures	Significance						
		Common	1A	1B	2A	2B	2C	Short
Increased noise pollution during construction will cause some territorial animals to be displaced	No	20	20	20	20	20	20	20
	Yes	15	15	15	15	15	15	15
Increased dust pollution during construction may affect animals and vegetation in the vicinity	No	20	20	20	20	20	20	20
	Yes	12	12	12	12	12	12	12
Increased risk of veld fires leading to damage of sensitive habitats or populations of sensitive plant species or vegetation production	No	14	24	24	14	24	24	24
	Yes	7	14	14	7	14	14	14
Loss of portions of sensitive habitats	No	30	60	22	20	33	33	45
	Yes	9	42	14	9	10	10	14
Fragmentation of sensitive habitats	No	24	52	22	20	22	20	39
	Yes	12	26	11	10	10	10	13
Spread of alien species	No	27	27	27	27	27	27	27
	Yes	16	16	16	16	16	16	16
Disturbance to sensitive ecosystems	No	42	42	24	22	24	20	42
	Yes	24	24	22	10	10	9	24
Impacts on populations of endemic and red data species	No	26	45	24	24	22	22	45
	Yes	13	13	10	10	10	10	13
Impacts on the movement and migration of bird and animal species	No	72	72	72	72	72	72	72
	Yes	45	45	45	45	45	45	45
MEAN OF IMPACT SIGNIFICANCE SCORES (sum ÷ 9)	**No**	**30.6**	**40.2**	**28.3**	**26.6**	**29.3**	**28.7**	**37.1**
	Yes	**17**	**23**	**18**	**15**	**16**	**16**	**18**

From an ecological impact perspective route 1A is likely to have more significant impacts than route 1B and route 1B is therefore preferable to route 1A. The reason is primarily due to the fact that route 1A passes through an untransformed area with high sensitivity.

Currently, route 2A is preferable to 2B or 2C primarily due to the fact that a small ridge is avoided, thus reducing potential impacts in sensitive habitats. Routes 2B and 2C have a small section of High sensitivity, but this is impacted by existing infrastructure. Route 2A is longer.

The Short Route Option is not preferred since it contains all the disadvantages of option 1A (the passage north of Neus se Berg) and, from an impact assessment point of view, includes the maximum potentail impacts of any of the individual shorter route alternatives.