PROPOSED RE-ALIGNMENT OF THE KOEBERG – ANKERLIG 132KV POWER LINE:

FAUNA & FLORA SPECIALIST REPORT FOR BASIC ASSESSMENT

PRODUCED FOR SAVANNAH ENVIRONMENTAL

ON BEHALF OF ESKOM DISTRIBUTION

SIMON TODD CONSULTING

Simon.Todd@3foxes.co.za

MARCH 2015

CONTENTS

EXECUTIVE SUMMARY

Eskom proposes to reroute the existing 132kV power line from Koeberg to Ankerlig. The deviation is approximately 6 km in length and the proposed new route would go around the western side of the Ankerlig Power Station and loop into the substation and a number of route alternatives to this end have been proposed. The existing section within the deviation will be decommissioned. Due to the proposed re-alignment of the route, a basic assessment process is required.

The purpose of this study is to detail the ecological characteristics of the site, identify any sensitive features present along the proposed routes and provide an assessment of the likely ecological impacts associated with the development.

The results indicate that the affected section of the Koeberg-Ankerlig line lies within nationally listed ecosystems and areas which are classified as priority Critical Biodiversity Areas within the City of Cape Town Biodiversity network. In addition, a large number of red-data listed plant species are known from the area and the affected vegetation types. As such, the potential for significant negative impacts is relatively high. Of the two Alternatives which are considered to be viable, Alternative 2 which does not cross Dassenberg road is seen to be the preferred Alternative. Alternative 1 is longer and also traverses a greater extent of sensitive habitat and would extend the footprint of the development north of the Dassenberg road is less preferred.

Although, the potential impact of the line is high, the actual impact of the power line can be reduced to a low level through ensuring that the footprint of the power line is kept to a minimum as well as ensuring positive management of the power line servitude after construction. A large proportion of the proposed deviation is heavily invaded by alien *Acacia saligna* which has significantly impacted the biodiversity value of some of these sections. This is especially true of Alternative 2 and somewhat less applicable to Alternative 1. The power line servitude therefore represents an opportunity to improve the quality of habitat in this area through alien clearing and management. However, a positive outcome would only be generated if specific management actions were applied during the operational phase of the power line. In this regard the following conlusions and recommendations are made:

- Alien vegetation clearing should take place on at least an annual basis along the power line corridor. All alien species present should be cleared in the appropriate manner in accordance with the DAFF alien plant control guidelines for the relevant species.
- Vegetation clearing beneath the power line should be target specific and only alien species should be removed on a regular basis. If the indigenous vegetation becomes

too tall and compromises safety, the the tall elements may be specifically trimmed to an acceptable height.

- General or wholesale vegetation clearing or brush cutting of indigenous vegetation should not take place without consultation with a suitably experienced botanical specialist. Under all circumstances it is recommended that 40cm should be used as the target height for vegetation clearing of indigenous vegetation when it is required.
- A formal road should not be constructed under the power lines, a simple track should be sufficient.

Summary assessment table for the two alternatives, before and after mitigation. Alternative 2 is the preferred Alternative.

Impact	**Without Mitigation**		**With Mitigation**	
	Alternative 1	**Alternative 2**	**Alternative 1**	**Alternative 2**
Construction Phase				
Impacts on vegetation and listed or protected plant species would occur due to the construction activities.	Medium (44)	Medium (40)	Low (24)	Low (18)
Direct faunal impacts due to construction activities	Medium (32)	Low (28)	Low (15)	Low (12)
Operational Phase				
Negative ecological impacts associated with power line servitude maintenance activities	Medium (48)	Medium (40)	Low (18)	Low (10)
Cumulative Impacts				
The power line may generate cumulative impact on listed ecosystems and CBAs.	Medium (33)	Medium (30)	Low (21)	Low (14)

1.1 DECLARATION OF CONSULTANTS' INDEPENDENCE

- I Simon Todd, as the appointed independent specialist hereby declare that I:
- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Simon Todd Pr.Sci.Nat 400425/11.
November 2014

1 INTRODUCTION

Eskom proposes to reroute the existing 132kV power line from Koeberg to Ankerlig. The deviation is approximately 6 km in length and the proposed new route would go around the western side of the Ankerlig Power Station and loop into the substation and a number of route alternatives to this end have been proposed. The existing section within the deviation will be decommissioned. Due to the proposed re-alignment of the route, a basic assessment process is required. Savannah Environmental has been appointed by Eskom to facilitate the EIA process and have appointed Simon Todd Consulting to provide ecological input for the Basic Assessment process.

As part of the Basic Assessment process for environmental authorisation of the power line, the purpose of this study is to detail the ecological characteristics of the site, identify any sensitive features present along the proposed routes and provide an assessment of the likely ecological impacts associated with the development. The full scope of study is detailed below.

1.1 SCOPE OF STUDY

The scope of the study includes the following activities

- A description of the environment that may be affected by the activity and the manner in which the environ mint may be affected by the proposed power line.
- A description and evaluation of environmental issues and potential impacts (incl. Using direct, indirect and cumulative impacts) that have been identified
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- An indication of the methodology used in determining the significance of potential environmental impacts
- An assessment of the significance of direct indirect and cumulative impacts in terms of the following criteria :
    - the nature of the impact, which shall include a description of what causes the effect, what will be affected and how it will be affected
    - the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
    - the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5- 15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity) or permanent
    - the probability of the impact, describing the likelihood of the impact actually

occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (Impact will occur regardless of any preventable measures)
    - the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit) severe/beneficial (long-term impact that could be mitigated/long-term benefit) moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight or have no effect
    - the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high
    - the status which will be described as either positive, negative or neutral
    - the degree to which the impact can be reversed
    - the degree to which the impact may cause irreplaceable loss of resources
    - the degree to which the impact can be mitigated
- A description and comparative assessment of all alternatives
- Recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the environmental management programme (EMPr)
- An indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- A description of any assumptions uncertainties and gaps in knowledge
- An environmental impact statement which contains :
    - A summary of the key findings of the environmental impact assessment;
    - An assessment of the positive and negative implications of the proposed activity;
    - A comparative assessment of the positive and negative implications of identified alternatives

1.2 RELEVANT ASPECTS OF THE DEVELOPMENT

Eskom Holdings SOC Limited obtained authorisation for the relocation of the turbine units at Acacia Power Station to Ankerlig Power Station in February 2009. These units provide a dedicated off-site power supply to the Koeberg Power Station in terms of the requirements of the National Nuclear Regulator (NNR). As part of this authorisation, a 132kV power line between Ankerlig Power Station and Koeberg Power Station was authorised. During the detailed planning process, and through discussions with the NNR, it has been determined that the authorised power line route is no longer technically viable as the NNR requires that the power line for the dedicated off-site supply to Koeberg is not crossed by any other power line so as to reduce any risks to this power line's normal operation. As the routing of

the authorised power line between Ankerlig and Koeberg crosses a number of 400kV power lines, Eskom is proposing to reroute a portion (~5km of the 15km route) of this power line in order to avoid these power line crossings. The deviation of the power line will be undertaken on the northern portion of the line in close proximity to the Ankerlig Power Station. The deviated portion of the line will be connected to a new 132kV HV yard within the Ankerlig Power Station boundary. After deviation of the power line, the existing portion of the Dassenberg-Koeberg power line which will no longer be required will be delinked and decommissioned.

The project will include the following:

- The deviation of approximately 5km of the northern section of the existing 132kV Dassenberg-Koeberg power line.
- Developing access roads along the servitude where required for construction and operational purposes.
- Decommissioning of a portion of the Dassenberg-Koeberg power line.

The activities associated with the construction of the power line will include site clearance and construction of access roads to facilitate access to the site (where required, where existing access roads are not present). A servitude of 36m will be required along the length of the power line during operation.

The proposed changes to the Koeberg-Ankerlig line are illustrated below in Figure 1. The following Alternatives are proposed:

- Alternative 1: A power line running north from the substation, crossing the R307 and then turning southwards to link with the existing power line;
- Alternative 2: A power line running north from the substation, parallel to the Ankerlig power station boundary to the south of the R307 road, turning southwards and linking into the existing Koeberg-Ankerlig 132kV power line;
- Alternative 3: A power line running north from the substation, parallel to the Ankerlig power station boundary to the south of the R307 road, and then down the eastern boundary of the Ankerlig Power Station towards Neil Hare road next to the railway line and then following the same route as for Alternative 2.
- Alternative 4: An underground cable at the 400kV transmission lines crossing.

Figure 1. The proposed changes to the Koeberg-Ankerlig line, illustrating the various sections of the line as follows: the decoupling will occur somewhere along the green section of the line, the red section would no longer be required and would be decommissioned and the blue section illustrates the approximate route of the new alignment Alternative 1, with Alternative 2 in pink, Alternative 3 in yellow and Alternative 4, outlined in orange.

In terms of the above options, Alternatives 3 and 4 are not considered to be viable options by Eskom for the following technical reasons:

- Alternative 3 - Due to the stress on the towers it is not possible to have angles of more than 60 degrees at bend points. This alternative will require bends of 90 degrees at the road intersections, which will not be possible. In addition, construction of the power line on the eastern boundary of the Ankerlig power station would limit potential future expansion opportunities for the power station, which is not considered desirable.
- Alternative 4 - underground cabling is not considered feasible due to issues relating to the reliability of the lines and the time taken to repair a fault. The time allowed, by the National Nuclear Regulator (NNR) for the off-site supply to be out of service without Koeberg having to shut down is 3 days per 12 month window. Using cable increases the duration of repair times and would increase the risk of exceeding the 3 day limit which could result in Koeberg being shut down. This option places the nuclear license of Koeberg at risk and is therefore not considered feasible.

Given the above, only the feasible Alternatives will be assessed, that is Alternative 1, Alternative 2 ans the No-Go Alternative.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Information on plant and animal species recorded for Quarter Degree Square (QDS) 3318CB was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.
- The IUCN conservation status (Table 1) of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2013).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Critical Biodiveristy Areas were obtained from the City of Cape Town Biodiversity Network map (2013 version).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- Apart from the literature sources, additional information on reptiles, frogs and mammals were extracted from the SARCA web portal, hosted by the ADU, http://vmus.adu.org.za
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as an assessment of the availability and quality of suitable habitat at the site.

- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 2013.2 (See Figure 2) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

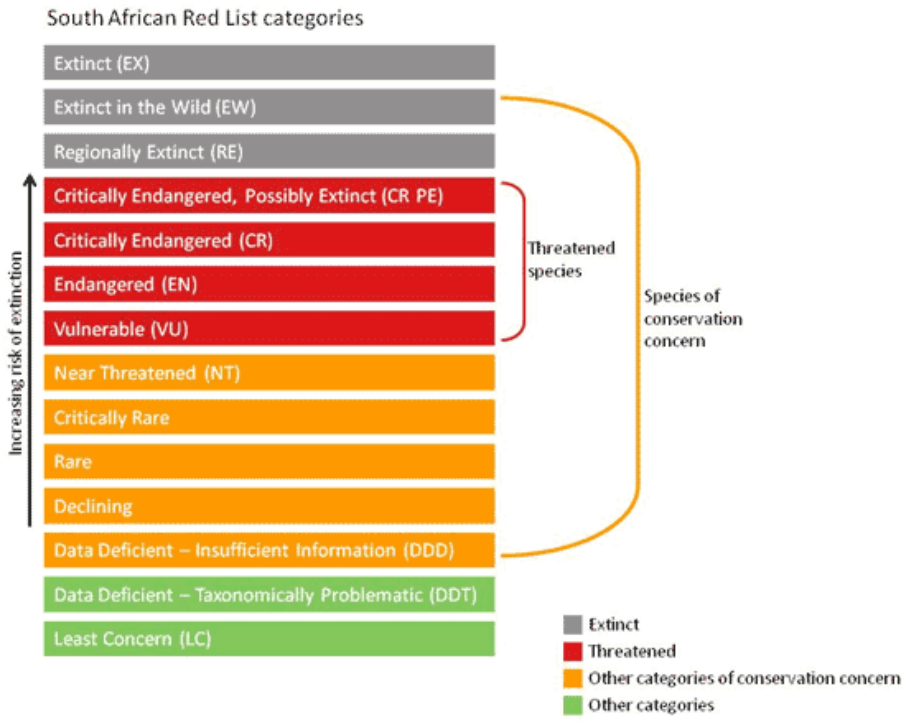

Figure 2. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

2.2 SITE VISIT

The site visit took place on the 9th of April 2014. During the site visit, the proposed re-alignment of the overhead power line was investigated, including a 300m buffer on either side of the power line. Along the power line route, walk through surveys were conducted at representative sites along the route and any habitats or areas of potential concern were also investigated and all species of conservation concern were recorded with a handheld GPS. Specific attention was paid to those parts of the route which had been identified as potentially sensitive. All plant species observed were recorded and a full species list for the investigated sections was developed. All fauna directly or indirectly observed were recorded and where habitats of concern for fauna were observed, these were specifically investigated in the field. The presence of sensitive habitats such as wetlands and unique edaphic environments such as rocky outcrops were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 BROAD-SCALE VEGETATION PATTERNS

The national vegetation map (Mucina & Rutherford 2006) for the study area is depicted below in Figure 2. The entire site falls within the Cape Flats Dune Strandveld vegetation type. This vegetation type has an extent of 138 km^2 and occurs in several discontinuous patches on dune fields of the Western Cape. The largest patch spans the south coast of False Bay and penetrates deep into the Cape Flats as a broad wedge as far north as Bellville, the other patch spans Silverstroomstrand and Table Bay and includes the Atlantis dune plume, the third region is a series of small patches covering coastal dune pockets on the Cape Peninsula, while the last patch is on Robben Island. It is associated with Tertiary to Recent calcareous sand of marine origin and overlying metasediments of the Tygerberg Formation. The dominant land type is HA with Hb and Ga playing subordinate roles. This area experiences winter rainfall of approximately 350mm in the north to 560 mm in the south. Cape Flats Dune Strandveld typically consists of a flat to slightly undulating dune field landscape covered by tall, evergreen, hard-leaved shrubland with abundant grasses and annual herbs in gaps. This vegetation type is listed as Endangered and about 40% has been transformed by agriculture and urban sprawl.

The section of power line where the delinking is proposed to occur, runs along the boundary between Cape Flats Dune Strandveld and Atlantis Sand Fynbos. Atlantis Sand Fynbos which has a total extent of 433 km^2 and occurs from Rondeberg to Blouberg on the West Coast coastal flats; along the Groen River on the eastern side of the Dassenberg-Darling Hills through Riverlands to the area between Atlantis and Kalbaskraal, as well as between Klipheuwel and the Paardeberg with outliers west of the Berg River east and north of Riebeek-Kasteel between Hermon Heuningberg. Atlantis Sand Fynbos is associated with moderately undulating to flat sand plains with dense, moderately tall, ericoid shrubland dotted with emergent, tall sclerophyllous shrubs and an open short restiod stratum. Restioid and proteoid fynbos are dominant, with asteraceous fynbos and patches of ericaceous fynbos in seepages. The presence of Atlantis Sand Fynbos near the affected area is significant because this vegetation type is listed as Critically Endangered and any further fragmentation and loss of this vegetation type is highly undesirable. It is important to note that boundaries between vegetation types are usually ‘fuzzy’ and therefore the boundaries depicted on the map cannot be relied upon to predict vegetation composition at a fine scale as there may be broad transitions between types.

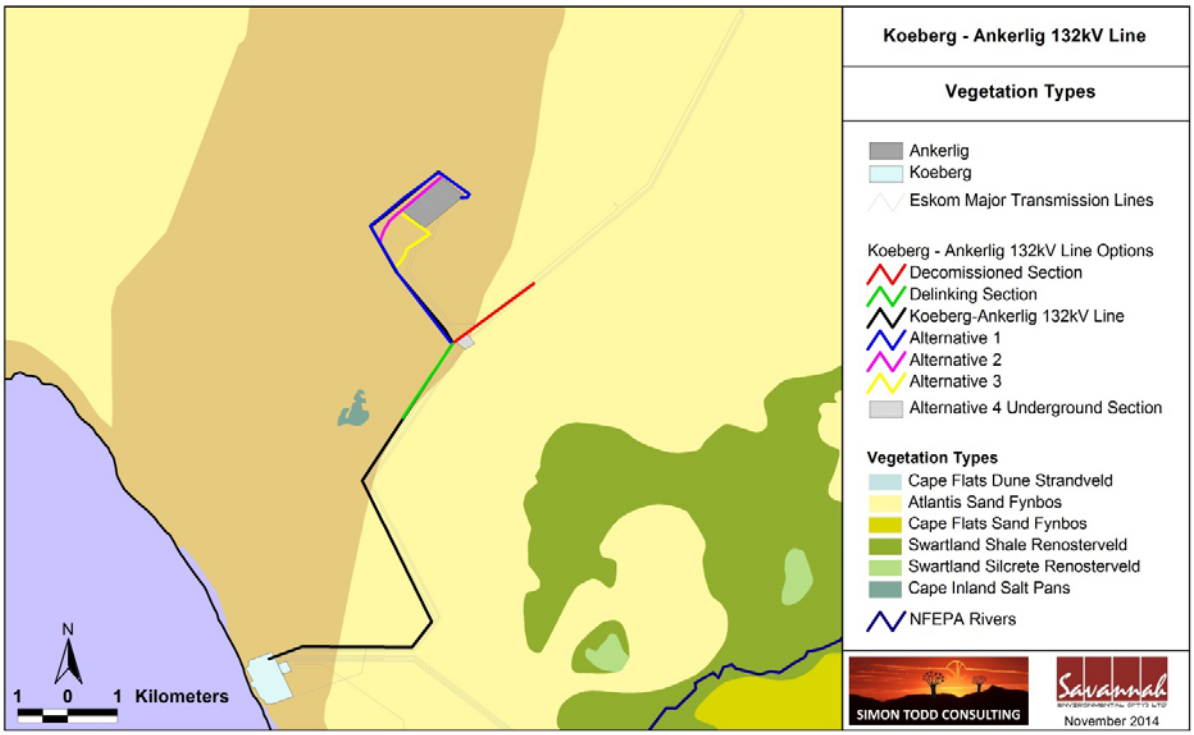

Figure 2. The national vegetation map (Mucina & Rutherford 2006) for the study area.

3.2 LISTED PLANT SPECIES

More than 600 species are known from the quarter degree square which includes the site. Although this is in itself a high number which illustrates the high diversity of the area, the fact that this includes 98 species of high conservation concern is at once more impressive and concerning. Given these results it is highly likely that some listed species occur along the power line route and may be impacted by the development. However, as a large proportion of the route is heavily invaded by alien acacia, this also presents the opportunity to clear these areas an improve the habitat for such species. Generating a positive outcome however depends very heavily on the manner in which the vegetation under the power is managed and inappropriate clearing techniques will definitely not improve the habitat for most species.

Table 1. Summary of listed plant species known from the quarter degree square 3318CB according to the SANBI SIBIS database.

IUCN Status	Count
Critically Endangered	15
Endangered	35
Threatened	1
Vulnerable	47
Near Threatened	20
Declining	4
Least Concern	528
Grand Total	**661**

3.3 ECOSYSTEM STATUS

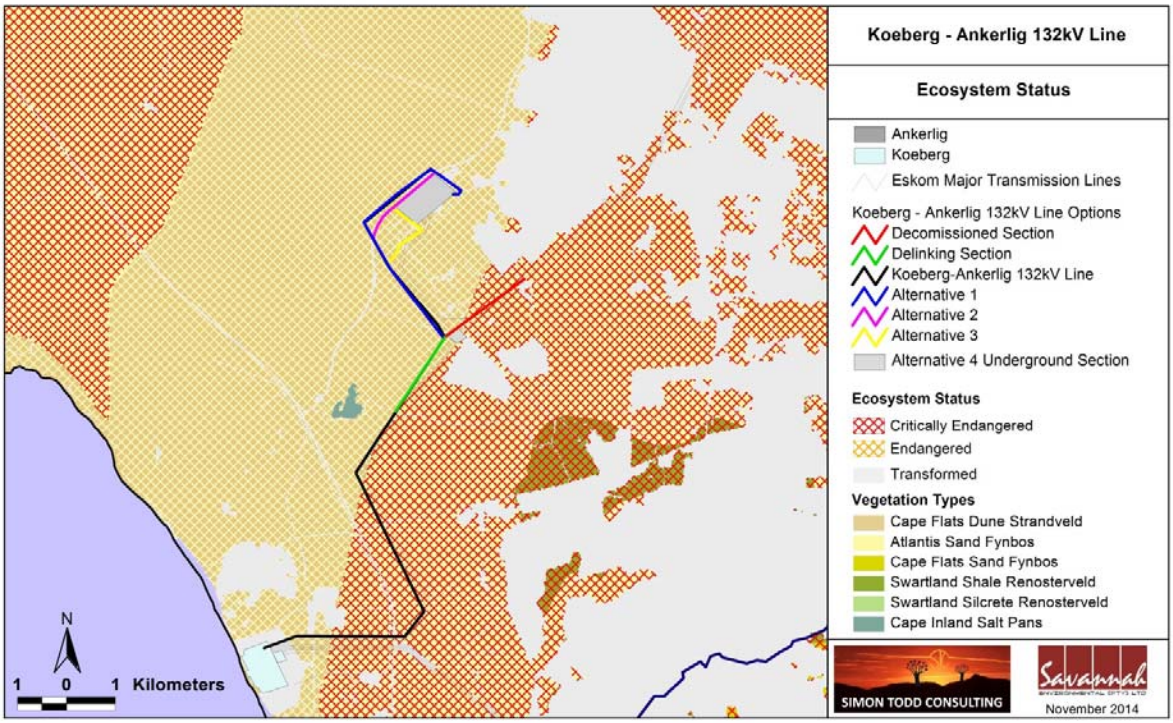

Figure 3. Ecosystem status of the power line route and adjacent areas according to the National List of Threatened Ecosystems (2011).

The power line occurs almost entirely within listed ecosystems (Figure 3), with significant portions of the route within Atlantis Sand Fynbos which is listed as Critically Endangered and within Cape Flats Dune Strandveld which is listed as Endangered. Both vegetation types

have experienced high levels of transformation, with only 43% of Cape Flats Dune Strandveld remaining and 51% of Atlantis Sand Fynbos. Both vegetation types have exceptional levels of diversity and associated species of conservation concern, with 66 red data species known from Cape Flats Dune Strandveld and 84 from Atlantis Sand Fynbos. As the study area includes some of the largest remaining tracts of these vegetation types, further habitat loss leading to additional fragmentation is highly undesirable. Within the study area, the threatened species maps fail to recognise the large amount of woody alien plant invasion that has taken place across large parts of these vegetation types and which has certainly further impacted the biodiversity value of the remaining fragments. Within the study area, the larger power line corridors potentially benefit these vegetation types within area of heavy alien plant invasion as the power line corridors are kept clear of alien plants and if managed appropriately, can promote indigenous plant diversity and maintenance within the corridor.

3.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

The site lies within the planning domain of the Cape Town City Biodiversity Network which was developed by the City of Cape Town and is updated on a regular basis, the current version is dated 2013. The relevant portion of the map is illustrated below in Figure 4. The whole power line route except for the section over the Dassenberg Road lies within various protected areas or category 1 CBAs, indicating that these areas have high conservation value and impact to these areas is undesirable. A mitigating circumstance for the section of power line through the Witzands Nature Reserve is that the affected area is heavily invaded and it is also along the margin of the area in proximity to the other power lines and the urban fringe of Atlantis.

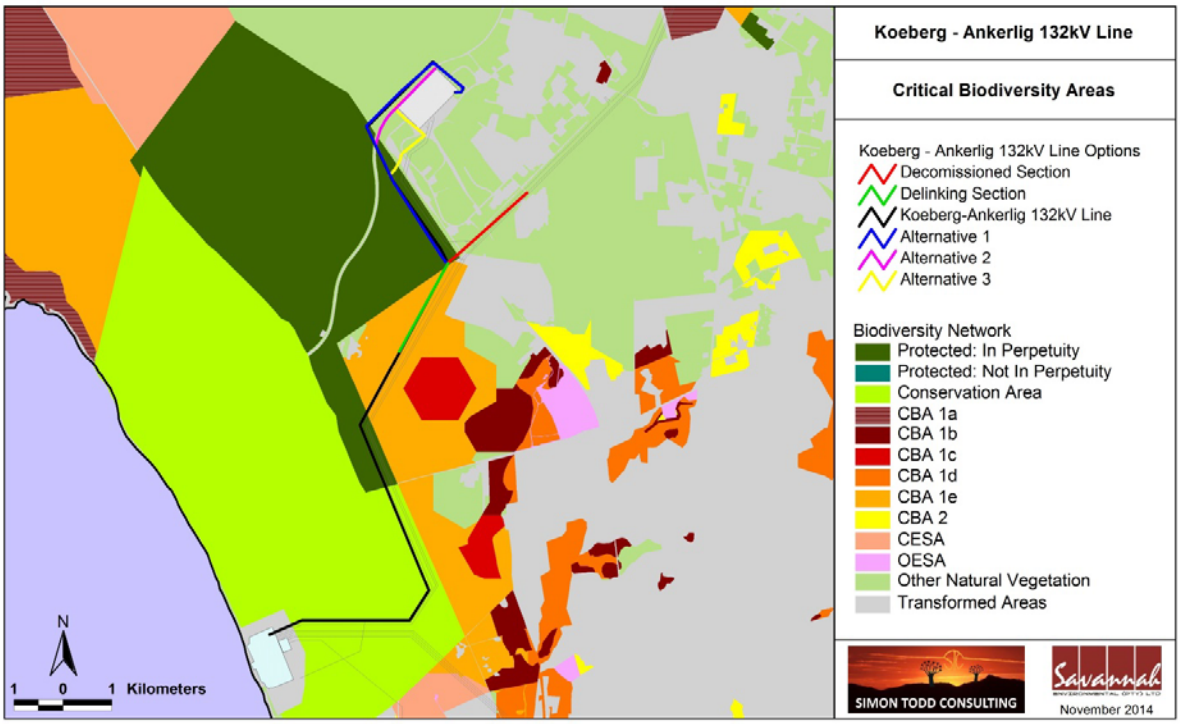

Figure 4. City of Cape Town 2013 Biodiversity Network map for the study area, indicating protected areas and Critical Biodiversity Areas.

3.5 FAUNAL COMMUNITIES

Mammals

The site is likely to have relatively low mammalian species richness. The site falls within or near the edge of the distribution range of 42 terrestrial mammals and nine bats. Species which were observed during the site visits include Steenbok *Raphicerus campestris*, Common Duiker *Sulvicapra grimmia*, Yellow Mongoose *Cynictis penicillata*, Cape Gerbil *Tatera afra*, Striped Mouse *Rhabdomys pumilio*, Karoo Bush Rat *Otomys unisulcatus*, Porcupine *Hystrix africaeaustralis*, Cape Molerat *Georychus capensis* and Cape Hare *Lepus capensis*. Two listed terrestrial mammal species may occur at the site, the Honey Badger *Mellivora capensis* and the White-tailed Mouse *Mystromys albicaudatus* (Endangered). It is likely that the Honey Badger is present in the area, but it is unlikely that the power line would generate significant habitat loss for this wide-ranging species.

Reptiles

Accroding to the SARCA database 31 reptiles have been recorded from the area. This includes three listed species, the Bloubergstrand Dwarf Burrowing Skink *Scelotes*

montispectus, Cape Dwarf Chameleon *Bradypodion pumilum* and Cape Sand Snake *Psammophis leightoni*. It is possible that all three species may occur within the affected area as the habitat is suitable for each of them. The Bloubergstrand Dwarf Burrowing Skink is however only known from near the coast and it has not been recorded so far inland, but given that it is associated with sandy dune vegetation, it is plausible that it occurs at the site as well as little is known about this species that was only described in 2002. In terms of the likely impacts of the development on reptiles, habitat loss is not likely to be highly significant as the power line is not likely to create a large loss of habitat. Although the construction phase will generate some disturbance which may negatively impact reptiles, this would be temporary and in the long-term impacts on reptiles are likely to be low.

Amphibians

The diversity of amphibians within the affected area is likely to be relatively low as there are no wetlands or significant drainage features within the power line route. Species present are likely to be those which are not dependent on water and associated with sandy soils such as the Sand Toad *Vandijkophrynus angusticeps*, Sand Rain Frog *Breviceps rosei* and Cape Sand Frog *Tomopterna delalandii*. Given the low diversity of frogs in the footprint area and the low likely terrestrial footprint of the power line, impacts on amphibians are likely to be low and concentrated in the construction phase.

3.6 POWER LINE ROUTE DESCRIPTION

The different sections of the study area and power line route are illustrated and described below.

The section of line where the delinking is proposed to occur is depicted below in Figure 5. This area lies along the boundary between Cape Flats Dune Strandveld and Atlantis Sand Fynbos. As can be seen from the photograph, the vegetation in this area consists of restiod fynbos dominated by species such as *Willdenowia incurvata*, *Trichocephalus stipularis*, *Eriocephalus africanus*, *Salvia africana-lutea* and *Metalasia muricata*. Although there are some areas that are invaded by *Acacia saligna*, the overall density is relatively low compared to most other areas in the vicinity. This area is considered high sensitivity due to the intact nature of the area and the transitional nature with Atlantis Sand Fynbos. It is recommended that the delinking should occur as near to Ankerlig as possible to ensure that no additional disturbance in this area takes place.

Figure 5. The section of line where the delinking is proposed to occur. This section is along the transition area between Cape Flats Dune Strandveld and Atlantis Sand Fynbos.

The section of the line which runs parallel to the 400kV lines where they deviate towards Ankerlig is illustrated below in Figure 6. Species prevalent in this area include *Putterlickia pyracantha*, *Searsia lucida*, *Searsia laevigata* var. *villosa*, *Willdenowia incurvata*, *Cotyledon orbiculata*, *Zygophyllum flexuosum*, *Ruschia indecora, Asparagus capensis*, *Tetragonia fruticosa*, *Cissampelos capensis*, *Osyris compressa*, *Euphorbia caput-medusae* and *Euphorbia mauritanica*. Although there is some remnant vegetation in this area, it is heavily invaded in many parts and this has reduced the biodiversity value of this area and potentially if the vegetation clearing under the line is conducted in the appropriate manner it could result in an overall net benefit along this section of the line as it would result in the rehabilitation of currently invaded areas below the power line. Alternatives 2 and 3 both run through this area and it considered less sensitive than the area affected by Alternative 1.

Figure 6. The vegetation near to the proposed deviation point towards the Ankerlig power station. Although there is some indigenous vegetation in this area, it is generally heavily invaded by *Acacia saligna*.

The section of the line to the north of Dassenberg Road which would be utilised by Option 1 is illustrated below in Figure 7. This section of line runs over the edge of the Atlantis dune field and is considered moderately sensitive. Some parts of this area are heavily invaded by Acacia saligna, while other parts are still relatively intact. In general vegetation cover is lower than along the other sections of the route which can be ascribed to the loose sandy soils. Common species include *Putterlickia pyracantha*, *Searsia laevigata* var. *villosa*, *Chrysanthemoides incana*, *Ehrharta villosa* var. *villosa*, *Afrolimon peregrinum*, *Brunsvigia orientalis*, *Haemanthus coccineus, Ischyrolepis eleocharis* and *Thamnochortus erectus*. Although the abundance of species of conservation along this section of the route appeared to be low, many of the species of concern are geophytes where were not present at the time of sampling due to the summer sampling event and little can conclusively be said about their presence based on the site visit. Overall, this area is considered more sensitive than the areas affected by Alternatives 2 and 3 and the latter are preferable as they confine the development to the south of the Dassenberg Road.

Figure 7. The section of line over the Dassenberg road where the route loops around the power station before turning into the substation. Left, indicating an area with relatively low alien invasion and right an area with a high density *of Acacia saligna*.

3.7 SITE SENSITIVITY ASSESSMENT

The sensitivity map for the affected sections of the power line is depicted below in Figure 8. The section where the decoupling will take place is considered the most sensitive section and the line should not be deviated from the current alignment in this section as this would generate additional disturbance in this sensitive area. The decoupling should take place as close to Ankerlig as possible. The section on the other side of the Dassenberg Road in the dunes is considered medium to high sensitivity and as a result, Alternative 1 is considered

less favourable to Alternative 2 and 3. Alternative 2 and 3 would confine the development to the Ankerlig side of Dassenberg Road and the affected final section of the power line would be confined to areas that are considered fairly degraded, where the risk of significant ecological impact would be low. As Alternative 3 has sharp corners that are problematic for a power line, this leaves Alternative 2 as the preferred option for the development and Alternative 1 as the less preferred Alternative.

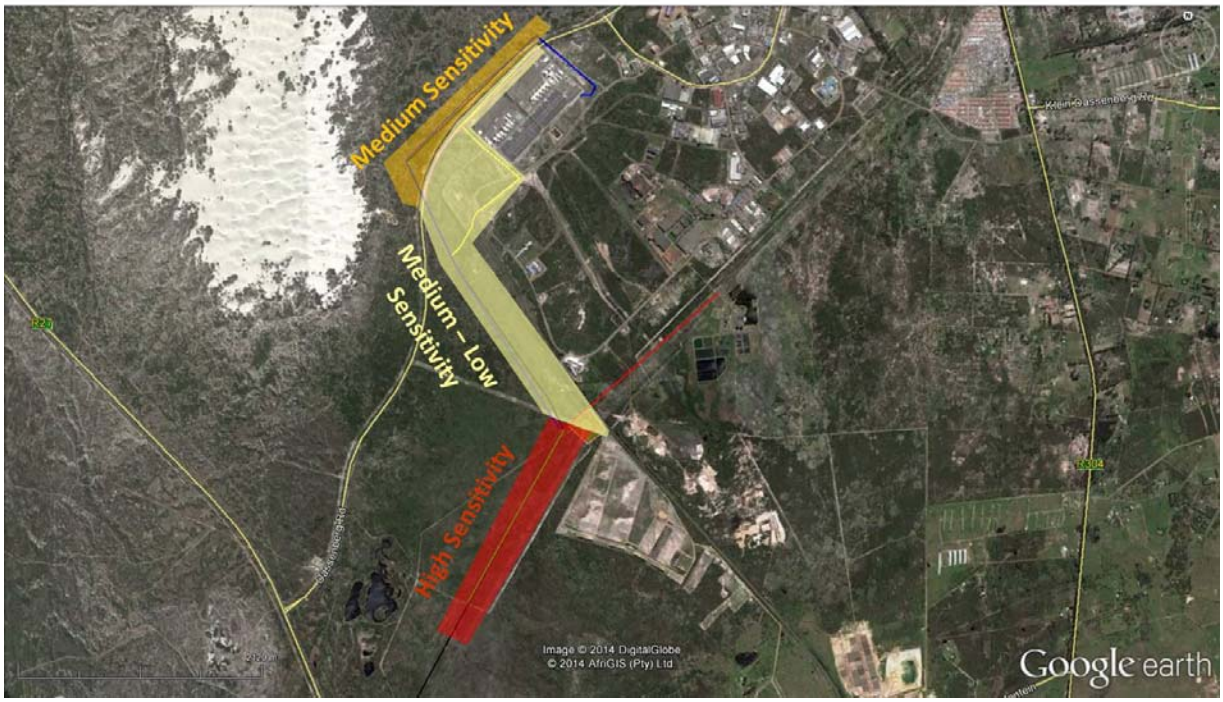

Figure 8. Ecological Sensitivity map for the power line corridor for the affected section of the Koeberg-Ankerlig line.

The major impacts associated with the development would be disturbance during construction and vegetation clearing underneath the power line during construction and operation of the line. There is a lot of variation in the condition of the vegetation underneath Eskom power lines in the area. This is related to the manner in which vegetation underneath the power line has been managed. Areas that have been unselectively mowed to keep the vegetation cover and height under control have become dominated by weedy species and retain low biodiversity and ecological function. In contrast, areas where the indigenous vegetation has not been tampered with and the alien woody vegetation selectively removed show a significant improvement over adjacent uncleared areas. Where such appropriate management allows for indigenous vegetation of at least 1m tall, the power line corridors appear to provide a net positive outcome for indigenous species and a number of listed species have been observed by the consultant in

the power line corridors in the area. It is clear therefore that the mitigation and long-term management for the development should focus on selective alien clearing and allowing the persistence of the indigenous vegetation as much as possible. Since the vegetation along the majority of the route is naturally fairly short, there do not appear to be any major constraints in this regard.

4 IMPACT ASSESSMENT

4.1 ASSESSMENT & SIGNIFICANCE CRITERIA

Direct, indirect and cumulative impacts of the issues identified in this report are assessed in terms of the following criteria:

- The **nature** which includes a description of what causes the effect what will be affected and how it will be affected.

- The **extent** wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high):

- The **duration** wherein it is indicated whether:

    - the lifetime of the impact will be of a very short duration (0- 1 years) - assigned a score of 1.
    - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2.
    - medium-term (5-15 years) - assigned a score of 3
    - long term (> 15 years) - assigned a score of 4; or
    - permanent - assigned a score of 5

- The **magnitude** quantified on a scale from 0-10 where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way 8 is high (processes are altered to the extent that they temporarily cease) and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

- The **probability** of occurrence, which shall describe the (likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5 where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but of 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** which shall be determined through a syntheses of the characteristics described above and can be assessed as low, medium or high;
and;
the status, which will be described as either positive, negative or neutral.
the degree to which the impact can be reversed.
the degree to which the impact may cause irreplaceable loss of resources.
the degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:
S = (E + D + M)P
Where

S = significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The significance weightings for each potential impact are as follows:

- **<30** points : **Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- **30-60** points : **Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- **>60** points : **High** (i.e. where the impact must have an influence on the decision process to develop in the area).

Cumulative Impact

Consideration is given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts are evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium or high impact.

Mitigation

The objective of mitigation is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats and to maximise re-vegetation and rehabilitation of disturbed areas. For each impact identified, appropriate mitigation measures to reduce or otherwise avoid the potential impacts are suggested. All impacts are assessed without mitigation and with the mitigation measures as suggested appropriately implemented.

In order to ensure that impacts are avoided as far as possible and to implement effective mitigation at the site, the following mitigation hierarchy is used to prioritise mitigation actions:

- ***Avoidance***: Avoiding or reducing at source is essentially 'designing' the project so that a feature causing an impact is designed out (eg a waste stream is eliminated) or altered (eg reduced waste volume). Often called minimisation (most preferred)
- ***Reduction***: impact is reduced in magnitude and/or significance
- ***Abate on Site:*** This involves adding something to the basic design to abate the impact - pollution controls fall within this category. Often called 'end-of-pipe'.
- ***Rectification***: impact is mitigated after it has occurred e.g. rehabilitation of areas disturbed by construction
- ***Compensation***: providing a substitute resource for a resource that has been lost because of the project (e.g. "*conservation offsets*")
- ***No action (least preferred)***

4.2 IDENTIFICATION & NATURE OF IMPACTS

The realignment of the Koeberg-Ankerlig 132kV line is likely to result in a number of different impacts on fauna and flora during the construction and operation phase which are summarized below.

Construction Phase

Impacts on vegetation and listed or protected plant species

Some loss of vegetation is an inevitable consequence of the power line construction and some individuals of protected or red-data listed species are also likely to be impacted. Although it may be possible in some instances to translocate affected individuals, this only partially mitigates the impact as not all individuals may survive and some habitat is no longer available for use as a result of transformation or the presence of permanent infrastructure.

Direct and Indirect Faunal impacts

The construction of the overhead power line will result in some habitat loss for resident fauna, while increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna, especially in those parts of the route which are not near currently near to human activity. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species (such as mole rats or blind snakes) would not be able to avoid the construction activities and might be killed. During the operational phase, interactions between

the infrastructure considered here and fauna is likely to be very low and therefore this impact is assessed only for the construction phase.

Operational Phase

Negative ecological impacts associated with power line servitude maintenance activities

Maintenance activities such as vegetation clearing or alien plant control beneath the power line may be detrimental to indigenous flora if conducted in an inappropriate manner. In some areas the vegetation beneath the power lines is mowed or brush cut to less than 30cm tall. This has a large detrimental impact on many species which are not able to resprout and may become lost from the affected area as a result. In addition this kind of disturbance encourages alien species which often come to dominate in these areas. However in the current context, the majority of vegetation is of a low stature and it is only the alien Acacia which is too tall and needs to be cleared. Alien clearing should be target specific and should utilise the recommended approaches as detailed by DAFF for a particular species.

Cumulative Impacts

Although the extent of transformation and habitat loss resulting from the new power line section is likely to be relatively low, this must be considered in light of the high conservation value of the affected area which falls within listed ecosystems as well as priority Critical Biodiversity Areas defined by the City of Cape Town Biodiversity Network. In addition, the actual amount of habitat loss resulting from the development could vary significantly depending on the management of the vegetation beneath the power line which could vary from a positive outcome to a large negative outcome.

4.3 ASSESSMENT OF IMPACTS

The major impacts identified above are assessed below, during the construction and operational phase of the power line as well as before and after mitigation.

4.3.1 Construction Phase

Construction Impact 1: *Impacts on listed vegetation types and plant species of conservation concern*

Impact Nature: Impacts on vegetation and listed or protected plant species would occur due to the

construction activities.				
	Without Mitigation		**With Mitigation**	
	Alternative 1	**Alternative 2**	**Alternative 1**	**Alternative 2**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Medium-term (3)	Medium-term (2)
Magnitude	Medium (6)	Medium (5)	Low (4)	Low (3)
Probability	Highly Probable (4)	Highly Probable (4)	Probable (3)	Probable (3)
Significance	Medium (44)	Medium (40)	Low (24)	Low (18)
Status	Negative	Negative	Negative	Negative
Reversibility	Low	Low	Moderate	High
Irreplaceable loss of resources	No	No	No	No
Can impacts be mitigated?	Yes, to a large extent			
Mitigation	• Vegetation clearing to be kept to a minimum. Blanket vegetation clearing or brush cutting should not take place, the footprint areas for the pylons can be cleared to facilitate construction but the servitude itself should only be cleared of alien species and any individuals of indigenous trees or shrubs that are particularly tall and may pose a hazard. • A formal road should not be constructed under the power lines, a simple track should be sufficient. • The final development area should be surveyed for the presence of listed and protected species and the pylons positions adjusted accordingly if necessary. If such species cannot be avoided, they should be marked and translocated prior to the commencement of construction as part of the search and rescue operation for the development.			
Cumulative Impacts	Cumulative impacts on vegetation are likely to be relatively low given the low expected footprint of the power line.			
Residual Impacts	With appropriate avoidance and mitigation residual impacts will be very low.			

Construction Impact 2. *Faunal Impacts.*

Impact Nature: Construction activities such as the operation of heavy machinery and the presence of construction personnel at the site will result in direct and indirect impacts on terrestrial fauna at the

site.				
	Without Mitigation		**With Mitigation**	
	Alternative 1	**Alternative 2**	**Alternative 1**	**Alternative 2**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Short-term (1)	Short-term (1)
Magnitude	Medium (5)	Medium (4)	Low (3)	Low (2)
Probability	Highly Probable (4)	Highly Probable (4)	Probable (3)	Probable (3)
Significance	Medium (32)	Low (28)	Low (15)	Low (12)
Status	Negative	Negative	Negative	Negative
Reversibility	High	High	High	High
Irreplaceable loss of resources	No	No	No	No
Can impacts be mitigated?	Noise and disturbance during the construction phase cannot be avoided but would be transient in nature and with appropriate mitigation, no long-term impacts from the construction phase can be expected.			
Mitigation	• Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. • Construction staff should undergo an environmental induction at the start of the project to ensure that they are aware of the appropriate response to the presence of fauna at the site and do not kill or harm fauna such as snakes or other reptiles which are often feared. • All hazardous materials used during construction should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.			
Cumulative Impacts	The construction of the infrastructure would contribute to cumulative disturbance and habitat loss for fauna, but the contribution would be very small and is not considered significant.			
Residual Impacts	Residual impacts would be very low.			

4.3.2 Operational Phase

Operational Phase Impact 1: *Negative ecological impacts associated with power line servitude maintenance activities*

Impact Nature: Maintenance activities may negatively affect vegetation if not conducted in the appropriate manner.				
	Without Mitigation		**With Mitigation**	
	Alternative 1	**Alternative 2**	**Alternative 1**	**Alternative 2**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Medium-term (3)	Medium-term (3)
Magnitude	Medium-High (7)	Medium (5)	Low (2)	Low (1)
Probability	Highly Probable (4)	Highly Probable (4)	Probable (3)	Improbable (2)
Significance	Medium (48)	Medium (40)	Low (18)	Low (10)
Status	Negative	Negative	Negative	Negative
Reversibility	Low	Moderate	High	High
Irreplaceable loss of resources	No	No	No	No
Can impacts be mitigated?	Yes.			
Mitigation	• Alien vegetation clearing should take place on at least an annual basis along the power line corridor. All alien species present should be cleared in the appropriate manner in accordance with the DAFF alien plant control guidelines. • Vegetation clearing beneath the power line should be target specific and only alien species should be removed on a regular basis. If the indigenous vegetation becomes too tall and compromises safety, the tall elements may be specifically cut. General vegetation clearing or brush cutting should not take place. • If the average height of the vegetation exceeds the safety standard, then the vegetation can be brush cut but not to a height lower than 40cm and preferably not more often than once every 10 years.			
Cumulative Impacts	Cumulative impacts on vegetation are likely to be relatively low given the low expected footprint of the power line.			
Residual Impacts	With appropriate avoidance and mitigation residual impacts will be very low.			

4.3.3 Cumulative Impacts

Cumulative Impact 1. *Cumulative impact on listed ecosystems and Critical Biodiversity Areas.*

Impact Nature: The power line may generate cumulative impact on listed ecosystems and CBAs.				
	Without Mitigation		**With Mitigation**	
	Alternative 1	**Alternative 2**	**Alternative 1**	**Alternative 2**
Extent	Local (2)	Local (2)	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Moderate (4)	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)	Probable (3)	Improbable (2)
Significance	Medium (33)	Medium (30)	Low (21)	Low (14)
Status	Negative	Negative	Negative	Negative
Reversibility	Low	Low	Moderate	High
Irreplaceable loss of resources	No	No	No	No
Can impacts be mitigated?	Yes			
Mitigation	• Regular targeted alien plant clearing within the power line servitude. • No wholesale vegetation clearing or brush cutting of indigenous species.			
Cumulative Impacts	Given that the affected vegetation types are listed ecosystems any loss of these vegetation types is potentially significant. However as these areas are invaded by aliens which compromises the biodiversity of these areas, alien plant clearing within the power line servitude will improve the habitat and counter the loss from the development footprint.			
Residual Impacts	Residual impacts will be very low.			

5 CONCLUSION & RECOMMENDATIONS

The affected section of the Koeberg-Ankerlig line lies within nationally listed ecosystems and areas which are classified as priority Critical Biodiversity Areas with the City of Cape Town Biodiversity network. In addition, a large number of red-data listed plant species are known from the area and the affected vegetation types. As such, the potential for significant negative impacts is relatively high. However, the actual impact of the power line is likely to be moderated by two factors. Firstly, the footprint of a 132kV line is relatively small and with careful construction, the total extent of habitat lost would be less than 1 ha. In addition, a large proportion of the proposed deviation is heavily invaded by alien *Acacia saligna* which has significantly impacted the biodiversity value of some of these sections. This is especially true of Alternative 2 and somewhat less applicable to Alternative 1. As a result, Alternative 2 is idenitified as the preferred Alternative and it is important that this alternative is selected for construction as this will ensure that the disturbance associated with the power line is maintained on the Ankerlig side of the Dassenberg road, which is seen to significantly reduce the overall impact of the power line and the potential for ecological impact and disruption of ecological processes in the area.

Given the impact of alien woody plants in the area, the power line represents a potential opportunity to improve the ecological value of the power line servitude through alien clearing and favourable management of the servitude. However, a positive outcome is highly contingent on favourable management of the power line servitude and in particular regular alien clearing and positive management in support of indigenous vegetation. With regards to the current assessment the following specific recommendations are made:

- Alien vegetation clearing should take place on at least an annual basis along the power line corridor. All alien species present should be cleared in the appropriate manner in accordance with the DAFF alien plant control guidelines for the relevant species.
- Vegetation clearing beneath the power line should be target specific and only alien species should be removed on a regular basis. If the indigenous vegetation becomes too tall and compromises safety, the tall elements may be specifically trimmed to an acceptable height.
- General or wholesale vegetation clearing or brush cutting of indigenous vegetation should not take place without consultation with a suitably experienced botanical specialist. Under all circumstances it is recommended that 40cm should be used as the target height for vegetation clearing of indigenous vegetation when it is required.
- A formal road should not be constructed under the power lines, a simple track should be sufficient.

6 ACTIVITIES FOR INCLUSION THE DRAFT EMP

Below are the measures that should be implemented as part of the EMP for the development.

Objective: Limit disturbance of vegetation and loss of protected flora during construction		
Project component/s	All infrastructure and activities which result in vegetation loss or clearing such as pylon construction or clearing vegetation within the power line servitude.	
Potential Impact	Loss of habitat within listed ecosystems and loss of individuals of listed and protected plant species.	
Activity/risk source	Construction activities	
Mitigation: Target/Objective	Minimal impact on biodiversity & terrestrial environment. Low impact on protected species	
Mitigation: Action/control	Responsibility	Timeframe
(1) Preconstruction walk-through of power line route and support structure positions and use micro-siting to reduce local impact. (2) Affected individuals of protected species which cannot be avoided should be translocated to a safe area on the site prior to construction. (3) Alien plant clearing where necessary using the appropriate treatment, by hand only and no mechanical clearing of aliens to be used.	Management/ECO	Construction & Operation
Performance Indicator	Vegetation loss restricted to infrastructure footprint. Protected species avoided by flexible infrastructure such as power line. Power line servitude which is free of woody aliens.	
Monitoring	• Vegetation is cleared only within essential areas. • Monitor alien plant abundance along the servitude on an annual basis to inform clearing program.	

Objective: Limit direct and indirect terrestrial faunal impacts during construction			
Project component/s	Construction activities, operational activities and human presence		
Potential Impact	Disturbance of faunal communities due to construction		
Activity/risk source	Habitat transformation during construction; operation of construction machinery and presence of construction personnel. .		
Mitigation: Target/Objective	Low faunal impact, during construction and operation.		
Mitigation: Action/control		Responsibility	Timeframe
(1) Environmental induction for all staff (2) Any fauna encountered during construction should be removed to safety by the ECO or other suitably qualified person, (3) All vehicles to adhere to low speed limits (40km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust.		Management/ECO	Construction & Operation
Performance Indicator	Low number of incidents with fauna during construction No removal of vegetation/plants during construction		
Monitoring	Monitoring for compliance during the construction phase. All incidents to be noted.		

Objective: Low ecological impact of decommissioning			
Project component/s	Decommissioning activities such as removal of existing power line infrastructure		
Potential Impact	Disturbance of vegetation and fauna due to decommissioning		
Activity/risk source	Disturbance of vegetation and fauna due to the operation of construction machinery and presence of construction personnel. .		
Mitigation: Target/Objective	Low ecological impact of decommissioning.		
Mitigation: Action/control		Responsibility	Timeframe
1. Any fauna encountered during decommission should be removed to safety by the ECO or other suitably qualified person, 2. All vehicles to adhere to low speed limits (40km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust. 3. Electrical cables and other power line components should be removed and no parts left lying in the veld.		Management/ECO	Construction & Operation
Performance Indicator	No residual components of the power line remain along the decommissioned section		
Monitoring	Monitoring for compliance during decommissioning. All incidents to be noted.		

Objective: Limit disturbance of vegetation and loss of protected flora during operation			
Project component/s	Power line servitude		
Potential Impact	Loss of habitat within listed ecosystems and loss of individuals of listed and protected plant species.		
Activity/risk source	Maintenance activities such as alien plant clearing or vegetation management along power line servitudes.		
Mitigation: Target/Objective	Servitude which is free of woody aliens and contains indigenous vegetation in good condition.		
Mitigation: Action/control		Responsibility	Timeframe
1. Alien plant clearing where necessary using the appropriate treatment, by hand only and no mechanical clearing of aliens to be used. 2. No wholesale clearing of indigenous vegetation without consulting with a botanical specialist first. 3. Target of 40cm minimum height for cleared vegetation when clearing is required.		Management/ECO	Construction & Operation
Performance Indicator	Servitude free of alien species. No clearing of indigenous species required.		
Monitoring	• Monitor alien plant abundance along the servitude on an annual basis to inform clearing program.		

7 REFERENCES

Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.

Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2013. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Strelitzia 32. SANBI, Pretoria.

Brownlie, S. 2005. Guideline for Involving Biodiversity Specialists in ESIA Processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. 63 pp.

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa.

Desmet, P and Marsh A. 2008. *Namakwa District Biodiversity Sector Plan*. Available from BGIS at http://bgis.sanbi.org/namakwa/project.asp.

De Villiers CC, Driver A, Clark B, Euston-Brown DIW, Day EG, Job N, Helme NA, Holmes PM, Brownlie S and Rebelo AB (2005) *Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape.* Fynbos Forum and Botanical Society of South Africa, Kirstenbosch.

Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.

IUCN 2012. IUCN Red List of Threatened Species. Version 2010.2. <www.iucnredlist.org>. Downloaded on 19 January 2012.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. *Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

8 ANNEX 1. LIST OF PLANTS

IUCN-listed of plant species recorded from the quarter degree 3318DC, which includes the study area. IUCN conservation status is from the South African Red Data List of Plants 2014.

Family	Species	IUCN
ASTERACEAE	*Chrysocoma esterhuyseniae*	CR
FABACEAE	*Amphithalea ericifolia subsp. erecta*	CR
HYACINTHACEAE	*Lachenalia purpureo-caerulea*	CR
IRIDACEAE	*Babiana blanda*	CR
IRIDACEAE	*Geissorhiza eurystigma*	CR
IRIDACEAE	*Geissorhiza purpurascens*	CR
IRIDACEAE	*Gladiolus griseus*	CR
MALVACEAE	*Hermannia procumbens subsp. procumbens*	CR
ORCHIDACEAE	*Corycium microglossum*	CR
PROTEACEAE	*Diastella proteoides*	CR
PROTEACEAE	*Leucadendron levisanus*	CR
PROTEACEAE	*Leucadendron stellare*	CR
PROTEACEAE	*Leucadendron thymifolium*	CR
PROTEACEAE	*Serruria trilopha*	CR
SANTALACEAE	*Thesium litoreum*	CR
ASTERACEAE	*Senecio foeniculoides*	EN
ASTERACEAE	*Steirodiscus speciosus*	EN
ASTERACEAE	*Stoebe gomphrenoides*	EN
ERICACEAE	*Erica ferrea*	EN
FABACEAE	*Argyrolobium velutinum*	EN
FABACEAE	*Aspalathus varians*	EN
FABACEAE	*Xiphotheca reflexa*	EN
GERANIACEAE	*Pelargonium viciifolium*	EN
IRIDACEAE	*Babiana nana subsp. nana*	EN
IRIDACEAE	*Babiana villosula*	EN
IRIDACEAE	*Geissorhiza radians*	EN
IRIDACEAE	*Gladiolus jonquilliodorus*	EN
IRIDACEAE	*Ixia monadelpha*	EN
IRIDACEAE	*Romulea eximia*	EN
MESEMBRYANTHEMACEAE	*Lampranthus amoenus*	EN
MESEMBRYANTHEMACEAE	*Lampranthus explanatus*	EN
MESEMBRYANTHEMACEAE	*Lampranthus immelmaniae*	EN
MESEMBRYANTHEMACEAE	*Lampranthus reptans*	EN
MESEMBRYANTHEMACEAE	*Lampranthus scaber*	EN
MESEMBRYANTHEMACEAE	*Lampranthus stanfordiae*	EN
MESEMBRYANTHEMACEAE	*Ruschia indecora*	EN
MESEMBRYANTHEMACEAE	*Ruschia tecta*	EN
ORCHIDACEAE	*Disa draconis*	EN

POLYGALACEAE	*Muraltia brevicornu*	EN
PROTEACEAE	*Leucadendron lanigerum var. lanigerum*	EN
PROTEACEAE	*Leucospermum heterophyllum*	EN
PROTEACEAE	*Leucospermum parile*	EN
PROTEACEAE	*Serruria fucifolia*	EN
PROTEACEAE	*Serruria linearis*	EN
RHAMNACEAE	*Phylica thunbergiana*	EN
RUTACEAE	*Agathosma corymbosa*	EN
RUTACEAE	*Agathosma latipetala*	EN
RUTACEAE	*Macrostylis cassiopoides subsp. dregeana*	EN
RUTACEAE	*Macrostylis villosa subsp. villosa*	EN
SCROPHULARIACEAE	*Microdon capitatus*	EN
MESEMBRYANTHEMACEAE	*Ruschia intermedia*	Thr*
ASTERACEAE	*Cotula duckittiae*	VU
ASTERACEAE	*Metalasia capitata*	VU
ASTERACEAE	*Steirodiscus tagetes*	VU
BORAGINACEAE	*Lobostemon capitatus*	VU
COLCHICACEAE	*Wurmbea capensis*	VU
ERICACEAE	*Erica trichostigma*	VU
FABACEAE	*Aspalathus albens*	VU
FABACEAE	*Aspalathus angustifolia subsp. robusta*	VU
FABACEAE	*Aspalathus lebeckioides*	VU
FABACEAE	*Aspalathus recurva*	VU
FABACEAE	*Aspalathus ternata*	VU
FABACEAE	*Lotononis villosa*	VU
GERANIACEAE	*Pelargonium suburbanum subsp. suburbanum*	VU
IRIDACEAE	*Babiana tubulosa*	VU
IRIDACEAE	*Geissorhiza tenella*	VU
IRIDACEAE	*Ixia curta*	VU
IRIDACEAE	*Moraea elsiae*	VU
MESEMBRYANTHEMACEAE	*Cheiridopsis rostrata*	VU
MESEMBRYANTHEMACEAE	*Dorotheanthus apetalus*	VU
MESEMBRYANTHEMACEAE	*Drosanthemum hispifolium*	VU
MESEMBRYANTHEMACEAE	*Lampranthus bicolor*	VU
MESEMBRYANTHEMACEAE	*Lampranthus peacockiae*	VU
MESEMBRYANTHEMACEAE	*Lampranthus sociorum*	VU
MESEMBRYANTHEMACEAE	*Lampranthus stenopetalus*	VU
MESEMBRYANTHEMACEAE	*Ruschia geminiflora*	VU
ORCHIDACEAE	*Disa atrorubens*	VU
ORCHIDACEAE	*Satyrium striatum*	VU
POLYGALACEAE	*Muraltia macropetala*	VU
PROTEACEAE	*Leucadendron cinereum*	VU
PROTEACEAE	*Leucadendron coniferum*	VU
PROTEACEAE	*Leucospermum hypophyllocarpodendron subsp.*	VU

	canaliculatum	
	Leucospermum hypophyllocarpodendron subsp.	
PROTEACEAE	*hypophyllocarpodendron*	VU
PROTEACEAE	*Leucospermum rodolentum*	VU
PROTEACEAE	*Leucospermum tomentosum*	VU
PROTEACEAE	*Protea burchellii*	VU
PROTEACEAE	*Protea scolymocephala*	VU
PROTEACEAE	*Serruria decipiens*	VU
PROTEACEAE	*Serruria glomerata*	VU
RESTIONACEAE	*Calopsis impolita*	VU
RHAMNACEAE	*Phylica harveyi*	VU
RHAMNACEAE	*Phylica strigulosa*	VU
RUTACEAE	*Diosma dichotoma*	VU
RUTACEAE	*Macrostylis crassifolia*	VU
SCROPHULARIACEAE	*Manulea corymbosa*	VU
THYMELAEACEAE	*Lachnaea capitata*	VU
THYMELAEACEAE	*Lachnaea grandiflora*	VU
THYMELAEACEAE	*Passerina ericoides*	VU
AMARYLLIDACEAE	*Gethyllis ciliaris subsp. ciliaris*	NT
APIACEAE	*Capnophyllum africanum*	NT
ASTERACEAE	*Helichrysum cochleariforme*	NT
ASTERACEAE	*Helichrysum tricostatum*	NT
ASTERACEAE	*Metalasia adunca*	NT
CRASSULACEAE	*Crassula decumbens var. brachyphylla*	NT
FABACEAE	*Otholobium bolusii*	NT
FABACEAE	*Psoralea repens*	NT
HYACINTHACEAE	*Lachenalia pustulata*	NT
IRIDACEAE	*Babiana angustifolia*	NT
IRIDACEAE	*Ixia maculata var. maculata*	NT
MESEMBRYANTHEMACEAE	*Drosanthemum marinum*	NT
POLYGALACEAE	*Muraltia trinervia*	NT
PROTEACEAE	*Serruria adscendens*	NT
PROTEACEAE	*Serruria fasciflora*	NT
RUTACEAE	*Agathosma microcalyx*	NT
RUTACEAE	*Diosma aspalathoides*	NT
SCROPHULARIACEAE	*Nemesia strumosa*	NT
SCROPHULARIACEAE	*Phyllopodium capillare*	NT
SCROPHULARIACEAE	*Polycarena capensis*	NT
HYACINTHACEAE	*Lachenalia longibracteata*	Declining
IRIDACEAE	*Babiana tubiflora*	Declining
IRIDACEAE	*Ixia dubia*	Declining
RESTIONACEAE	*Thamnochortus punctatus*	Declining

9 ANNEX 2. LIST OF MAMMALS

List of mammals which are likely to occur in the broad vicinity of the study area. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2013.

Genus	Species	Common name	Red list category	No. records
Chrysochloris	*asiatica*	Cape Golden Mole	Data Deficient	101
Georychus	*capensis*	Cape Mole-rat	Least Concern	57
Sylvicapra	*grimmia*	Common Duiker	Least Concern	18
Tatera	*afra*	Cape Gerbil	Least Concern	16
Raphicerus	*melanotis*	Cape Grysbok	Least Concern	14
Raphicerus	*campestris*	Steenbok	Least Concern	13
Mus	*minutoides*	Pygmy Mouse	Least Concern	10
Procavia	*capensis*	Rock Hyrax	Least Concern	8
Caracal	*caracal*	Caracal	Least Concern	7
Otomys	*irroratus*	Vlei Rat	Least Concern	6
Suncus	*varilla*	Lesser Dwarf Shrew	Data Deficient	6
Hystrix	*africaeaustralis*	Porcupine	Least Concern	5
Rattus	*rattus*	Black Rat	Least Concern	5
Dendromus	*mesomelas*	Brant's Climbing Mouse	Least Concern	4
Myomyscus	*verreauxi*	Verreaux's Mouse	Least Concern	4
Rhabdomys	*pumilio*	Striped Mouse	Least Concern	4
Genetta	*genetta*	Small-spotted Genet	Least Concern	4
Genetta	*tigrina*	Large-spotted Genet	Least Concern	4
Bathyergus	*suillus*	Cape Dune Mole-rat	Least Concern	3
Papio	*ursinus*	Chacma Baboon	Least Concern	3
Galerella	*pulverulenta*	Small Grey Mongoose	Least Concern	3
Myosorex	*varius*	Forest Shrew	Data Deficient	3
Herpestes	*ichneumon*	Large Grey Mongoose	Least Concern	1
Atilax	*paludinosus*	Water Mongoose	Least Concern	2
Cynictis	*penicillata*	Yellow Mongoose	Least Concern	2
Lepus	*capensis*	Cape Hare / Desert Hare	Least Concern	2
Acomys	*subspinosus*	Cape Spiny Mouse	Least Concern	2
Dendromus	*melanotis*	Grey Climbing Mouse	Least Concern	2
Mastomys	*coucha*	Multimammate Mouse	Least Concern	2
Otomys	*unisulcatus*	Karoo Bush Rat	Least Concern	2
Steatomys	*krebsii*	Krebs' Fat Mouse	Least Concern	2
Aonyx	*capensis*	Cape Clawless Otter	Least Concern	2
Ictonyx	*striatus*	Striped Polecat	Least Concern	2
Crocidura	*cyanea*	Reddish-grey Musk Shrew	Data Deficient	2
Crocidura	*flavescens*	Greater Musk Shrew	Data Deficient	2
Vulpes	*chama*	Cape Fox	Least Concern	1

10 ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur in the vicinity of the affected section of the Koeberg-Ankerlig line, based on records from the SARCA database, conservation status is from Bates et al. 2013.

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Cordylidae	*Cordylus*	*cordylus*		Cape Girdled Lizard	Least Concern	22
Testudinidae	*Chersina*	*angulata*		Angulate Tortoise	Least Concern	19
Gekkonidae	*Pachydactylus*	*geitje*		Ocellated Gecko	Least Concern	9
Gekkonidae	*Afrogecko*	*porphyreus*		Marbled Leaf-toed Gecko	Least Concern	8
Lacertidae	*Meroles*	*knoxii*		Knox's Desert Lizard	Least Concern	7
Colubridae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern	6
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Least Concern	6
Scincidae	*Scelotes*	*bipes*		Silvery Dwarf Burrowing Skink	Least Concern	6
Scincidae	*Scelotes*	*montispectus*		Bloubergstrand Dwarf Burrowing Skink	Near Threatened	6
Scincidae	*Acontias*	*meleagris*		Cape Legless Skink	Least Concern	4
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern	4
Colubridae	*Dispholidus*	*typus*	*typus*	Boomslang	Least Concern	3
Colubridae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern	3
Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern	3
Scincidae	*Typhlosaurus*	*caecus*		Southern Blind Legless Skink	Least Concern	3
Atractaspididae	*Homoroselaps*	*lacteus*		Spotted Harlequin Snake	Least Concern	2
Chamaeleonidae	*Bradypodion*	*pumilum*		Cape Dwarf Chameleon	Vulnerable	2
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern	2
Colubridae	*Psammophis*	*leightoni*		Cape Sand Snake	Vulnerable	2
Colubridae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Least Concern	2
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern	2
Gekkonidae	*Pachydactylus*	*austeni*		Austen's Gecko	Least Concern	2
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern	2
Scincidae	*Trachylepis*	*homalocephala*		Red-sided Skink	Least Concern	2
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern	1
Chamaeleonidae	*Bradypodion*	*occidentale*		Western Dwarf Chameleon	Least Concern	1
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern	1
Gekkonidae	*Goggia*	*lineata*		Striped Pygmy Gecko	Least Concern	1
Gerrhosauridae	*Tetradactylus*	*tetradactylus*		Cape Long-tailed Seps	Least Concern	1
Lacertidae	*Pedioplanis*	*lineoocellata*	*pulchella*	Common Sand Lizard	Least Concern	1

Leptotyphlopidae	*Leptotyphlops*	*nigricans*	Black Thread Snake	Least Concern	1

11 ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in in the vicinity of the affected section of the Koeberg-Ankerlig line. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from the Minter et al. 2004.

Family	Genus	Species	Common name	Red list category	No. records
Brevicepitidae	*Breviceps*	*namaquensis*	Namaqua Rain Frog	Least Concern	3
Brevicepitidae	*Breviceps*	*rosei*	Sand Rain Frog	Least Concern	4
Bufonidae	*Vandijkophrynus*	*angusticeps*	Sand Toad	Least Concern	10
Pyxicephalidae	*Cacosternum*	*capense*	Cape Caco	Vulnerable	4
Pyxicephalidae	*Strongylopus*	*grayii*	Clicking Stream Frog	Least Concern	5
Pyxicephalidae	*Tomopterna*	*delalandii*	Cape Sand Frog	Least Concern	6