STRATEGIC ENVIRONMENTAL ASSESSMENT FOR EXPANSION OF ELECTRICITY GRID INFRASTRUCTURE IN SOUTH AFRICA

Biodiversity and Ecological Impacts (Terrestrial Ecosystems and Species) - Fynbos Biome

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE EXPANSION OF ELECTRICITY GRID INFRASTRUCTURE IN SOUTH AFRICA

Draft v3 Specialist Assessment Report for Stakeholder Review

FYNBOS BIOME

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ABBREVIATIONS AND ACRONYMS

CBA	Critical Biodiversity Area, numerals 1 and 2 indicate differing conservation importance
CR	Critically Endangered
EGI	Electricity Grid Infrastructure
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area, numerals 1 and 2 indicate differing conservation importance
IAP	Invasive alien plants
IAS	Invasive alien species
LM	Local Municipality
NBA	National Biodiversity Assessment
NPAES	National Protected Area Expansion Strategy
ONA	Other Natural Area
PA	Protected Area
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
VU	Vulnerable
WCBSP	Western Cape Biodiversity Spatial Plan

SUMMARY

A few patches of Fynbos Biome can be found in the proposed Expanded Western Electricity Grid Infrastructure (EGI) corridor.

The Fynbos Biome is globally recognised for its high diversity of plant species with about 7 500 species, 69% of which are endemic and 1 889 are listed as threatened (Raimondo et al., 2009). Many of these threatened species occur in the lowlands which are the logical route for the proposed powerline corridors. On the inland side and in the drier valleys in the western part of the biome the Fynbos adjoins the Succulent Karoo. The western part of the biome experiences winter rainfall. This will affect the timing of vegetation re-establishment. Summers are hot and dry in the west with strong, desiccating, south-easterly winds which create conditions of moisture stress, particularly in the north-western part of the biome.

The hot, dry conditions in summer dry out plant litter and dead fuels, creating high-fire danger conditions in the west. Fynbos requires fires at intervals of 10-30 years to maintain biodiversity and ecosystem functioning but fires in arid Fynbos are rare and may not be essential for regeneration. Many species' seeds may only germinate after fires and many species require fires to flower, produce seed and reproduce. Fires occur in and do regenerate Renosterveld, but it is able to persist for decades without fires, especially in the drier areas such as the inland slopes of the mountains and the Roggeveld escarpment. Strandveld rarely burns but can do so under extreme weather conditions and regeneration apparently is not fire-dependent. Fires under powerlines can be a hazard but management of fuel loads by carrying out fires at ecologically acceptable times of the year and in weather that will minimise the hazard should allow ecologically acceptable fire regimes to be maintained. The Environmental Management Programme should include measures to reduce fire hazards in accordance with the relevant specifications.

All forms of Fynbos are highly susceptible to invasion by alien (introduced) tree species, the arid fynbos in this corridor being invaded mainly by *Acacia cyclops* and *Prosopis* species. Sand-plain Fynbos and Renosterveld are very prone to invasion by alien herbaceous species, particularly grasses but invasions in Strandveld are poorly documented. Invasive species control will be an important part of the construction and operational phases, especially in the restored areas of pylon foundations at substations.

The diversity and endemism of the terrestrial fauna in Fynbos is not particularly high except for certain groups such as amphibians (60 species in the Western Cape, 36 endemic and 15 threatened), reptiles (146 species, 18 threatened), fossorial mammals (moles) and invertebrates (particularly butterflies, dragon flies, long-tongued flies, beetles). There are areas with populations of various species within the corridor that need to be excluded, as far as possible, during the routing phase of the EGI development.

Some of the taller Fynbos shrub species may exceed height requirements for the powerline although this is unlikely in the case of the arid fynbos occurring in this area. Should this be the case then the powerline servitude would have to be kept clear of these plants. The loss of these plant species will change the habitat suitability for fauna that live, feed on, shelter under, or otherwise use or depend on them, so that cleared strips under the powerline may become a barrier to the movement of some terrestrial fauna, notably reptile and invertebrate species. Fire could be used in the vegetation managed and, if it is, the intervals between fires and the seasonal timing need to be ecologically acceptable as noted above.

There is a growing body of research on the restoration of Fynbos, but it is still a developing science. There are a few guidelines and handbooks for restoration which have been noted in the text. Research has shown that removing the upper few centimetres of the topsoil, returning it to the site as soon as possible, and the use of treatments to stimulate seed-germination can facilitate recovery. Most of the research conducted, and experience that has been gained is in the higher rainfall parts of the biome. There is little research or experience in the arid areas, such as the Expanded Western EGI Corridor, to guide rehabilitation. These areas are at the limits of the climatic tolerance of Fynbos species, so there is a high likelihood of failure at the establishment stage, and recovery after disturbance could be slow. Active restoration will be required but, even then, there is a high risk of failure. The uncertainties about the role of fire and the poor understanding of the potential for restoring Fynbos in these areas, compared with the adjacent Succulent

Karoo vegetation, are strong rationales for making every effort to avoid Fynbos in arid areas when selecting the final EGI routes and placement. Disturbance also facilitates invasion, so regular monitoring and control operations will be required as part of the Environmental Management Programmes for the construction and operational phases.

The high diversity of the Fynbos together with a lack of adequate knowledge of most species' responses to the powerline construction and operation makes it very difficult to assess the sensitivity with much confidence, especially the impacts of an extensive linear disturbance and potential habitat alteration. The effectiveness of the proposed mitigation also is difficult to assess for many species, especially those with limited mobility and have narrow distributions and/or specific habitat requirements which confine them to natural or near natural vegetation remnants. Examples would include tortoises, chameleons, small burrowing or slow-moving surface dwelling snakes and potentially many invertebrate species.

Corridor	Overall Suitability	Comment
Expanded Western EGI Corridor	Moderate suitability for power line infrastructure development.	Fynbos occupies very little of the proposed Expanded Western EGI Corridor but the Fynbos that there is, is also characterised by a significant density of High and Very High sensitivity features. These areas typically harbour endemic and threatened plants and fauna. Much of the fynbos is located on the upper slopes and crests of mountain ranges which makes these areas unlikely to be selected for the final routes. However, there are areas of sand fynbos in the coastal areas which are more suitable for powerline routing but these should be avoided if at all possible. The risk of failure of the rehabilitation is high because Fynbos, especially the sand fynbos, is at the climatic limit so plant recruitment is likely to fail, especially for perennial species, unless there is good rainfall.

1 INTRODUCTION

The Department of Environment Affairs (DEA) appointed the Council for Scientific and Industrial Research (CSIR) to undertake a Strategic Environmental Assessment (SEA) for the expansion of Electricity Grid Infrastructure (EGI) within two 100 – 125 km corridors. The CSIR, in turn, appointed Dr David Le Maitre to carry out an assessment of the potential impacts of EGI on the Fynbos biome with the boundaries of the proposed Expanded Western EGI Corridor which extends northwards from about Nuwerus to the Orange River. This is an extension of the original EGI SEA (which was carried out in 2016 by the CSIR on behalf of DEA and Eskom) to include a section linking South Africa and Namibia. The Expanded Eastern EGI Corridor is not included within this assessment, as it does not intersect with the Fynbos Biome.

The purpose of this assessment is to inform decision makers about the potential impacts and facilitate coordination between the authorities responsible for issuing authorisations, permits or consents and so streamlining the environmental authorisation process. The specific Terms of Reference are to provide expert input as a Contributing Author to a Strategic Issue Chapter (specialist assessment report) on the impact on Biodiversity and Ecology (Terrestrial Ecosystems, Flora and Fauna), specifically for the Fynbos Biome. Aquatic ecosystems, including wetlands, were excluded from this assessment because these are covered separately by other specialist studies.

2 SCOPE OF THIS STRATEGIC ISSUE

This study assesses the potential impacts of EGI in the proposed Expanded Western EGI Corridor on the vegetation types and the associated fauna (excluding avifauna) of the Fynbos Biome within the boundary of this corridor. Two boundaries were provided by the South African National Biodiversity Institute (SANBI), the one being the corridor itself and the other the same corridor but with the inland boundary buffered by 25 km.

3 APPROACH AND METHODOLOGY

3.1 Study Methodology

A desktop approach was used to assess terrestrial biodiversity sensitivity for the sections of the Fynbos Biome that are situated within the corridor section. The southern section of the corridor is located in the Western Cape but most of it is located within the Northern Cape Province. The two provinces do not have the same level of detail in their conservation planning although the 2016 plan for the Northern Cape (Holness and Oosthuysen, 2016) has far more detail than previous plans for this Province. The Western Cape has recently completed its own detailed assessment which supersedes and replaces all the previous studies including the national datasets (Pool-Stanvliet et al., 2017). The plan is detailed in a handbook which sets out, among others, the land-uses that can be permitted in areas that fall in the different categories of conservation protection. These differences were reconciled as far as possible.

The datasets provided for this study by SANBI and by the CSIR (as shown in Table 1) were consulted to determine if there were any conservation priorities such as threatened fynbos vegetation types or Critical Biodiversity Areas (CBAs) within the corridor boundaries. These datasets included the most recent conservation planning outputs for the corridor as well as information on the location of specific taxa. However, the data did not distinguish between the different categories of CBAs or Ecological Support Areas (ESAs) and so the original conservation plan datasets for the Northern Cape and for the Matzikama Local Municipality (LM) subset of the Western Cape Biodiversity Spatial Plan (WCBSP) were downloaded from the SANBI Biodiversity GIS (BGIS). The National Protected Areas Expansion Strategy (DEAT, 2008) is currently being updated, with a dataset for 2010 from the BGIS website being the most recent that is available. The 2016 Northern Cape Biodiversity Plan has updated the areas planned for protected area expansion but the WCBSP did not include the expansion of protected areas in the Matzikama dataset so the 2010 data were used for this part of the corridor.

3.2 Data Sources

A list and description of all data sources on which this assessment is based, and from which sensitive features/criteria were extracted is given in Table 1. Forest patches are often embedded in the Fynbos but there are no such patches in this corridor so forest was not included. Primary data sources used in these studies include a variety of organizations and databases as documented in the respective reports, including many of those listed in the table below. All of the plans used in this assessment conform to the standards for bioregional planning of the DEA (DEA, 2009).

The datasets also incorporated the best available information on the locations of threatened flora and fauna (Table 1). The WCBSP included threatened plants, mammals, reptiles, amphibians[1], birds, butterflies, dragon and damselflies, and species with management plans (Pool-Stanvliet et al., 2017). The planning process involved selecting priority areas to focus on and could have excluded some species locations as part of the optimisation process.

The Northern Cape Biodiversity Plan included locations of populations of threatened species of plant, butterfly, and reptiles based on data from SANBI, and the province, as CBA1 minimum (Holness and Oosthuysen, 2016) (Table 1). However, it is important to note that the terrestrial fauna of the Fynbos vegetation types in the Northern Cape have not been well studied and are not as well-known as those in the Western Cape.

In the 2016 Northern Cape Biodiversity Plan, areas supporting high climate change resilience (i.e. climate change adaptation corridors) were included as ESA polygons based on data from the National Biodiversity Assessment (NBA) 2011 (Driver et al., 2011) and sourced from SANBI (Table 1) (Holness and Oosthuysen, 2016). The Table Mountain Fund Climate Adaptation Corridors (Pence, 2009) were included in the ESAs and CBAs in the WCBSP after being edited to exclude all portions falling within the urban edge (Pool-Stanvliet et al., 2017).

The full set of threatened species locations for all the taxa within the corridor was supplied by SANBI to address potential gaps due to the optimisation processes noted above. The species data were point locations and have been buffered with buffer radiuses of different sizes depending on the likely home range of the particular species. The buffering was done in a way that will not allow the exact location to be determined by species collectors. The radius to use for each taxon was determined by discussions among the specialists involved in this SEA (see Section 6). For the fauna a bounding polygon was also created around the outer boundaries of the localities as a way of defining the range. In practice though this leads to overly wide ranges for species with few occurrence records. As such this information has not been shown in this assessment. Plant locations have not been buffered for this assessment because this also results in very extensive areas which are not meaningful.

The threatened species that would be most at risk typically occur within remnants of natural vegetation in the Sandveld and on the Kamiesberg. Whether or not the powerline would have to be routed through such remnants can only be determined at the next level of assessment and not at this strategic level which can simply emphasise: (a) that there are many species, often recorded from more than one locality; and (b) that it is highly likely that there are more, undocumented occurrences, which means that at least all the natural remnants that will be affected must be subject to a thorough impact assessment.

In the case of the large mammals the buffered locations are so large that they appear to occupy the very wide ranges, often collectively spanning most of the corridor. These wide ranges also tend to obscure those of the taxa with smaller ranges. Although the larger mammals will be disturbed during the construction phase, they are highly unlikely to be permanently affected by the powerline and so are not shown in the maps presented in this assessment.

[1] Some amphibian species are independent of water and thus terrestrial but those species are not included in this assessment

Table 1: Summary of the data sources used in this assessment.

Data title	Source and date of publication	Data Description
Protected Areas (PAs)	SANBI (2018) supplied for the SEA from the South African Protected and Conservation Areas Database with permission from DEA	PAs classified according to the Protected Areas Act. Broadly as Formal (i.e. government: national, provincial and local authority, World Heritage Sites, Private Nature Reserves and certain forms of Stewardship) and Informal (e.g. Conservancies, and some forms of Stewardship Sites). This includes Protected Environments, Biosphere unprotected areas which are part of the outer zone of a Biosphere Reserve.
National Protected Areas Expansion Strategy 2010	The 2016 National Protected Areas Expansion Strategy is currently underway. The 2010 data was used as supplied by SANBI for the SEA (based on BGIS data) (SANParks. 2010. National Protected Areas Expansion Strategy: Focus areas for protected area expansion. http://bgis.sanbi.org/).	Areas systematically identified for expansion of the protected areas
Listed Threatened Ecosystems of South Africa	Department of Environmental Affairs (2011). National list of ecosystems that are threatened and in need of protection. Government Gazette No. 34809, Notice No. 1002, 9 December 2011. Supplied by SANBI for the SEA	Gazetted list of threatened ecosystems classified as Critically Endangered, Endangered, or Vulnerable; loss of parts of these ecosystems to development should be avoided or minimised, especially for the first two categories
South African Vegetation Map	Mucina L. & Rutherford, M.C. (eds) (2006). The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. SANBI, Pretoria.	The 2012 version of this map was downloaded from the BGIS and used to identify the specific vegetation types involved
Western Cape Biodiversity Spatial Plan datasets (Matzikama Local Municipality)	Pool-Stanvliet et al. 2017. The Western Cape Biodiversity Spatial Plan Handbook. Stellenbosch: CapeNature	The most recent biodiversity conservation plan available for the Province and includes all the relevant priority biodiversity areas and ecological infrastructure that require protection. The handbook includes definitions of all the categories and the land-use constraints.
2016 Northern Cape Critical Biodiversity Areas	2016 Northern Cape CBAs (Holness and Oosthuysen, 2016) Datasets downloaded from the BGIS.	The most recent biodiversity conservation plan available for the Province; includes Critical Biodiversity Areas and Ecological Support Areas. The Northern Cape CBA Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province.
Critically Endangered, Endangered and Vulnerable taxa	Mammals (Child et al., 2016) Reptiles (Bates et al., 2014) Plants (Raimondo et al., 2009) updated to 2018; butterflies (Henning et al., 2009; Mecenero et al., 2013)	As prepared by SANBI and supplied to the CSIR
Other natural areas	Geoterraimage. 2015. 2013-2014 South African National Land-Cover. Department of Environmental Affairs. Geospatial Data. https://egis.environment.gov.za/	Natural land cover classes were used to identify remnants. Based on the natural land cover classes in the DEA Land Cover 2013/14 for the Northern Cape. A customised land cover classification was developed for the Western Cape for 2017 (Pool-Stanvliet et al., 2017)

3.3 Assumptions and Limitations

This desktop assessment of biodiversity sensitivity is based primarily on the most recent datasets available as supplied by SANBI in January 2018. None of these datasets were refined and/or modified. However, original data from the 2016 WCBSP for Matzikama LM and the 2016 Northern CBAs was added to better understand the features being considered in this study and the reasons for corridor being dominated by CBA1 and CBA2 features. This is a sufficient level of detail for this study, but route selection will require more detailed field work by specialists to ground-truth and verify these assessments as well as consultation with local experts (Table 2).

The scale and thus the spatial resolution of the input data used in these plans varied from points for occurrences of species observations or populations through graded data at different special resolutions (e.g. 30x30 m for land cover) to units mapped at approximately 1:250 000 scale such as vegetation types (Table 2). This heterogeneity is inappropriate for fine-scale analysis and interpretation, such as proposing provisional routes, except in a very general sense. Data at this range of spatial resolutions and accuracies cannot simply be mixed and used to assess routes with a high degree of confidence without field verification. The extent of the corridor that needs to be assessed means that fine-scale features cannot be assessed in detail. This is just a high level screening that identifies where there are concentrations of features and highlights those as areas where route selection will need additional field assessments.

An important assumption in relating qualitative sensitivity classes to the conservation categories (e.g. CBA, ESA) is that their biodiversity value is directly related to their sensitivity to impacts. And that this sensitivity is the same for all such units in all places. While there is a general relationship, a number of factors could influence how specific species or groups of species respond to impacts. For example: the specific features or combination of features that result in a taxon or other biodiversity feature being placed in a particular conservation category – an area may be classified as CBA1 because it contains a threatened ecosystem, or threatened flora or fauna, or is irreplaceable or provides a vital link in a climate change movement corridor, or is a combination of some or all of these things. The short, medium and long-term effect of the construction and operation of a powerline through that area on those different features could be very different, even depending on the species involved. This means that their sensitivities would differ and cannot be reduced to one single sensitivity rating.

This assessment also only focuses on terrestrial ecosystems and their fauna and flora (Table 2), but aquatic systems are embedded in and threaded through the terrestrial ones and these ecosystems have functional interactions that could be disrupted by the changes caused by the powerline (Mouquet et al., 2013; Nakano and Murakami, 2001; Samways and Stewart, 1997). There is a separate assessment of aquatic systems but, ideally, the terrestrial and aquatic experts should collaborate to develop an integrated assessment. Only such an integrated assessment can provide the knowledge required to properly assess ecosystem sensitivity and the impacts that powerline construction and operation would pose.

Although sensitivity maps do reduce the level of detail that needs to be taken into account when making choices, they cannot be the basis for choosing whether to take one alternative route or another. That choice has to be based on a proper assessment of the nature of the underlying features that determine the sensitivity class. Final route selection must entail more detailed field work by specialists to ground-truth and verify these assessments as well as consultation with local experts.

As argued above, the variety and heterogeneity of the features being grouped into sensitivity classes already make a single sensitivity rating problematic. When this is combined with the range of environments which these powerlines potentially will traverse, from very low to very high rainfall, with varying rainfall reliability in all kinds of terrain, such a sensitivity rating needs to be interpreted with great caution. It is vital that those who will use this information understand and appreciate these issues when taking it into account in making decisions about the routes of the powerlines.

Table 2: Summary of limitations and assumptions in this study

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Resource availability	Only existing, published datasets used	Field verification of datasets and outcomes, and extensive local expert consultation	Reasonable accuracy of data layers used. Field verification will take place on a site by site basis linked to development proposals.
Scale of analysis	This assessment is limited to a strategic overview of important conservation concerns, not detailed route planning	As above.	As above.
The information is not sufficiently accurate or complete to be sure the species may not occur if suitable habitat is available	Datasets used as supplied by SANBI for the SEA	Field verification of datasets and outcomes, and extensive local expert consultation	The locations in the data layers are reasonably accurate and complete. Field verification will take place on a site by site basis (e.g. suitable habitat remnants) linked to development proposals.
Scope	Limited to terrestrial biodiversity.	Embedded ecosystems with different functions (e.g. wetlands, river floodplains) and the functional interactions between these ecosystems.	Wetlands, birds and bats biodiversity concerns are adequately covered in separate specialist reports

3.4 Relevant Regulatory Instruments

A wide range of regulatory instruments are applicable for the construction and operation of powerlines and across the different spheres of government (Table 3).

Table 3: Summary of the relevant regulatory instruments for the different spheres of government.

Instrument	Key objective	Feature
International Instrument		
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat.	Only where this includes terrestrial features due to boundary choices. Unlikely to be an issue unless the final routing crosses the Orange River near the mouth.
World Heritage Convention as recognised in the World Heritage Convention Act No 49 of 1999	Recognising that the cultural heritage and the natural heritage are among the priceless and irreplaceable possessions, not only of the Republic, but of humankind as a whole. Acknowledging that the loss, through deterioration, disappearance or damage through inappropriate development of any of these most prized possessions, constitutes an impoverishment of the heritage of all the peoples of the world and, in particular, the people of South Africa.	For natural heritage sites: natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view, geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation, natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.
National Instrument		
National Environmental Management: Protected Areas Act, 2003	No development, construction or farming may be permitted in a national park or nature reserve without the prior written approval of the management authority (Section 50 (5)). Also in a 'protected environment' the Minister or MEC may restrict or regulate development that may be inappropriate for the area given the purpose for which the area was declared (Section 5).	All natural and heritage features in protected areas including species and ecosystems
National Environmental Management Act (Act 107 of 1998) as amended.	The National Environmental Management Act of 1998 (NEMA), outlines measures that….”prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”	Overall promotion of the protection and conservation of all natural features
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) provides for listing threatened or	Overall promotion of the protection and conservation of all threatened species and ecosystems; regulation and control

Instrument	Key objective	Feature
	protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. Listing Notice 3 (Government Notice R324 of 2017) Activity 12 relates to clearing of 300 m² or more of vegetation, within Critical Biodiversity Areas. The Act and Regulation 598 of 1 August 2014 require the control of listed invasive alien species, including plants on all land.	of invasive listed alien species
Conservation of Agricultural Resources Act (Act No. 43 of 1983) and associated regulations	This Act provides for, inter alia, restrictions on the cultivation of land, the protection of soils and water courses, the combating and prevention of erosion, and the prevention of the weakening or destruction of water sources on agricultural land.	One of the provisions of the Act is measures to protect wetlands and watercourses by maintaining uncultivated buffers along water courses and around water bodies to reduce sedimentation and for reducing agro-chemical pollution.
Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)	The Mineral and Petroleum Resources Development Act governs prospecting, mining, exploration and production in South Africa.	In terms of section 49 of the Act, the Minister may restrict or prohibit the granting of prospecting or mining, exploration or production rights in respect of specified geographical areas if such restriction or prohibition is necessary to promote the sustainable development of South Africa's mineral or petroleum resources.
Spatial Planning and Land Use Management Act (SPLUMA) (No. 16 of 2013)	This is a national framework Act that regulates spatial planning as well as land use management, across all spheres of government.	Protection of natural features through zonation and other planning measures that prohibit or limit development and human activities.
NEMA EIA 2014 Regulations (Government Gazette 40772 (as amended, April 2017)	These regulations provide a list of activities that require environmental authorisation prior to development because they are identified as having a potentially detrimental effect on natural ecosystems, including freshwater ecosystems. Different sorts of activities are listed as environmental triggers which determine the different levels of impact assessment and planning required. They also set out the procedures to be followed for basic or full environmental impact assessments. DEA's intention is to include Strategic Water Source Area requirements in the listing.	Prohibition and limitation of activities and developments affecting natural areas by requiring of Strategic and site or Project level Environmental Impact Assessments
NEM: Biodiversity Act (No 10 of 2004): Alien and Invasive Species Regulations, 2014	Listings of alien species by category, restricting activities involving alien species and other matters	Requirement for land owners to control invasive alien species on their land in accordance with the restrictions and measures provided for in the act and regulations
NEMA Biodiversity Act 10 of 2004: Threatened and protected species regulations (2015) (seemingly not yet in force)	The purpose of these Regulations is to regulate the activities involving specimens of listed threatened or protected species	Protection of threatened and protected species.

Instrument	Key objective	Feature
Provincial Instrument		
Nature Conservation Laws Amendment Act of 2000 (an amendment of the Cape nature Conservation Ordinance of 1994)	This Act is applicable in the Western Cape. It provides measures to protect the natural flora and fauna, lists nature reserves and endangered flora and fauna	Protection of natural flora and fauna
Northern Cape Nature Conservation Act No. 9 of 2009 (came into force in January 2012 but according to some legal authorities the 1994 Ordinance still applies)	To provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.	Protection of natural flora and fauna

4 IMPACT CHARACTERISATION

The development of EGI involves the construction of powerlines, substations and other infrastructure together with permanent access routes for the servicing the infrastructure including the powerlines. The access roads have to be built to a level which enables vehicular access during construction as well as for maintenance operations, including poor weather conditions. They are generally constructed for all-wheel drive vehicles which are able to transport the equipment and materials required for construction and subsequently for maintenance work.

This assessment assumes that the proposed EGI infrastructure will be developed for a typical 765 kV power line which requires a servitude of 40 m on either side of the power line and an additional 50 m on either side for the “development envelope”, making a total width of 180 m (Figure 1) (DEA, 2016). Building width restrictions are 22-40 m from the centre line and vegetation clearance is required from the centre to the outer conductor plus an additional 10 m either side. The minimum vertical clearance would be 8.5 m. During construction each pylon footprint would be about 1 ha or 166 ha per 100 km. There will be substations which could be as large as 70 ha and could have significant impacts. However, the only planned substation (powerline anchor point) indicated in this corridor will be located near Springbok (DEA, 2016). This is located is well outside the fynbos biome and has been excluded from this assessment. Access (service) roads for construction are generally ±4 m wide during construction but can be allowed to revert to a typical two-track for those required for maintenance operations. The width of the road impact will depend on the habitat, slope or terrain because traversing slopes requires cut and fill, and routing tracks directly up steep slopes is not desirable because of the risk of erosion, even with suitable drainage. Special provision will have to be made in areas with deep, loose sand to ensure that the tracks do not grow wider or become multiple tracks as drivers seek to find easier routes. There will also be temporary areas for construction camps or storage of materials and for borrow pits (permanent excavations). Any areas and roads that will not be used for maintenance during the operational phase must be restored.

Figure 1: Diagram of the typical footprint of a 765 kV powerline corridor (DEA, 2016).

The fynbos vegetation is typically a low shrubland (<1.2 m) and so does not need special maintenance under the powerline which means that its habitat suitability for fauna should not be affected. Normally fynbos would require fires to maintain biodiversity and ecosystem function (Kraaij and Wilgen, 2014), but fires are very infrequent in these arid fynbos areas. Only single occurrences of fires have been detected in the past 16 years and these affected <1% of the fynbos in the area, with the biggest fire being in the Kamiesberg (unpublished data, Advanced Fire Information System, Meraka Institute, CSIR). Eskom does practice clearing under its powerlines to avoid the electrical shorts that can happen when soot accumulates on the isolators or reaches sufficient concentrations to cause flash overs. Should Eskom deem it necessary to maintain cleared 80 m wide belts under the powerlines this is likely to have significant impacts on ecosystem structure, biodiversity and function, at least at the local level and where remnants become further fragmented into smaller remnants (Pool-Stanvliet et al., 2017; Rouget et al., 2014, 2006, 2003). This outcome should be avoided if at all possible given the potentially significant loss of habitat this would entail, the potential loss of species unable to survive the clearing, and the formation of a linear barrier that may affect faunal migration and movements. Since the EGI corridor is generally routed across the altitudinal and climatic gradients between the coast and the inland highlands in this area, the clearing also could affect the viability of climate adaptation corridors that have been planned in the area.

The diversity and endemism of the terrestrial fauna in Fynbos is relatively low except for certain groups such as amphibians (60 species in the Western Cape, 36 endemic and 15 threatened), reptiles (146 species, 18 threatened), fossorial mammals (moles) and invertebrates (particularly butterflies, dragon flies, long-tongued flies, beetles) (Anderson et al., 2014; Colville et al., 2014; Turner, 2017). Biotic interactions are essential for the pollination of many species and many species depend on ants for seed dispersal (myrmecochory) (Anderson et al., 2014; Rebelo et al., 2006). Little is known about its importance in arid fynbos although it is known to be widespread in the fynbos and to occur in Springbok in the corridor (Picker and Griffiths, 2011). Ant seed dispersal is disrupted by the Argentine ant which is able to invade disturbed areas and care will be needed to ensure that invasions by this ant species are not facilitated by, for example, ensuring that construction material does not contain colonies of this species (Anderson et al., 2014; Bond and Slingsby, 1988; Wilson et al., 2014).

There have not been any studies of the effects of fire on these fynbos vegetation types to assess the modes of regeneration (e.g. sprouting and non-sprouting, fire stimulated seed germination or flowering, seedling establishment) or of the time required for species to reach reproductive maturity. The low frequency of fires suggests that fire may not play a significant role in maintaining these communities so they may not require fire to persist. Nevertheless, the planning of the powerline and its operation should make provision for periodic fires and the environmental management programme should make provision for prescribed fires at ecologically acceptable intervals and times of the years while minimising the hazard that fires under powerlines can pose. The optimal seasons for burning are summer or autumn but the desired intervals between fires are not known at present. Expert advice should be obtained before conducting any planned fires.

All the fynbos vegetation in the corridor is at the limits of the climatic tolerance which means that recovery after disturbance could be slow, with a high risk of failure, and probably will require active restoration as demonstrated by experience at the Namaqua Sands mine (Blignaut et al., 2013) which is in an area with more higher and more reliable rainfall. There has been research on restoration in Namaqualand but in the Strandveld or Succulent Karoo and not in the fynbos (Carrick et al., 2015; Carrick and Krüger, 2007; James and Carrick, 2016). There are some guides for restoration in books on the management of the Fynbos and Karoo but mainly developed for higher rainfall areas or the Nama Karoo (Esler et al., 2014, 2010; Krug, 2004). The uncertainties about the role of fire and the poor understanding of the potential for restoring fynbos in these areas are strong rationales for making every effort to avoid the areas of fynbos when selecting the final EGI routes.

Fynbos is subject to invasion by introduced alien tree species which must be removed in terms of the National Environmental Management: Biodiversity Act and regulations (see section 3.4). Invasive trees known to be present in fynbos in the corridor include *Acacia cyclops* and *Prosopis* species. Invading alien grasses are an issue of increasing concern in the drier parts of South Africa and there is concern that they can alter and transform ecosystems, including making them fire-prone (Rahlao et al., 2009; Todd, 2008; V. Visser et al., 2017). In the corridor area the current and potential invaders include *Bromus* species and potentially *Pennisetum setaceum* which are invaders in the Succulent Karoo but are spreading into Fynbos. Both are dispersed by wind and along roads by the movement of vehicles and special care will have to be taken to avoid dispersing them in the construction and operational phases of the powerlines and to control them if they become established. Grass invasion may be facilitated by soil enrichment by the nitrogen-fixing Acacia species (Heelemann et al., 2010; Krupek et al., 2016; Le Maitre et al., 2011; Musil et al., 2005; Vernon Visser et al., 2017) and may severely affect heuweltjie[2] communities (D.C. Le Maitre personal observations).

Field surveys to assess the occurrence of threatened and other species of interest must be commissioned about a year in advance of the date by which decisions about the final routing are made. This is because

[2] Heuweltjies are circular features with distinctive plant communities and enhanced levels of faunal diversity and activity associated with their characteristically relative fertile soils.

many plant species, in particular, are only flower and can be positively identified in the spring or early summer. Some may only flower after fire but the low frequency of fire will generally rule out detection of these species.

In summary, the construction of powerlines and associated infrastructure has a number of key ecosystem impacts during the construction and operational phases, the main ones being:

- Changes in ecosystem structure, function and biodiversity with potential impacts on threatened ecosystems and species including loss of habitat and displacement;
- Alien plant invasions which can also alter fire regimes.

5 EXPANDED WESTERN EGI CORRIDOR DESCRIPTION

The corridor is situated on the West Coast of South Africa and in the winter rainfall area of South Africa. The annual rainfall ranges from <50 mm in the Orange River valley to 100-200 mm over the lowlands and more than 400 mm in the Kamiesberg and is supplemented by fog along the coast. The summers are hot and dry but the temperatures are moderated by onshore winds.

The corridor extends about 100 km inland from the West Coast and is about 375 km in length. The southern boundary is near the town of Nuwerus and the northern boundary is the Orange River and border with Namibia. Four biomes are found within the corridor, Succulent Karoo, Nama Karoo, Desert and Fynbos and there are extensive areas of Azonal vegetation along rivers and along coast. The Fynbos Biome in the corridor comprises four vegetation types: Namaqualand Granite Renosterveld, Kamiesberg Granite Fynbos, Namaqualand Sand Fynbos, Stinkfonteinberge Quartzite Fynbos (Rebelo et al., 2006). The 25 km buffer includes some areas of Bokkeveld Sandstone Fynbos but they do not extend into the corridor itself. The only Azonal vegetation types within the corridor are found in the estuary and areas of salt marsh of the Olifants River which just enters the 25 km buffer in the extreme south. They are described in a separate specialist report.

Namaqualand Granite Renosterveld and Kamiesberg Granite Fynbos are found on the upper slopes and peaks of Kamiesberg Mountains with the latter confined to the highest peaks in the area. Stinkfonteinberge Quartzite Fynbos is only found on the upper slopes and peaks of some of the mountains in the Richtersveld. All of these montane fynbos vegetation types grade into Succulent Karoo rather than having abrupt transitions. Namaqualand Sand Fynbos is found on the leached, deep sands on the coastal plain where it is embedded in the Strandveld vegetation types which are part of the Succulent Karoo. The Namaqualand Sand Fynbos is generally within 20 km of the coast, but a narrow strip does extend about 30 km inland in the northernmost section of the vegetation type. Namaqualand Sand Fynbos may require the additional moisture from the frequent fogs that occur on the West Coast, particular in the summer and early autumn, and can supply reasonable amounts of water (Olivier, 2002). However, their ecological role is not well understood. Cutting or mowing of the vegetation under the powerline could reduce its ability to capture moisture and could make it more prone to mortality during summer, especially during droughts.

None of these vegetation types were considered threatened in the 2011 National Biodiversity Assessment (Driver et al., 2011). Many of the plant species are endemic to these vegetation types, especially in the Kamiesberg and Richtersveld (Rebelo et al., 2006). In the Northern Cape, the Kamiesberg Granite Fynbos is considered a CBA1 because of its extreme rarity and endemism – it covered less than 5000 ha originally and is confined to the province (Holness and Oosthuysen, 2016). Most of the Namaqualand Granite Renosterveld and Namaqualand Sand Fynbos fall into areas which are CBA1 or CBA2. All of the areas which were considered CBAs were classified as such because of conservation importance and not just because they are earmarked for protected area expansion.

Only the Namaqualand Sand Fynbos extends into the Western Cape in the Matzikama LM. Portions of this vegetation type are regarded as CBA1 and portions as Other Natural Areas (ONAs). The southern end of the most southerly portion of Namaqualand Sand Fynbos is part of a climate adaptation corridor. A portion of the Bokkeveld Sandstone Fynbos falls into the 2010 National Protected Area Expansion Strategy but all of it is within the 25 km buffer around the corridor.

The northern section of the Stinkfonteinberge Quartzite Fynbos falls within the Richtersveld National Park and the southern portion within the Richtersveld World Heritage Site. There are no PAs in the Namaqualand Granite Renosterveld and Kamiesberg Granite Fynbos; two small portions of the Namaqualand Sand Fynbos fall into the Namaqua National Park. The Namaqualand National Park forms a link between the coast and the Namaqua Highlands. Linking this park to the Kamiesberg is seen as a very high conservation priority so routing a powerline through this area would be seen as much more than just a significant aesthetic and visual impact.

The terrestrial fauna of these fynbos vegetation types has not been well studied and is poorly known. Threatened species of plant, mammal, and reptile locations, based on data supplied by SANBI and the provincial records, were included this assessment (see Table 1 for details). In the Northern Cape all threatened species were in included in the areas designated as CBA1. For the Matzikama LM (which falls in the Western Cape), threatened species occurrences were included in the CBAs but some records may have been excluded through the optimisation process. To compensate for this all the threatened species locations within the corridor and 25 km buffer, as supplied by SANBI, were included in the maps for this assessment. The only Important Bird Area in the corridor is the Ramsar site on the Orange River estuary which is the subject of a separate specialist assessment. No species names were supplied with the data so it is not possible to provide information on the species that are likely to be found in the corridor based on their historical occurrences.

It is very clear from the maps that areas falling in the classes CBA1 and CBA2 extend over the entire northern portion of the corridor and are narrowest near the north-eastern corner of the corridor where the N7 approaches the Orange River.

6 FEATURE SENSITIVITY MAPPING

6.1 Identification of feature sensitivity criteria

This study has used the most recent conservation plans for the areas concerned because they already include all the relevant layers of information such as threatened vegetation, threatened vertebrates, National Protected Area Expansion Strategies (NPAES) and climate adaptation corridors in their CBAs and ESAs and the latest information on the PAs (Table 4). This has been supplemented with information on the treated species locations as supplied by SANBI (see Section 3.2).

Table 4: Summary of the data sources and their preparation and processing as applicable to the Expanded Western EGI Corridor

Sensitivity Feature Class	Data Source + Date of Publications	Data Description, Preparation and Processing
Protected Areas	As included in the 2016 Northern Cape CBA and WCBSP for Matzikama	These datasets were found to be more complete than those in the last version of National PAs available from the BGIS. All protected areas in the Northern Cape were given a 5 km buffer and National Parks 10 km (Holness and Oosthuysen, 2016) based on “Listing Notice 3” under NEMA (Act 107 of 1998) 2014 EIA Regulations, as amended. Environmental Authorisation is required and a Basic Assessment needs to be conducted for specified activities within these buffers.
World Heritage Site	Richtersveld World Heritage Site in the Northern Cape	The World Heritage Site was treated the same as a Protected Area (see above)
Ramsar site	Estuary including the salt marshes	Excluded from this assessment as it is covered in a separate specialist study
National Protected Areas Expansion Strategy (NPAES) 2010	The 2016 National Protected Areas Expansion Strategy is currently still in progress so the 2010 data was used as supplied by SANBI for the SEA (based on BGIS data)	A modified and expanded version of the 2010 data is included in Northern Cape CBA 2016. The expansion strategy areas were not included in the WCBSP Matzikama Plan so the 2010 NPAES data were used for this part of the corridor
CBA1	Western Cape Biodiversity Spatial Plan: Matzikama & 2016 Northern Cape Critical Biodiversity Areas	In the WCBSP every individual CBA is provided with a “reason” which takes one or more features into account. The “reasons” given often include both terrestrial and aquatic systems in the same CBA which makes it difficult to differentiate. The Northern Cape CBAs took four features into account: ecosystem threat status, rarity, endemism and ecosystem process importance
CBA2	Western Cape Biodiversity Spatial Plan: Matzikama & 2016 Northern Cape Critical Biodiversity Areas	See above for WCBSP. For the Northern Cape the individual CBAs did not include reasons, only the general rules applied in the development of the plan (Holness and Oosthuysen, 2016)
ESA1	Western Cape Biodiversity Spatial Plan: Matzikama	See above for WCBSP. These areas include ecosystems that range from natural to moderately degraded
ESA2	Western Cape Biodiversity Spatial Plan: Matzikama	See above for WCBSP. These areas require restoration because they are severely degraded or have no natural cover
ESA	2016 Northern Cape Critical Biodiversity Areas	Does not distinguish between ESA categories or give reasons for specific ESAs
Other Natural Areas (ONA)	Western Cape Biodiversity Spatial Plan: Matzikama & 2016 Northern Cape Critical Biodiversity Areas	ONAs are not a priority at present; they retain a natural level of biodiversity and ecosystem functions and should be avoided where possible

In the WCBSP (Pool-Stanvliet et al., 2017), the category CBA is reserved for areas that are required to meet biodiversity targets for species and ecosystem pattern (i.e. composition and spatial distribution) or ecological processes and infrastructure. These include Critically Endangered (CR) ecosystems and all areas required to meet ecological infrastructure targets for sustaining the existence and functioning of ecosystems and the delivery of ecosystem services. They also include the corridors required to maintain landscape connectivity and allow communities to respond to climate change. A CBA1 is for ecosystems in natural or near-natural condition and a CBA2 comprises ecosystems that are degraded and can and should be restored. The category ESA is used for areas which are important for buffering and sustaining the functioning of PAs or CBAs, and can deliver important ecosystem services, and remnants of endangered vegetation types (Pool-Stanvliet et al., 2017). They provide connectivity, and so improve the potential to adaptation to climate change. So they include corridors, water source and groundwater recharge areas, and azonal habitats along rivers and around wetlands. Every individual CBA and ESA is provided with a “reason” or rationale which takes one or more features into account. These reasons include threatened vegetation types and vertebrates, ecological processes and specific habitat types. The “reasons” given often include both terrestrial and aquatic systems in the same CBA which makes it difficult to differentiate. ONAs have not been identified as a priority in the current biodiversity spatial plan but retain most of their natural character, biodiversity and ecological functions and are still important. Rather than include PAs in their CBA classes they were retained as separate, but with land-use practices tightly restricted by guidelines in the protected area plan, as prescribed in the NEM: Protected Areas Act. In essence this amounts to treating PAs as having very high sensitivity and equivalent to a CBA1.

In the 2016 Northern Cape CBA plan the CBAs took four features into account: ecosystem threat status, rarity, endemism and ecosystem process importance (Holness and Oosthuysen, 2016). Threatened species of plant, butterfly, and reptile locations based on data from SANBI and the province were included in the Northern Cape as CBA1 minimum. The PA expansion areas were also categorised as CBA2. ESAs are areas which are important for sustaining the functioning of PAs or CBAs, deliver important ecosystem services, include special habitats, provide connectivity and thus include corridors for improving resilience to climate change. ONAs have not been identified as a priority in the current biodiversity spatial plan but retain most of their natural character, biodiversity and ecological functions and are still important. The sensitivity ratings given to each feature class and the buffers (where appropriate) are summarized below (Table 5).

Table 5: Summary of the features and the sensitivity ratings applied in the assessment of the proposed Expanded Western EGI Corridor.

Feature Class	Feature Class Sensitivity	Buffer Distance, Sensitivity
World Heritage Site	Very High	High: Northern Cape Biodiversity Plan included proclaimed buffer as CBA2, WCBSP – no such areas in this part of the province
Protected Areas Matzikama (all types)	Very High	No buffer used in Matzikama Local Municipality (WCBSP)
Protected Areas Northern Cape (all types)	Very High	High: in this assessment; Moderate for PA buffers of 5 km and National Parks by 10 km as CBA2
CBA from Western Cape Biodiversity Spatial Plan	CBA1: Very High	None
	CBA2: High	None
	ESA1 and ESA2: Medium	None
CBA from 2016 Northern Cape CBA Plan	CBA1: Very High	None
	CBA2: High	None
	ESA: Medium	None
Threatened taxa - Mammals: Perissodactyla (Zebras, Rhinos) and the larger Carnivora (African Wild Dogs, Cheetahs, Leopards)	High	50 km

Feature Class	Feature Class Sensitivity	Buffer Distance, Sensitivity
Threatened taxa - Mammals: Rodentia, Soricomorpha (Shrews) and Afrosoricida (Golden moles);	High	2.5 km
Threatened taxa - Mammals: larger Artiodactyla (Antelope) – Tsessebe, Bontebok, Roan Antelope, Sable Antelope, Mountain Reedbuck.	High	10 km
Other mammals: (Hyracoideae (Hyraxes), Lagomorpha (Rabbits, Hares), Macroscelidae (Elephant shrews), Pholidota (Pangolins), Primates, Tubulidentata (Aardvarks)).	High	5 km
Threatened taxa - Reptiles: Crocodiles	High	25 km
Threatened taxa - Other reptiles, amphibians and butterflies	High	2.5 km
Land Cover: Natural Area (includes Other Natural Areas) Land Cover: Transformed	Medium Low	None

6.2 Feature maps

The feature maps highlight the Fynbos Biome (outlined by a 5 km external buffer) with the features in the other biomes being shown but translucently masked. This enables the context for each feature within the Fynbos to be seen in relation to the surrounding biomes. This means that important features in the adjacent biome and the connectivity across biome boundaries are at least visually evident to the decision makers.

6.2.1 Expanded Western Corridor

This section highlights the different features that have been combined to develop the overall sensitivity map. Most of the corridor is located in the Northern Cape with a portion of the Matzikama Local Municipality in the Western Cape Province in southern part of the corridor (Figure 2). The Fynbos in this corridor is essentially a set of islands located either on the mountain tops (Kamiesberg, Richtersveld, Bokkeveld in the 25km corridor buffer in the SE corner) or on the coastal plain. Since the Richtersveld portion is located on rugged mountain tops, and either in a national park or world heritage site, it is very unlikely to be considered for the powerline route and so need not be covered in detail. Excluding the Richtersveld portion allows for more detail to be shown of the southern section (Figure 3), illustrating how the Fynbos is embedded in the Succulent Karoo and how conservation features extend across the biome boundaries. The same rationale was applied to the maps of the occurrences of threatened species where only those in the southern section of the corridor and within 5km of the boundary between the Fynbos and the Succulent Karoo biomes are shown. It is evident that the threatened species in the Fynbos are located mainly in the Kamiesberg (Figure 4 and Figure 5). This is not surprising because the Kamiesberg is a relatively well studied and documented part of Namaqualand because of its unusual and unique ecosystems.

The Namaqualand National Park only includes small portions of Fynbos, including part of the central area of Namaqua Sand Fynbos (Figure 2), and extends inland to near the Kamiesberg. The aim is to connect it to the Kamiesberg Fynbos to provide a climate change adaptation corridor and this is included in the protected area expansion strategy. Although the powerline could be routed through this area it should be avoided if possible.

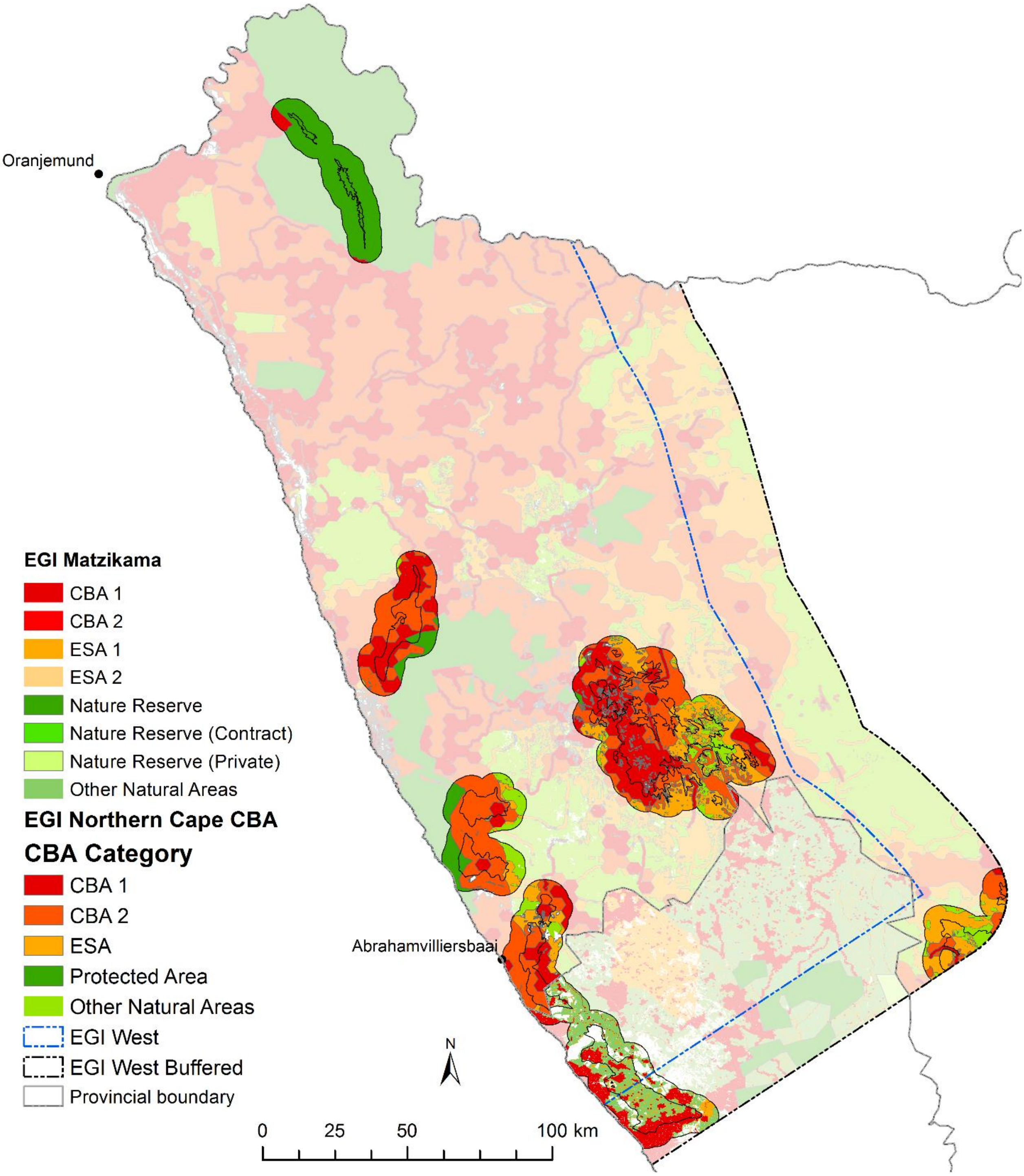

Figure 2: The EGI Expansion Western Corridor showing the outlines of the areas of Fynbos vegetation, outlined by a 5 km external buffer, and overlaid on the conservation plan data for the Northern Cape and the Western Cape. White areas are transformed with no natural vegetation remaining or areas not included in this assessment (e.g. the Olifants River estuary).

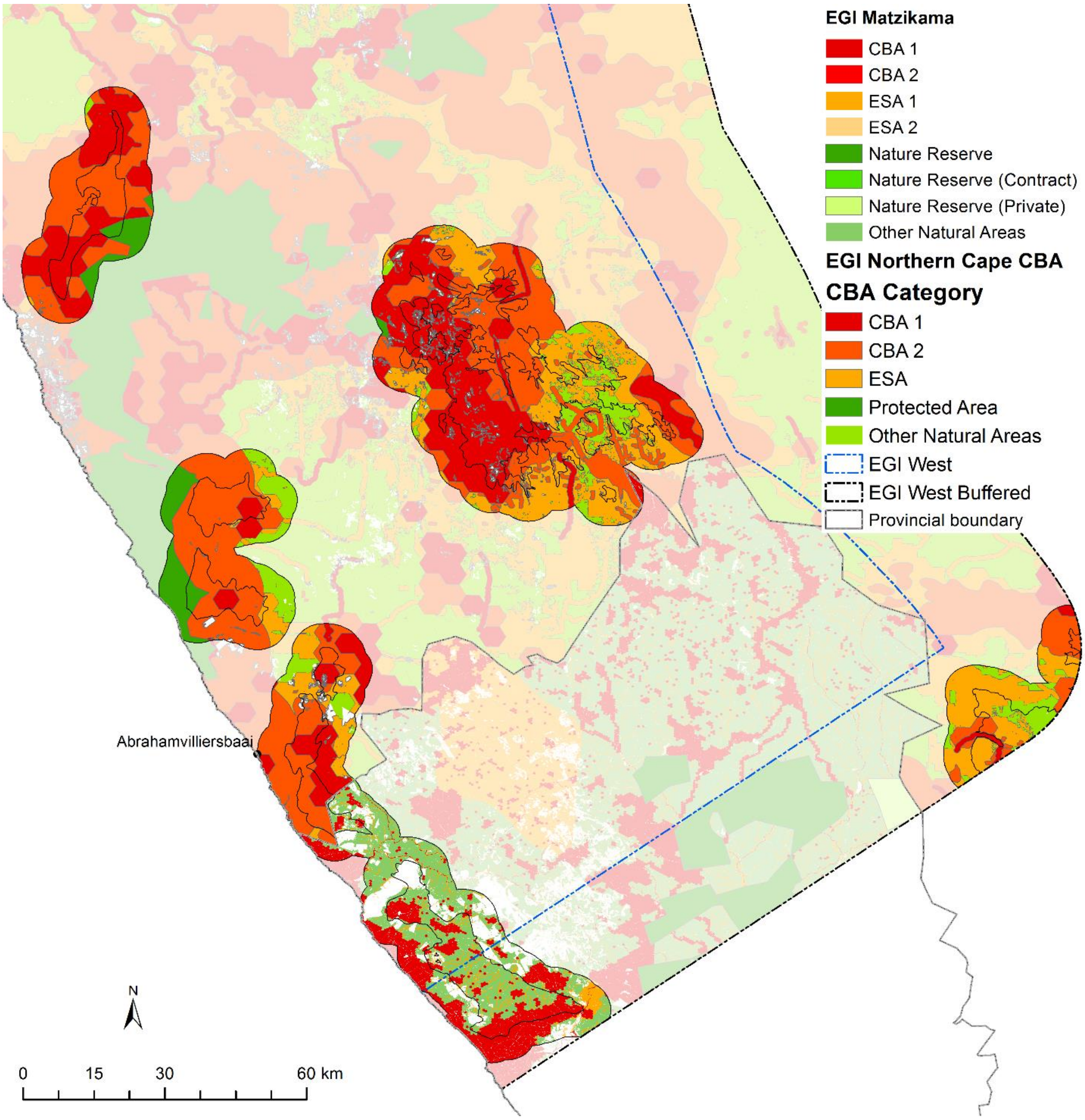

Figure 3: Detail of the southern portion of the Expanded Western EGI Corridor showing the outlines of the areas of Fynbos vegetation (black line), outlined by a 5 km external buffer, and overlaid on the conservation plan data for the Northern Cape and the Western Cape. White areas are transformed with no natural vegetation remaining or were excluded from this assessment).

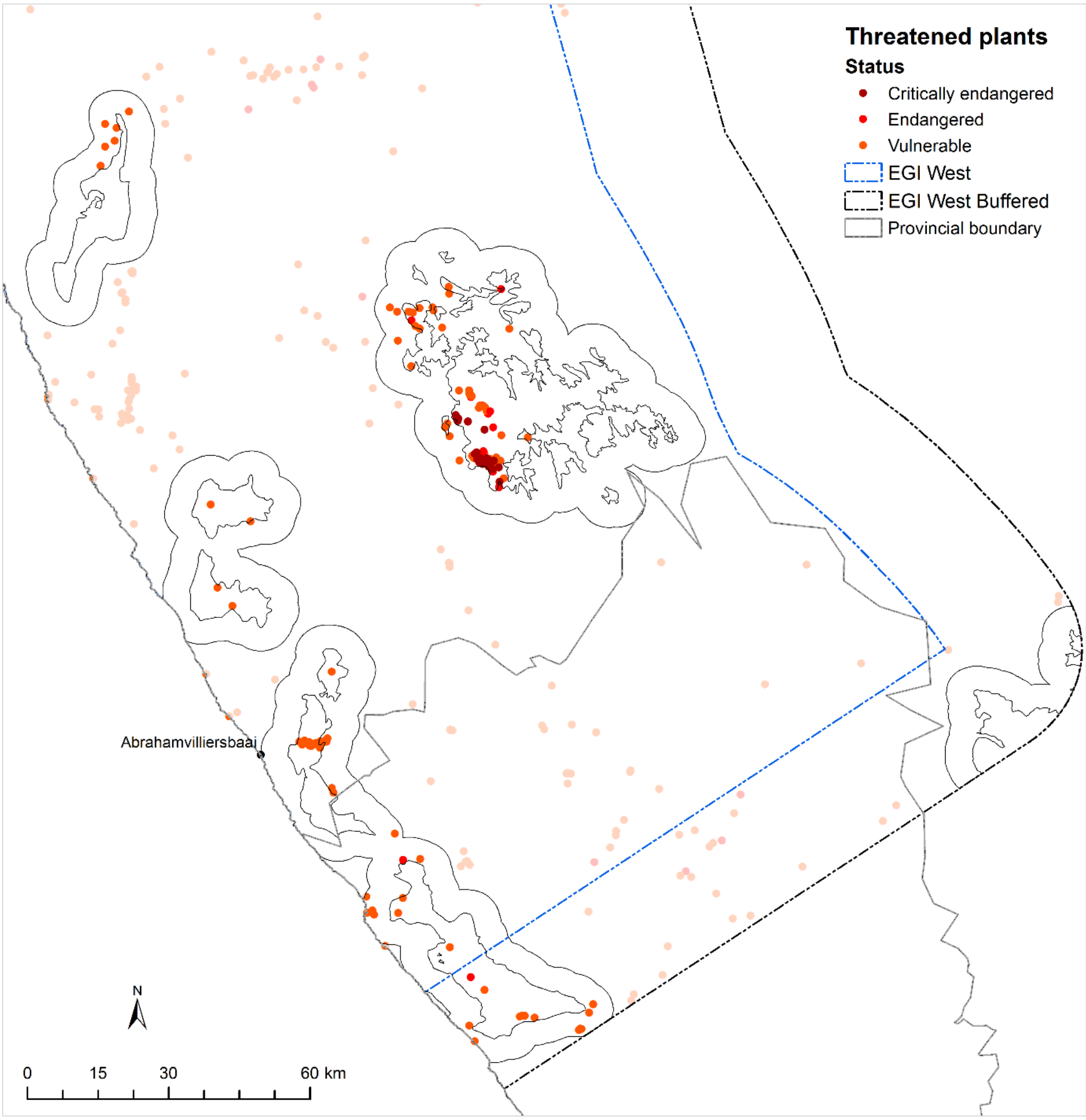

Figure 4: The occurrences of plant species classified as critically endangered, endangered, and vulnerable.

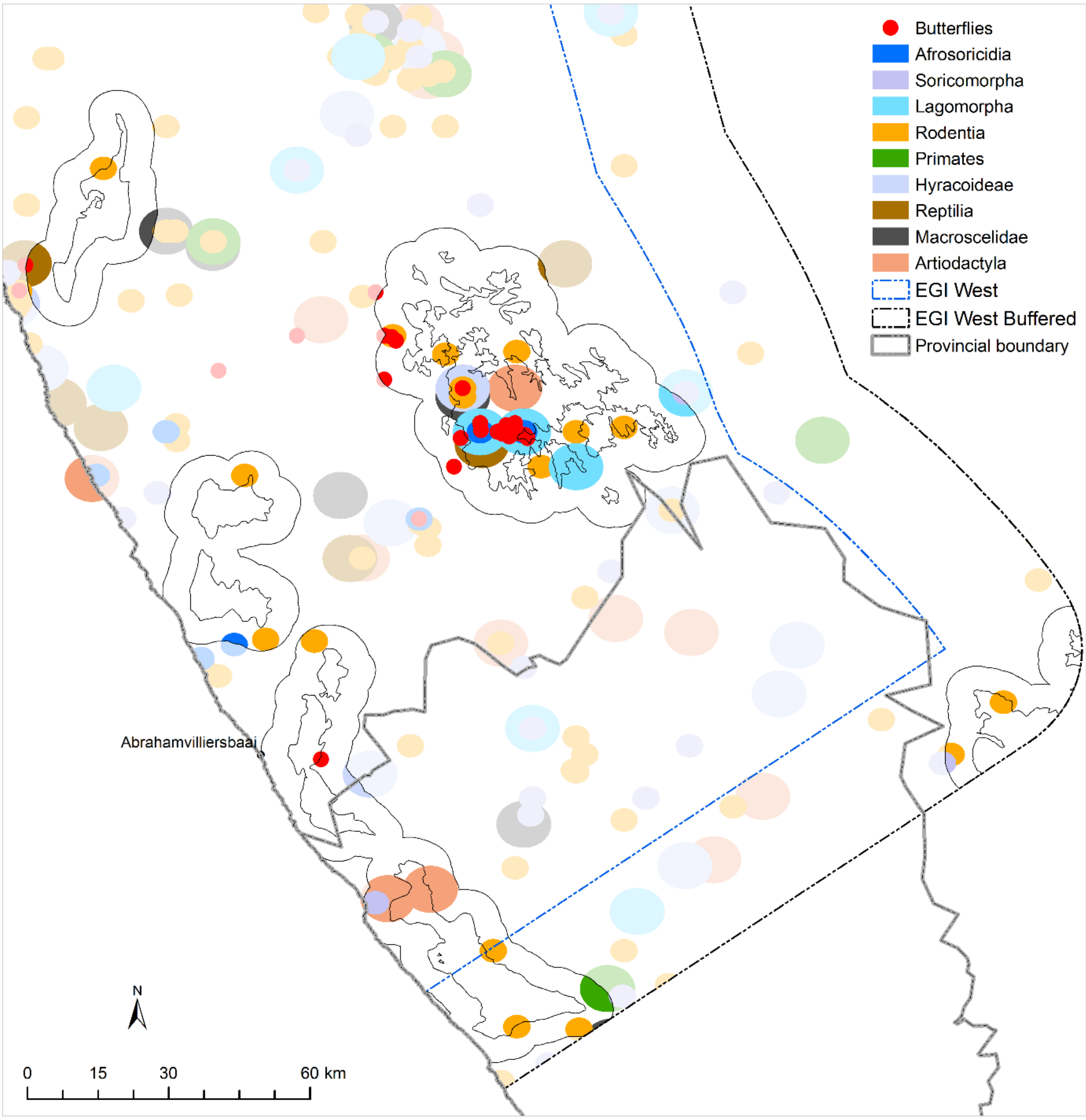

Figure 5: The occurrences of faunal species classified as critically endangered, endangered, and vulnerable.

7 FOUR- TIER SENSITIVITY MAPPING

The relative sensitivity mapping is based on a four-tier sensitivity classification using the following classes:

- Dark Red: Very High Sensitivity
- Red: High Sensitivity,
- Orange: Moderate Sensitivity
- Green: Low Sensitivity

The lowest sensitivity forms the base layer and the higher sensitivity features are overlaid on this so that the final decision making can be based on the highest sensitivity in a given area.

7.1 Four Tier sensitivity maps

The biodiversity planning classes have been converted to the four levels (Table 6):

Table 6: Four-tier sensitivity classes assigned to the biodiversity planning features

Biodiversity planning class	Sensitivity
CBA1	Very high
CBA2	High
ESA1 or ESA2	Moderate
Protected Area	Very High
Other Natural Area	Moderate
Transformed (no natural vegetation remaining)	Low

7.1.1 Expanded Western Corridor

Only the southern portion of the corridor is shown here as the fynbos in the Richtersveld area in the north is all in the Very High sensitivity class because it is all situated within a formally protected area (Figure 6). It is clear that the Fynbos vegetation within this corridor includes extensive areas which are classified as Highly or Very Highly sensitive and should be avoided if at all possible. When taken together with the Succulent Karoo sensitivity classes, the portion between the Namaqualand National Park and the Kamiesberg is an area which is all Highly or Very Highly sensitive, suggesting that a route to the east of the Kamiesberg is the best option. Given that this corridor is dominated by Succulent Karroo, the optimal route will be determined by the spatial distribution and characteristics of the features in this biome rather than the Fynbos.

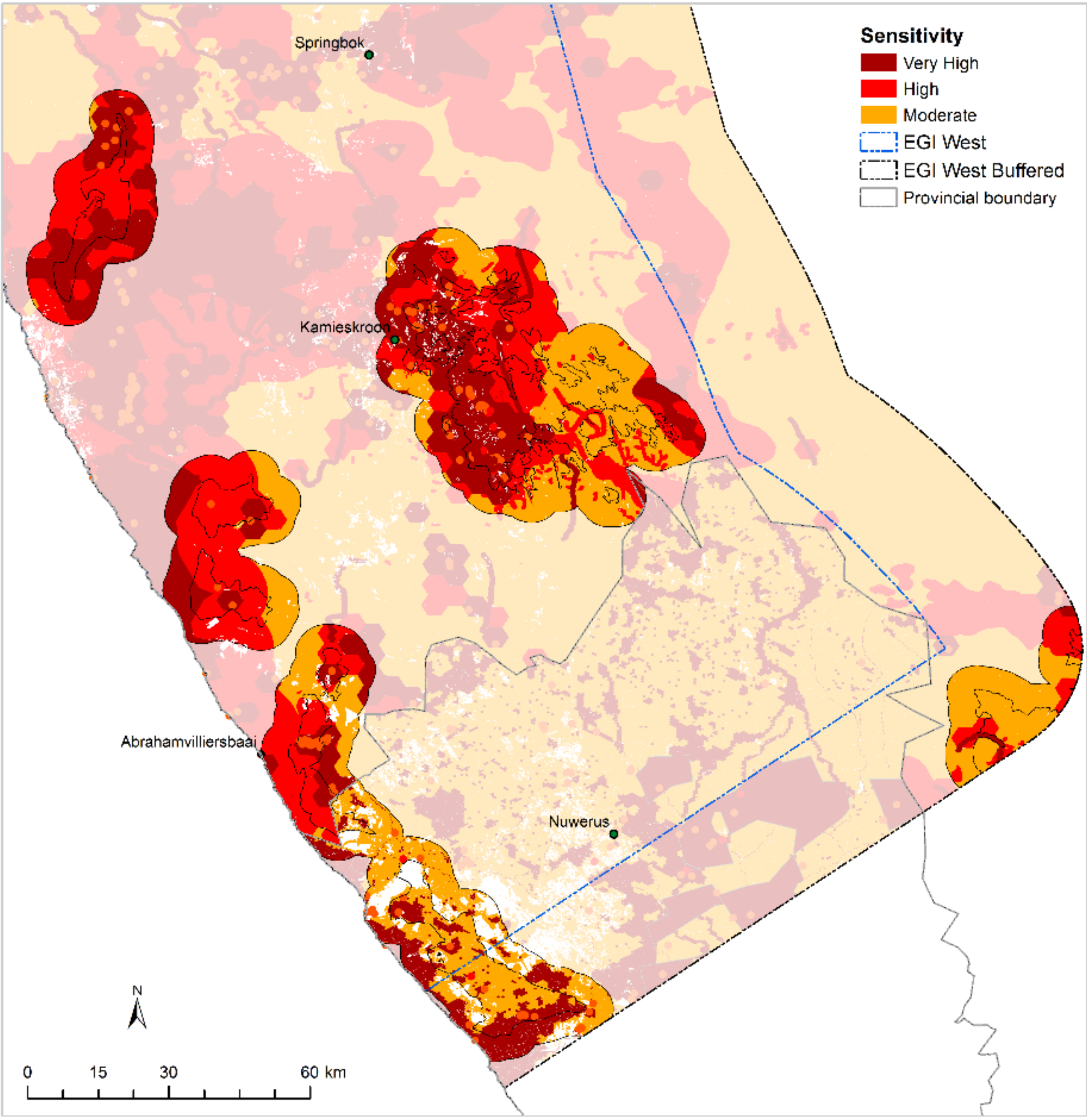

Figure 6: Sensitivity map for the Expanded Western Corridor for EGI. The white areas in the south-western corner are either transformed or are azonal types associated with the Olifants River estuary (extreme south-west in the 25 km buffer) and the subject of a separate specialist study.

8 KEY POTENTIAL IMPACTS AND MITIGATION

The sensitivity map is intended to provide strategic-level guidance by illustrating the areas where biodiversity related features and sensitivities will constrain development options. Specific environmental constraints are linked to all of the High and Very High sensitivity areas, with national legislation governing any development proposed within a national park. The provincial reserves will be governed by their own legislation on development within or areas identified as CBAs as discussed in the Western Cape Biodiversity Spatial Plan Handbook (Pool-Stanvliet et al., 2017).

Additional actions are required for all areas shown as Very High, High or Moderate sensitivity as appropriate for that sensitivity class and the specific requirements of the features associated with the sensitivity class (which will be detailed in the Decision-Making Tools that are being compiled as part of this SEA).

The construction of powerlines and associated infrastructure has a number of key biodiversity impacts during the construction and operational phases (Table 7).

The direct clearing of vegetation and disturbances to the area during pylon construction is one of the single biggest disturbances to biodiversity. The second most extensive potential disturbance is the service (and access) road network created in support of the construction which is assumed to be primarily 4x4 vehicle tracks rather than graded gravel roads. The importation of equipment, construction personnel and materials for pylon foundations could also result in the importation of invasive alien species. The disturbance and clearing of areas for pylon foundations, access roads and line-spanning equipment can initiate soil erosion and invasions by invasive alien species.

As described in Section 0, the vegetation is a low to medium height shrubland and should not need to be mowed or cleared under the conductors. If such clearing or mowing is deemed necessary, this will significantly increase the extent and frequency of the impacts during the operation of the powerline and may require special management measures. The disturbance and habitat modification that will be caused by such clearing is likely to alter habitats and hinder movements of some fauna and dispersal of plant species across the powerline corridor. This is important as the powerline will cross corridors specifically designed to allow species to respond to climate change by shifting their distributions along the corridor (Midgley and Thuiller, 2007; Yates et al., 2010). The access tracks will also require maintenance to avoid wind and water erosion, especially on the deep, loose and easily mobilised sands found in the coastal areas. It is understood that no substations are planned within the Fynbos Biome within this corridor.

Although fire is a natural and normal feature in Fynbos, fires appear to be very rare in Fynbos in these areas (see Section 5) and may not be needed to maintain ecosystem biodiversity, structure or function. However, there may have been fires but they covered areas that were too small to be detected by the satellite sensors that have been used, so the incidence of fires may simply be under-reported. In addition, there do not appear to have been any studies of the role and effects of fire in these fynbos ecosystems so more research is needed to address the fire issue.

Although the summary table below required site-specific descriptions, this would require describing all the sites and possible impacts, and as such a generic approach has been adopted here to distinguish between levels of sensitivity and to specify additional mitigatory measures for Very High and High sensitivity sites. Detailed site descriptions are appropriate when the routes are being selected and not before then.

Table 7: Key potential impacts of EGI development in the Fynbos biome and mitigation options.

Key Impact Driver	Site specific descriptions	Possible Impact / Effects	Mitigation options
Vegetation clearing for pylon construction and roads involving removal, replacement or severe disturbance of the vegetation and soils. The affected areas will require rehabilitation. It is understood that no substations will be located within the Fynbos Biome in this corridor.	Generic (for all sensitivity classes)	Permanent changes in ecosystem structure, function and biodiversity and severe disturbance of the vegetation with potential impacts on threatened ecosystems and species, including loss of habitat and loss or displacement of fauna. For more mobile and resilient fauna the impact is likely to be short-term but longer term or permanent for less mobile and resilient species. The footprint is small but the short-term impact is potentially of high significance and could extend beyond the site or road servitude. Impact will also include harm to animals or loss of breeding habitat. Impact may also include electrocution of snakes and other climbing animals during the operational phase.	All access tracks must be built and maintained to appropriate environmental standards during the construction and operational phases. Vehicles speeds to be kept low to minimise collisions with animals. Control dust to minimise settlement on surrounding ecosystems. Control sedimentation runoff into rivers and water bodies. For fauna, avoid roosts, nests, burrows and movement corridors, and provide for buffers where possible; avoid construction activities in the breeding season of threatened taxa. A walk through of each pylon foundation area to be conducted prior to clearing of vegetation and breaking of ground to ensure no animals or nests/ burrows/ roosts are harmed. Rescue and release less mobile species such as snakes, frogs, reptiles, invertebrates and certain burrowing mammals to occur prior to construction. No animals should be intentionally harmed or killed for any purpose. Areas with a high abundance of threatened ecosystems and species (High to Very High Sensitivity) should be avoided if possible. If this is not possible, then relocation of threatened species or some form of offset may provide some mitigation. During the operational phase, install mammal and snake barriers or deterrents on pylons in areas with high mammal and/or snake activity or High sensitivity.
	Very High sensitivity		Specialist field surveys to identify threatened plant or animal species before finalising pylon locations (micro-siting). Relocation of threatened species should be attempted it there is no other option. Use barriers or other measures to minimise the footprint required for the construction of the foundation and other infrastructure.

Key Impact Driver	Site specific descriptions	Possible Impact / Effects	Mitigation options
	High sensitivity		Detailed field surveys to identify threatened species before finalising pylon locations. Every effort must be made to minimise the footprint required for the construction of the foundation and other infrastructure.
Introduction of vehicles and machinery, construction teams and importation of materials for construction of the pylons and their foundations could result in the introduction of invasive alien species.	Generic	Alien plant invasions which can result in a loss of biodiversity and change in ecosystem function. Species that increase fuel loads (e.g. grasses) could result in more frequent fires. Alien fauna may displace indigenous species and disrupt ecosystem function	Minimise import of materials that could contain propagules of invasive species, particularly plants and/or screen such materials to ensure they are propagule free
	Very High and High sensitivity		Cleaning of machinery before moving onto the pylon site both when initially brought into the area and when moved between vegetation types. Any materials that may include alien species propagules must be obtained from sources known to be free of listed alien species (e.g. only source sand from a quarry certified to be alien species free). Keep vehicle and machinery movement to a single route to reduce the extent of the impact.
Vegetation clearing for pylon construction and roads. The disturbed areas can provide sites for alien plant invasion and potentially also for other alien species.	Generic	Alien plant invasions can result in a loss of biodiversity and change in ecosystem function. Species that increase fuel loads (e.g. grasses) could result in more frequent fires.	Include a systematic alien species control programme in the Environmental Management Programme (EMPr) as required by the National Environmental Management: Biodiversity Act and Regulations. This should provide for regular inspections of the pylon sites and access tracks for new invasions that must then be controlled.
	Very High and High sensitivity		The Environmental Manager or an alien species expert must carry our regular inspections of the machinery and materials during the construction; all the pylon sites and access tracks should be thoroughly surveyed in the late spring for at least 5-years after construction to ensure that no alien species have become established; any alien species that are detected should be controlled immediately. Further surveys can be aligned with the provisions of the EMPr.
Vegetation rehabilitation after construction and along roads is not successful as is often found with current methods.	Generic	Permanent changes in ecosystem structure, function and biodiversity with potential impacts on threatened ecosystems and species displacement. Potential for successful vegetation rehabilitation is low, resulting in a loss of biodiversity and changes in ecosystem structure and function, including habitat loss	Provide for ongoing measures to prevent or stop soil erosion, especially along access tracks; prevent sedimentation of rivers and water bodies. Aim to achieve at least a functional cover of perennial plant species together with a diversity of annual plants. In all cases rehabilitation must be aimed at preventing wind and water erosion. As far as possible use local plant material to minimise genetic impacts (e.g. use material such as topsoil from the areas cleared for that pylon). Provide for ongoing rehabilitation of the vegetation and support scientific studies of vegetation rehabilitation approaches and methods. The duration of these studies should be sufficiently long to

Key Impact Driver	Site specific descriptions	Possible Impact / Effects	Mitigation options
			confirm success or failure.
	Very High and High sensitivity		Intensive and active rehabilitation to rehabilitate to acceptable levels of ecosystem biodiversity, structure and function. Funding of studies to improve rehabilitation techniques, especially for perennial plants as keystone species, is strongly recommended. The duration of these studies should be sufficiently long to confirm success or failure.
Vegetation modification during operations to reduce fire risks such as cutting or mowing of the vegetation to reduce fuel accumulation and the potential for fires	Generic	Permanent changes in ecosystem structure, function and biodiversity with potential impacts on threatened ecosystems and species including loss of habitat and the potential loss of species unable to survive the clearing	Avoid such measures if at all possible as the effects of this on biodiversity, ecosystem structure and function in arid Fynbos are not known and could be severe. Use prescribed burning where fire risks need to be reduced, preferably with fires in the summer and at ecologically acceptable intervals.
	Very High and High sensitivity		No modification of this kind should be permitted. See recommendation of fires above.

9 BEST PRACTICE GUIDELINES AND MONITORING REQUIREMENTS

This section provides best practice guidelines and management actions (including relevant standards and protocols) for the different stages of the powerline development from planning to operation and rehabilitation. There are several guides that provide advice on the planning of and construction of access tracks and rehabilitation measures which should be consulted and have been included in the references for this assessment (Coetzee, 2005; Esler et al., 2014, 2010).

9.1 Planning phase

- Avoid high sensitivity biodiversity areas (CBA1 and CBA2) and other High and Very High sensitivity areas.
- Avoid routes that go through such features, rather route along the edge.
- Undertake field surveys of the final routes, pylon locations and access tracks (services roads) at a suitable time of the year (e.g. spring when species are most likely to be detectable and identifiable, focusing on the High and Very High sensitivity areas).
- Plan the route to avoid threatened species occurrences and populations where these are found[3]. Where this is not possible, obtain appropriate permits for special and threatened species where they will be disturbed or displaced. Plan for re-location where necessary.
- Little is known about the seasonality of animal movements but minimise disturbances in the spring which is likely to be the breeding season; movements are most likely in spring and autumn.
- Convene an expert workshop to discuss and debate the best options and propose methods for rehabilitation, including experiments that should be carried out and monitored, and obtain their recommendations on monitoring and evaluating the effectiveness of the rehabilitation in terms of ecosystem biodiversity, structure and function for areas with different sensitivities. The outputs of this workshop should be incorporated into the EMPr.
- Plan access track (service road) routes and pylon locations to minimise risks of erosion through routing and effective drainage measures.

9.2 Construction phase

- Plan the flow of construction activities on site to minimise the duration and extent of the disturbance.
- Minimise the construction footprint (area to be disturbed) using fixed barriers (e.g. rope or cable strung between poles) to confine activities and limit the impact in areas with a high or very high sensitivity.
- Carry out the planned threatened species protection measures (e.g. remove and replace after construction) and the re-locations where necessary.
- Carry out the inspections of the machinery and materials for alien species propagules before they are brought onto site.
- Ensure that staff follow procedures that will minimise soil, vegetation and animal disturbance; use rewards for appropriate behaviour and penalties with severe sanctions for prohibited activities such as poaching fauna or illegal plant collection.
- Helicopters should be used to string lines, especially where lines traverse high or very high sensitivity environments or rugged areas.
- Remove and stockpile topsoil from the places where it will be disturbed and replace as soon as possible in the disturbed areas to get the best vegetation recovery.
- When introducing material for rehabilitation, try to obtain it from local sources or at least from the same vegetation type.
- Carry out regular inspections to ensure that no alien species are becoming established, and eradicate those species populations that are detected.

[3] The SANBI threatened species data did not include the taxon names so they could not be summarized for inclusion in an Appendix.

9.3 Operations phase

- Follow general vegetation and access track management procedures.
- Minimise vehicle access to minimise disturbance.
- Monitor for and control soil erosion and invasive alien plants (IAP).
- Monitor the success of the rehabilitation measures and carry out remedial measures where necessary.
- The issue of maintaining fire regimes is problematic because fires appear to be very rare in these arid fynbos environments and little is known about the desired intervals between such fires. They are most likely to occur in summer. The best option is to ensure that records are kept of all fires and their causes so that information on the fire regimes in this arid fynbos can be accumulated, assessed and use to guide fire management decisions and actions.

9.4 Rehabilitation

- Ensure that where special endangered species occurred within the construction sites that they are returned or re-located appropriately.
- Follow best rehabilitation practices as recommended by the expert workshop and incorporated into the EMPr.
- This includes minimising the duration and extent of the disturbance.
- Minimise disturbances to vegetation and animals when removing temporary infrastructure.
- Monitor for IAP and remove if found during the rehabilitation; pay particular attention to the High and Very High sensitivity areas.

9.5 Monitoring requirements

- Monitoring of vegetation recovery should be conducted twice yearly in winter for the first 2 years to assess recruitment, then yearly in late summer to assess plant survival patterns until the natural vegetation is fully re-established, no erosion is being observed.
- Monitor the effectiveness of the rehabilitation using the procedures and methods recommended by the expert workshop and incorporated into the EMPr; pay special attention to the High and Very High sensitivity areas; attempt to achieve a functional vegetation cover as soon as possible in all areas, including perennial plant species.
- Monitor for IAPs and remove if found; pay particular attention to the High and Very High sensitivity areas where there should be annual surveys in spring for at least 5 years and two- or three-yearly surveys after that period as is done in less sensitive areas.
- Monitor for erosion at both the pylon locations and along the access tracks and take appropriate corrective measures (e.g. repairing drainage systems prior to the rainy season).

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