Annexure D

Specialist Reports

Annexure D1

Terrestrial Ecology

Fauna and Flora Specialist Ecological Basic Assessment Study

Basic Assessment for the Proposed Development of the Impofu Grid Connection and Associated Infrastructure, Eastern Cape Province.

aurecon

3Foxes Biodiversity Solutions
ECOLOGICAL SPECIALIST SERVICES
Assessment/Management/Research

Prepared for Aurecon South Africa (Pty) Ltd on Behalf of Red Cap Impofu (Pty) Ltd

By 3Foxes Biodiversity Solutions (Pty) Ltd

Revised August 2019

Compliance with Appendix 6 of the 2014 EIA Regulations, as Amended

Requirements of Appendix 6 – GN R326 2014 EIA Regulations, 7 April 2017	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	vii
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	ix
c) an indication of the scope of, and the purpose for which, the report was prepared;	1
(cA) an indication of the quality and age of base data used for the specialist report;	6-7
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	8-23
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	4-6
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	4-7
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	25-32
g) an identification of any areas to be avoided, including buffers;	23
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	23
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	6
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	25-32
k) any mitigation measures for inclusion in the EMPr;	25-32
l) any conditions for inclusion in the environmental authorisation;	N/A
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	N/A
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main Report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main Report
q) any other information requested by the competent authority.	
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

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Short CV/Summary of Expertise – Simon Todd

ECOLOGICAL SPECIALIST SERVICES

Assessment/Management/Research

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Ecological Solutions for People & the Environment

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.
- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town

- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent specialist ecological studies for power lines and associated insfrastructure

- Eskom Hex-Sandhills 66kV Power Line. SRK Consulting 2018.
- Osplaas-Hugo 66kV Power Line. SRK Consulting 2018.
- Proposed Mookodi Integration Phase 2 132kv Power Lines and Ganyesa Substation Near Vryburg, North West Province. SiVEST 2014.
- Eskom Vryheid Grid Strenthening Project, Western Cape. Nsovo Environmental Consultants 2016.
- Eskom Inyaninga Substation and Inyaninga – Mbewu 400kv Powerline. Nsovo Environmental Consultants 2017.
- Re-Alignment of the Koeberg – Ankerlig Power Line. Savannah Environmental 2014.
- Grid Connection for the Mainstream South Africa Perdekraal Wind Energy Facility. ERM 2014.

Specialist Declaration

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

-
- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- 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, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: 

Name of Specialist: ____Simon Todd_____

Date: ____08 August 2019_____

SPECIALIST FAUNA AND FLORA STUDY

1. INTRODUCTION AND METHODOLOGY

1.1. SCOPE AND OBJECTIVES

In order to evacuate the power generated by the proposed Impofu North, Impofu West and Impofu East Wind Farms, a 120 km long 132 kV overhead power line between the wind farm project area at Oyster Bay and Port Elizabeth in the Eastern Cape is required. The applicant, Red Cap Impofu (Pty) Ltd has appointed Aurecon South Africa (Pty) Ltd to undertake the Environmental Impact Assessment (EIA) process for the Impofu Wind Farms, and the Basic Assessment (BA) process for the associated Grid Connection Project. As part of the required specialist studies for authorisation, Red Cap Impofu has appointed 3Foxes Biodiversity Solutions to provide a specialist terrestrial biodiversity basic assessment study of the proposed grid connection route and associated infrastructure.

The purpose of the Impofu Grid Connection Ecological Basic Assessment Report is to describe and detail the ecological features of the proposed grid connection route; provide an assessment of the ecological sensitivity of the route corridor and identify the likely impacts associated with the development of the power line. Impacts are assessed for the preconstruction, construction, operation, and decommissioning phases of the development. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development which should be included in the EMPr for the development.

1.1.1. Terms of Reference

The study includes the following activities:

- a description of the environment that may be affected by a specific activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of environmental issues and potential impacts (including assessment of 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 of the development;
- a description and comparative assessment of all alternatives including cumulative impacts;
- 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; and
- 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; and
    - a comparative assessment of the positive and negative implications of identified alternatives.

General Considerations for the study included the following:

- Disclose any gaps in information (and limitations in the study) or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the EMPr for faunal or flora related issues.
- The assessment of the potential impacts of the development and the recommended mitigation measures provided have been separated into the following project phases:
    - Planning and Construction
    - Operational
    - Decommissioning

1.2. APPROACH & ASSESSMENT PHILOSOPHY

This assessment is conducted according to the 2014 EIA Regulations (Government Notice Regulation 982) in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) as amended, as well as best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers *et al*. (2005).

In terms of NEMA, this assessment demonstrates how the proponent intends to comply with the principles contained in Section 2 of NEMA, which amongst other things, indicates that environmental management should:

- (In order of priority) aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
- Avoid degradation of the environment;
- Avoid jeopardising ecosystem integrity;
- Pursue the best practicable environmental option by means of integrated environmental management;
- Protect the environment as the people's common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

Furthermore, in terms of best practice guidelines as outlined by Brownlie (2005) and De Villiers *et al*. (2005), a precautionary and risk-averse approach should be adopted for projects which may result in

substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. CBAs (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:

- The study includes data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:
    - The broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc*).

Species level

- Species of Conservation Concern (SCC) (giving location if possible using GPS);
- The viability of an estimated population size of the SCC species that are present (including the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident);
- The likelihood of other Red Data Book (RDB) species, or SCC, occurring in the vicinity (include degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development;
- Conduct a faunal assessment that can be integrated into the ecological study;
- Describe the existing impacts of current land use as they affect the fauna;
- Clarify species of special concern (SSC) and that are known to be:
    - endemic to the region;
    - that are considered to be of conservational concern;
    - that are in commercial trade (CITES listed species); or
    - are of cultural significance.
- Provide monitoring requirements as input into the EMPr for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity;
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites);
- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified and/or described:

- The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

1.3. FIELD ASSESSMENT

The field assessment component of the study took place in multiple stages between September 2017 and July 2019. Initially, in September 2017 the grid connection corridor was flown by helicopter in order to observe the features present along the route and identify the main areas of concern and sensitive features present. This was followed-up by extensive ground-truthing in which the different features present within the grid connection corridor were investigated and characterised on the ground. These site visits took place in September 2017, March 2018, May 2018 and July 2019. During the field assessment, specific attention was paid to potentially sensitive parts of the corridor and these were visited in the field to assess and verify their sensitivity as well as possible avoidance measures that could be implemented to avoid or mitigate impact to these features.

1.4. SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This includes delineating the different habitat units identified in the field and assigning sensitivity values to the units based on their ecological properties, conservation value and the observed presence of species of conservation concern. The

ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion is low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High/No Go** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories. However, it is important to note that there are no sensitivities that are identified as “Medium to High” or similar ranged categories because this adds uncertainty to the mapping as it is not clear if an area falls at the bottom or top of such a range.

1.5. ASSUMPTIONS AND LIMITATIONS

The current report is based on the results of a series of site visits as well as a desktop study, which serves to reduce the limitations and assumptions required for the study. The site visits took place in September 2017, March 2018, May 2018 and July 2019, during which time the vegetation was in a good to reasonable condition for sampling. The corridor was well covered, both through the aerial survey and on the ground with the result that there are no features likely to be present which were not observed and mapped.

Many fauna are difficult to observe in the field and their potential presence at a site must be evaluated based on the literature and available databases. In many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. Many remote areas have not been well sampled with the result that the species lists derived for an area do not always adequately reflect the actual fauna and flora present at the site. Within the wind farm area, extensive camera trapping was conducted in order to characterise the larger fauna of the site and this information is used to inform the power line study where relevant. In addition, small mammal live trapping was conducted within the wind farm area within a variety of habitats to characterise the small mammal community and this

information is also used where applicable. Due to the detailed faunal sampling that took place within the wind farm area, the faunal communities in this area is well characterised. However, away from the site detailed faunal sampling was not conducted and faunal presence in these areas relies largely on information from the existing databases as well as a habitat evaluation to evaluate likely presence. Overall, the timing and extent of the field assessment is considered adequate to provide a reliable reflection of the fauna and flora and associated sensitivity of the grid connection corridor.

1.6. SOURCE OF INFORMATION

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

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006 and 2012 update) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Information on plant and animal species recorded for the area was extracted from the new Plants of South Africa (POSA) database hosted by the South African National Biodiversity Institute (SANBI). Data was extracted for a significantly 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 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 (2017).
- Rare and listed plant species occurrences near the power line corridor within the Longmore forestry area were obtained from Karen Kirkman (Kirkman pers. comm. 2019).

Habitats & Ecosystems:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Critical Biodiversity Areas in the study area were obtained from the Eastern Cape CBA layer as well as the fine-scale plans for the Garden Route Initiative, the Nelson Mandela Bay Conservation Plan, the Baviaanskloof Initiative and the Succulent Thicket Ecosystem Programme (STEP).

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 the Animal Demography Unit (ADU) databases http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, EWT & SANBI (2016) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.

- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2017).
- Information on Hewitt's Ghost Frog distribution near the Longmore Forestry Area was obtained from the Longmore Conservation Management Plan Version 5, Longmore Plantation Tsitsikamma Region (Kirkman, 2019)

Previous Specialist Studies:

A number of specialist studies have been conducted for the other wind farm developments in the area. Confirmed records of fauna from these studies can be used to inform the current study and reduce uncertainty as to which species are likely to be present and their associated habitats. Studies that were reviewed included the following:

- Fauna and Flora study for the Banna ba Pifhu Windfarm near Humansdorp (Pote 2013).
- Fauna and Flora specialist study for the Jeffery's Bay Wind Farm (Bluesky 2010).
- Fauna specialist report (Marshall 2010) and vegetation specialist report (Pote 2010) for the Kouga and Gibson Bay Wind Farms.
- Ecological Specialist studies for the Oyster Bay Wind Farm (Hoare 2011) and Tsitsikamma Community Wind Farm (Hoare 2011).
- Fauna and Flora specialist study for the Ubuntu Wind Energy Project (Pote 2012).

2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO ECOLOGICAL IMPACTS

To evacuate the power generated by the proposed Impofu North, Impofu West and Impofu East Wind Farms, a 120 km length 132 kV overhead power line between the wind farm project area and Port Elizabeth is required. The transmission line includes three short separate 132 kV high voltage (HV) overhead power lines that emanate from the Impofu North, Impofu West and Impofu East switching stations. The three short separate 132 kV HV lines link each of the three switching stations on the wind farms to a combined central "collector switching station" (Impofu collector switching station). The role of the collector switching station is to consolidate the three power lines from the wind farms into one, such that a single line continues from here onwards. This will also allow Eskom more control over the management of the wind farms' connections into the national grid.

From the Impofu collector switching station, a single 132 kV HV power line will continue towards PE via the Eskom Melkhout Substation. Due to the complex nature of navigating linear infrastructure, this assessment considers that a 31 m servitude will be required for the construction of the powerline, which will occur within an area demarcated by a 2 km corridor. Within this assessed corridor, a single 132 kV HV power line continues to the existing Eskom Melkhout substation, located to the north of the N2 and north of the town of Humansdorp. Thereafter, the corridor continues through or around the Jeffrey's Bay Wind Farm, across the Mondplaas area and Gamtoos River valley (roughly following the existing Eskom 132 kV lines that come down from PE to Melkhout) towards Thornhill. It then passes north through the Thornhill area, into the MTO Longmore forestry

area in the foothills of the Elandsberg Mountains and the Van Stadens Natural Heritage Site, continuing around the southernmost section of the Hopewell Conservation Estate, and connecting into the Nelson Mandela Bay Metropolitan Municipality (NMBM) Sans Souci substation. From Sans Souci substation it then continues to the NMBM Chatty substation where the grid connection terminates (Figure 1, Figure 2). The reason the power line goes through the Eskom Melkhout substation and the NMBM Sans Souci substation is to improve the evacuation capacity and technical parameters of the grid connection, as well as improving the overall stability and reliability of the Eskom and NMBM networks. The whole grid connection including the wind farm switching stations, the HV line to the collector switching stations, the collector switching station and the HV line back to PE all will be transferred to Eskom once construction is complete.

Following an initial corridor design, some changes were later included in the project, following engagement with landowners or by changes to where the lines would feed into the various substations. These changes are summarized as follows:

- An alternate section of the corridor through Hopewell Estate just before Sans Souci was been added. This is to allow the proposed line to potentially follow the existing power lines through this estate. This is seen as a positive change as impacts are lower where lines run adjacent to existing lines.
- There are two areas where the proposed alignment goes through a no go area within the grid corridor as identified by the bird, ecology and wetland specialists. These sections have been inspected and found to be acceptable in terms of terrestrial ecology. The longest section of no-go area is 200 m and the line can easily span the no-go area with minimal impact to the sensitive features present. As such, these deviations are considered acceptable and would not generate higher impact than the original planned route.
- Proposed 150 m San Souci Substation extension area- this is the area that the Sans Souci Sub may need to be extended for the line to connect in here and thus needs to be assessed. At Melkhout and Chatty substations, a 50 m extension to the existing substation footprints right around the substation has been assumed as a potential possibility as the exact entry point of the line cannot be determined at this stage.

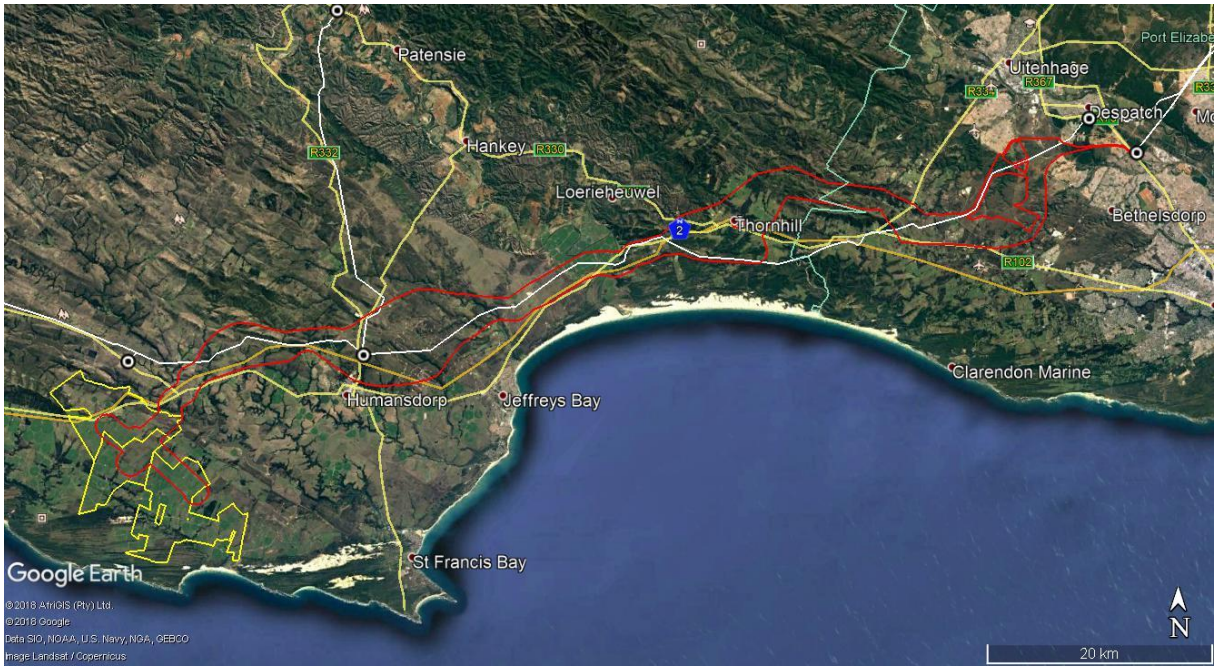

Figure 1. The Impofu Grid Corridor (in red) from the Impofu Wind Farms in the West to the Chatty Substation in the east.

A variety of different pylon options are being considered and several different types would be used depending on the situation along the power line route. These vary from Monopole intermediate Double Circuit with Twin Tern Conductors to Strain Lattice Tower (247 type) for Double Circuit Twin Tern Conductor. The latter would only be used where very long spans (>500 m) across valleys and rivers are required. The current assessment is not focused on a specific pylon type, but it is implicit in the assessment that the various required types would be used across the study area as and where required. In addition, certain types may be recommended or required in order to span sensitive features such as river valleys. Overall, the different pylon types have little direct implications for ecological impact as while the larger pylon types would generate a large footprint they also generally have a larger span, with the result that the impact per km of power line is not highly variable.

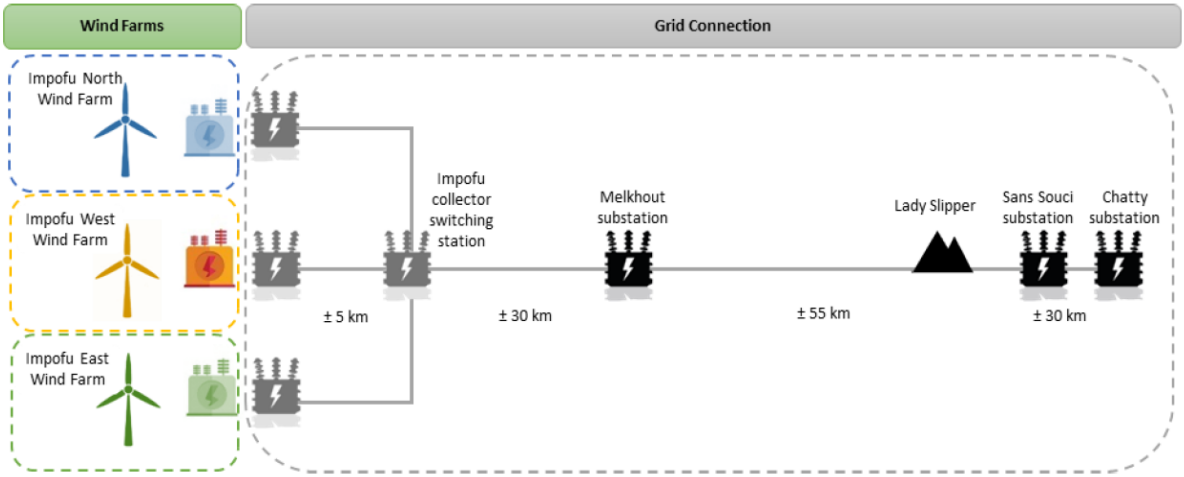

Figure 2. Schematic representation of the power line components considered in this assessment, which includes parts of the three wind farm substations, the Impofu Collector substation and the route through to the Eskom Chatty Substation.

Figure 3. On-site substation of the Jeffreys Bay Wind Farm which would be similar to the on-site substations required for the Impofu Wind Farms.

Figure 4. Example of 132 kV power line which would be similar to the current project, showing the extent of the pylon footprint areas, access road and the likely impact associated with the construction of the current power line.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. VEGETATION TYPES

According to the VegMap, the grid corridor has a wide diversity of vegetation types, belonging to several biomes, indicative of the climatic and edaphic heterogeneity of the region (Figure 5). The total extent of each vegetation type within the corridor is listed in Table 1. Important vegetation types include Gamtoos Thicket, Albany Coastal Belt, Groot Thicket and Sundays Thicket which fall within the Albany Thicket Biome; Tsitsikamma Sandstone Fynbos, Kouga Sandstone Fynbos, Kouga Grassy Sandstone Fynbos, Algoa Sandstone Fynbos and Humansdorp Shale Renosterveld which are part of the Fynbos Biome. The remaining vegetation types do not occupy a significant proportion of the grid corridor and several of these would not be impacted at all as they do not fall along the likely power line route. Although some of these are listed under the 2011 Threatened Ecosystems List, this is not considered to be the most up to date status and the vegetation map produced as part of the STEP Programme is considered to provide a better representation, at least of the thicket-related vegetation types. The STEP vegetation map (Figure 6) provides a more detailed vegetation map of the thicket areas and also provides an updated vegetation status of the affected units. The major implication of these different vegetation maps for the current study is that

several of the thicket vegetation types which were previously classified as Least Concern under the 2011 Threatened Ecosystems layer are considered of concern under the STEP and Nelson Mandela Bay Conservation Plans. Although the VegMap and STEP Programme provide descriptions of the affected vegetation types, these are not repeated in full here as the actual vegetation along the corridor is described in the next section and makes reference to the VegMap and STEP vegetation units.

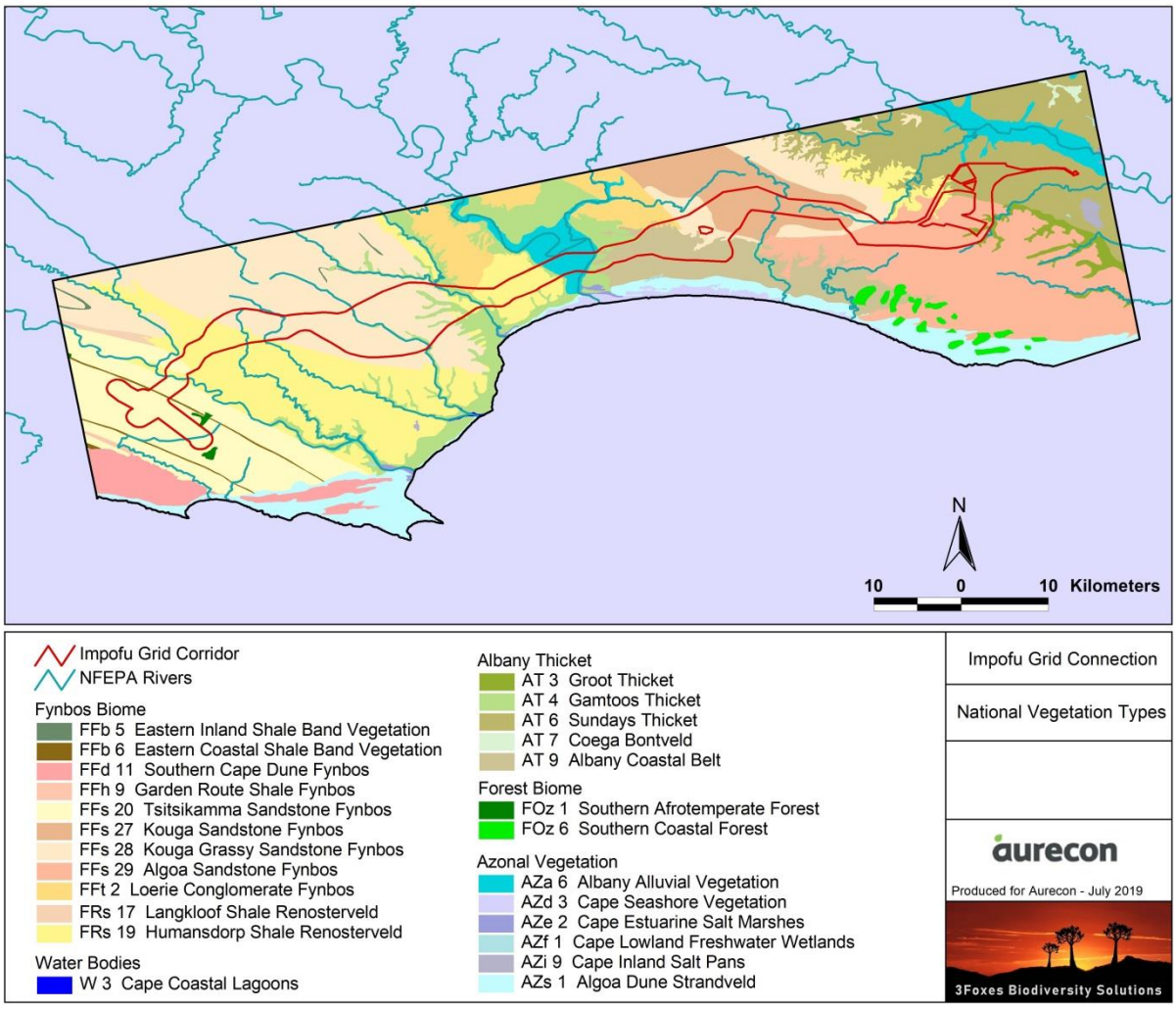

Figure 5. Vegetation map (Mucina and Rutherford 2006 and 2012 Powrie Update) of the Impofu Grid Connection Corridor and surrounds.

Table 1. The extent of the different vegetation types within the Impofu Grid Connection corridor, based on the 2012 update of the Vegmap. Status is according to the 2011 Threatened Ecosystems list and may differ from more recent regional assessments such as the Nelson Mandela Bay Conservation Plan. However, it is only the 2011 Threatened Ecosystems that is currently legislated.

Vegetation Type	**2011 Status**	**Extent (Ha)**
Albany Thicket		
AT 3 Groot Thicket		122
AT 4 Gamtoos Thicket		1 621
AT 6 Sundays Thicket		1 526
AT 9 Albany Coastal Belt		3 165
Azonal Vegetation		
AZa 6 Albany Alluvial Vegetation	Endangered	904
Fynbos Biome		
FFb 5 Eastern Inland Shale Band Vegetation		15
FFb 6 Eastern Coastal Shale Band Vegetation	Vulnerable	37
FFs 20 Tsitsikamma Sandstone Fynbos		3650
FFs 27 Kouga Sandstone Fynbos		3537
FFs 28 Kouga Grassy Sandstone Fynbos		10 768
FFs 29 Algoa Sandstone Fynbos	Vulnerable	3414
FFt 2 Loerie Conglomerate Fynbos		177
FRs 19 Humansdorp Shale Renosterveld	Endangered	3990
Forest Biome		
FOz 1 Southern Afrotemperate Forest		4
Total		**32 842**

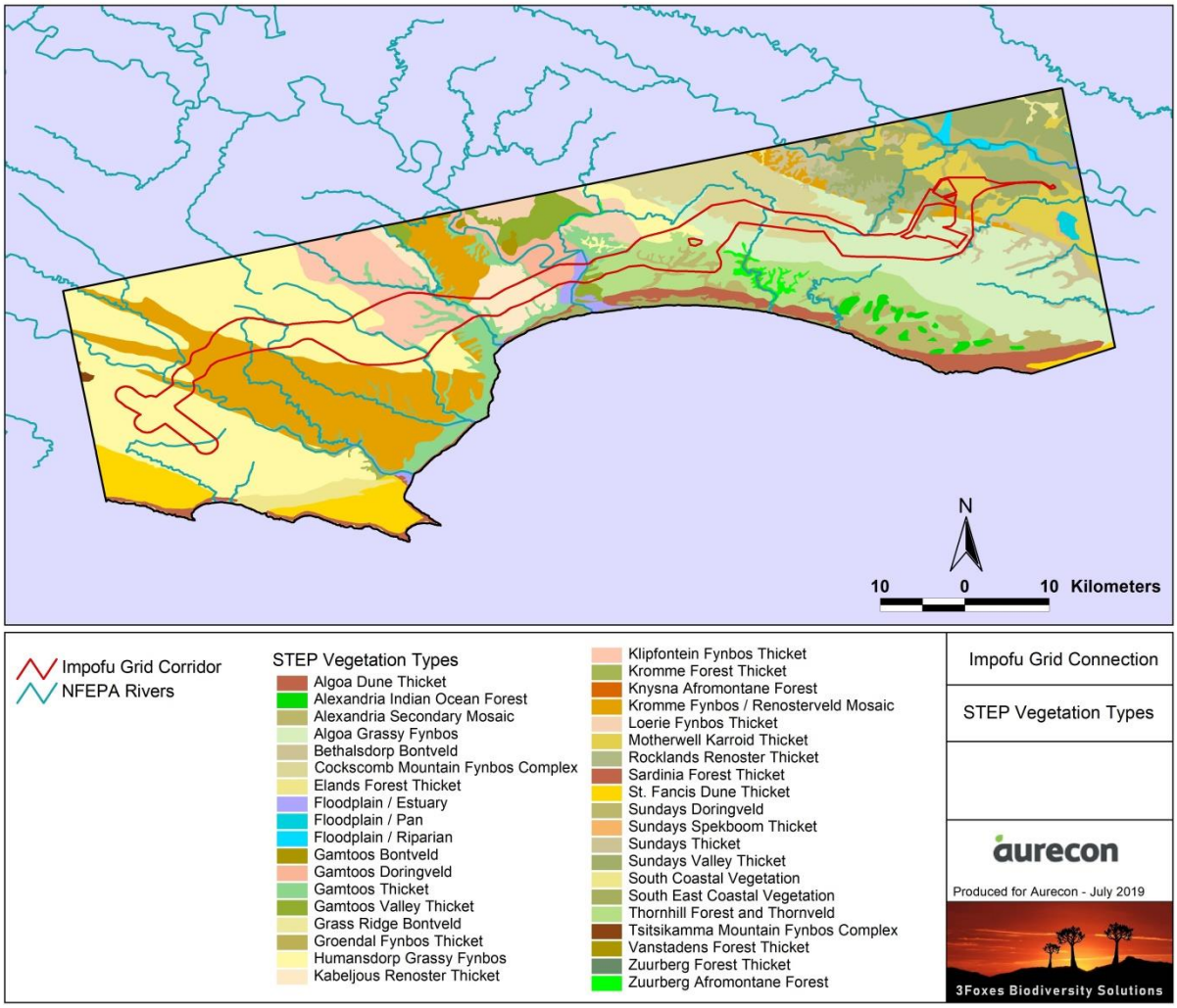

Figure 6. Vegetation Map of the Impofu Grid Corridor and surrounding area produced as part of the STEP Programme.

3.2. IMPOFU GRID CORRIDOR HABITAT DESCRIPTION

The Impofu Grid Corridor is described and illustrated below. For descriptive purposes the route is broken down into various relatively homogenous sections.

Impofu on-site substations to Eskom Melkhout Substation

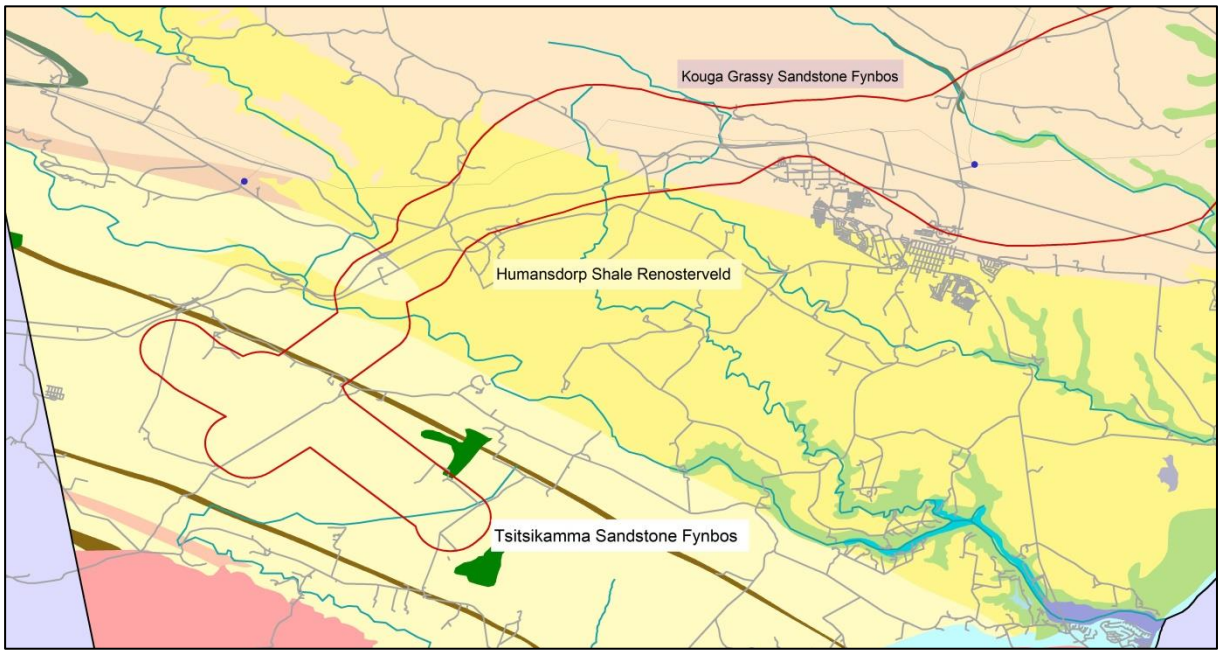

Figure 7. Overview map of the power line route from Impofu to the Melkhout substation north of Humansdorp.

There are three vegetation types in this area, the on-site substations and collector substation are all within Tsitsikamma Sandstone Fynbos; from the Krom River the vegetation becomes Humansdorp Shale Renosterveld for about 7.5 km before transitioning into Kouga Grassy Sandstone Fynbos which covers an extensive area within the corridor all the way to the Kabeljous River east of the Melkhout substation (Figure 7). Within the wind farm area, transformation levels are very high and the majority of the area has been transformed for croplands and pastures. The on-site substations for each of the Impofu wind farms are within transformed areas and no intact vegetation would be impacted by the on-site substations (Figure 9). The collector substation is within an area of degraded Tsitsikamma Sandstone Fynbos where no species of conservation concern were observed (Figure 8). Sensitive features in this area include the crossing of the Krom River near the Impofu Dam, the remaining intact fragments of Humansdorp Shale Renosterveld west of Humansdorp, the various minor river crossings and the relatively undisturbed Fynbos north of the N2 highway. Kouga Grassy Sandstone Fynbos is fairly variable and the composition varies significantly depending on aspect and soil depth and structure (Figure 12, Figure 13). Some areas share a large proportion of species with the nearby Tsitsikamma Sandstone Fynbos and these two vegetation types are clearly closely allied to one another. There are more than 20 species of conservation concern known from this area, many of which are however coastal species and not associated with the Sandstone Fynbos vegetation types of the area.

Common and dominant species observed within the areas of Tsitsikamma Sandstone Fynbos include *Leucodendron conicum, Metalasia densa, Passerina corymbosa, Protea nerifolia, Pterocelastrus tricuspidatus, Erica discolor, E.sparsa, E.rosacea, Ursinia scariosa, Agathosma ovata, Anisodontea scabrosa, Berzelia intermedia, Euryops munitus, Helichrysum teretifolium, Indigofera flabellata, Leucodendron salignum, Otholobium carneum, Phylica axillaris, Protea cynaroides, Stoebe plumosa*, *Commelina africana, Gazania krebsiana, Restio triticeus, Tetraria capillacea, Diheteropogon filifolius, Elegia juncea, Heteropogon contortus, Hypodiscus synchroolepis, Tetraria robusta, Themeda triandra* and *Tristachya leucothrix*.

Figure 8. Location of the Impofu Collector Substation, with degraded Tsitsikamma Sandstone Fynbos present. The vegetation is dominated by *Elytropappus rhinocerotis* and *Stoebe plumosa* with an understorey of species such as *Cynodon dactylon*, *Gazania krebsiana*, *Restio triticeus, Ischyrolepis eleocharis*, *Leucospermum cuneiforme*, *Erica cerinthoides*, and *Euryops munitus*.

Kouga Grassy Sandstone Fynbos is similar to Tsitsikamma Sandstone Fynbos but as the name suggests is more grassy, at least in some parts (Figure 12). Common species observed include *Pteronia incana, Stoebe plumose, Tephrosia capensis, Helichrysum felinum, Disparago ericoides, Erica sparsa, Helichrysum teretifolium, Bobartia orientalis subsp orientalis, Watsonia meriana, Brachiaria serrata, Cymbopogon marginatus, Digitaria eriantha, Diheteropogon folifolius, Eragrostis curvula, Heteropogon contortus, Ischyrolepis capensis, Pentaschistis eriostoma, Pentaschistis pallida, Restio triticeus, Tetraria capillacea, Themeda triandra* and *Trischachya leucothrix*.

Figure 9. On-site substation site for the Impofu East Wind Farm, showing the transformed nature of large parts of the Impofu wind farms area. Development in such areas is considered to have minimal impact and these areas are considered low sensitivity.

Figure 10. Intact, recently burnt Tsitsikamma Sandstone Fynbos on the hills south of the Impofu Dam. These areas are considered to be moderate sensitivity and with a relatively low abundance of species of concern.

Figure 11. Intact Humansdorp Shale Renosterveld near to the N2. The majority of Humansdorp Shale Renosterveld within the grid corridor has been transformed and as a result, the remaining intact areas are considered moderate to high sensitivity.

Figure 12. Kouga Grassy Sandstone Fynbos along the existing 132 kV line, west of Humansdorp.

Figure 13. Kouga Grassy Sandstone Fynbos at the Melkhout Substation, showing an area with a high abundance of low shrubs and low grass abundance. This area is considered to be moderate sensitivity.

Melkhout Substation to Gamtoos River

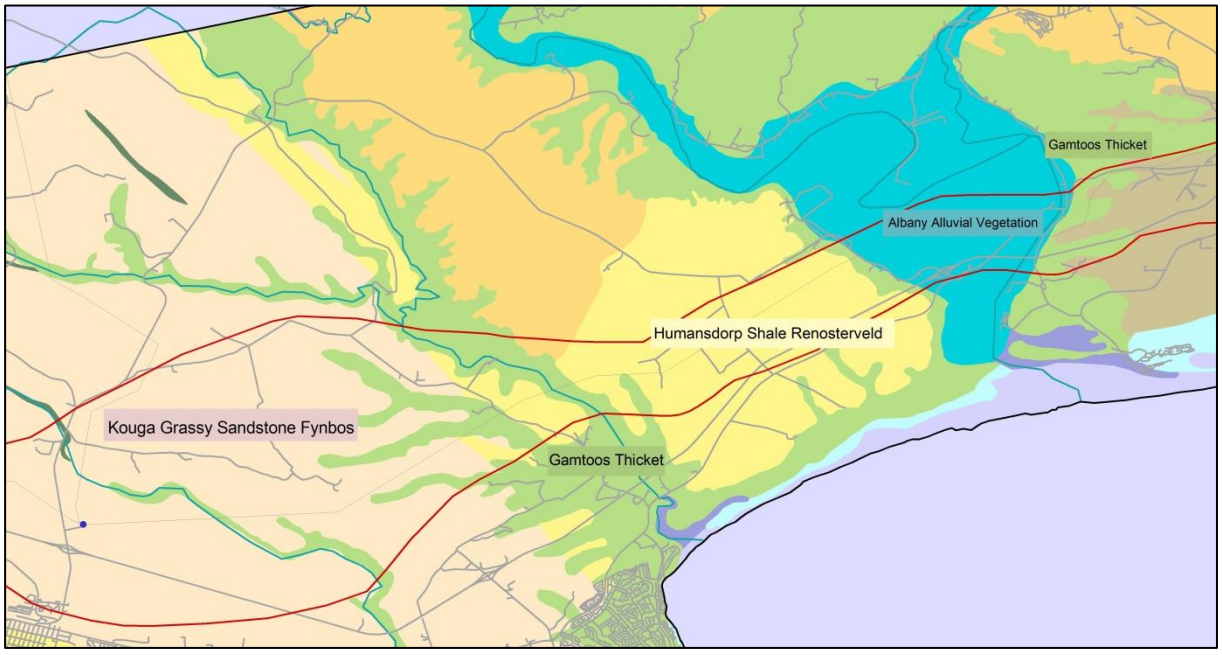

Figure 14. Overview map of the grid corridor from the Melkhout substation in the west to the Gamtoos River in the east.

The Melkhout substation is located north of Humansdorp in Kouga Grassy Sandstone Fynbos. From there the grid corridor goes past the Jeffreys Bay Wind Farm before traversing the Kabeljou's

River which has Gamtoos Thicket in the valleys before going across the relatively flat plains of Humansdorp Shale Renosterveld before reaching the Gamtoos River. The plains towards the Gamtoos River would once have consisted of Albany Alluvial Vegetation but within the study areas, this has entirely been lost to transformation. Large tracts of the Humansdorp Shale Renosterveld have also been lost to transformation, but the Kouga Grassy Sandstone Fynbos is generally more intact. The major sensitive feature along this section of the corridor are the river crossings, but as these are all relatively minor rivers, it is likely that they can be spanned with relatively minor impact to the adjacent thicket communities. Some of the valleys along the rivers are however quite large and steep and disturbance on the steep slopes will increase erosion risk. At least 30 plant species of conservation concern are known from this section of the corridor, which is a relatively high number and reflects the threat status of the Humansdorp Shale Renosterveld which dominates this section of the route and the high levels of transformation which have impacted locally endemic species.

Within the Humansdorp Shale Renosterveld common species observed include *Elytropappus rhinocerotis, Ochna serrulata, Diospyros dichrophylla, Oedera genistifolia, Berkheya heterophylla, Searsia pallens, Aloe Africana, Searsia incisa, Metalasia aurea, Metalasia densa, Leonotis leonurus, Euryops munitus, Aristida junciformis, Cynodon dactylon, Eragrostis curvula and Bobartia orientalis*. Much of these areas are degraded through overgrazing or fire mismanagement.

Figure 15. Kouga Grassy Sandstone Fynbos east of the Melkhout Substation, showing the Jeffreys Bay Wind Farm in the background.

Figure 16. Looking north along the existing power line alignments with Kouga Grassy Sandstone Fynbos visible in the foreground and distant hills. The southern extent of the Jeffreys Bay Wind Farm is visible in the distance. There are some valleys and hills in this area which increases the sensitivity of this section of the route. As can be seen from the existing power line, the valleys can be well spanned by the power line.

Figure 17. Looking west along the grid connection corridor showing degraded Humansdorp Shale Renosterveld near Mondplaas.

Figure 18. Looking east along the grid connection corridor showing the existing power lines running through an area of intact Humansdorp Shale Renosterveld.

Figure 19. The plains along the Gamtoos River have been almost entirely transformed for crop production and there is very little intact vegetation remaining. This area would historically have consisted of Albany Alluvial Vegetation.

Gamtoos River to Van Stadens

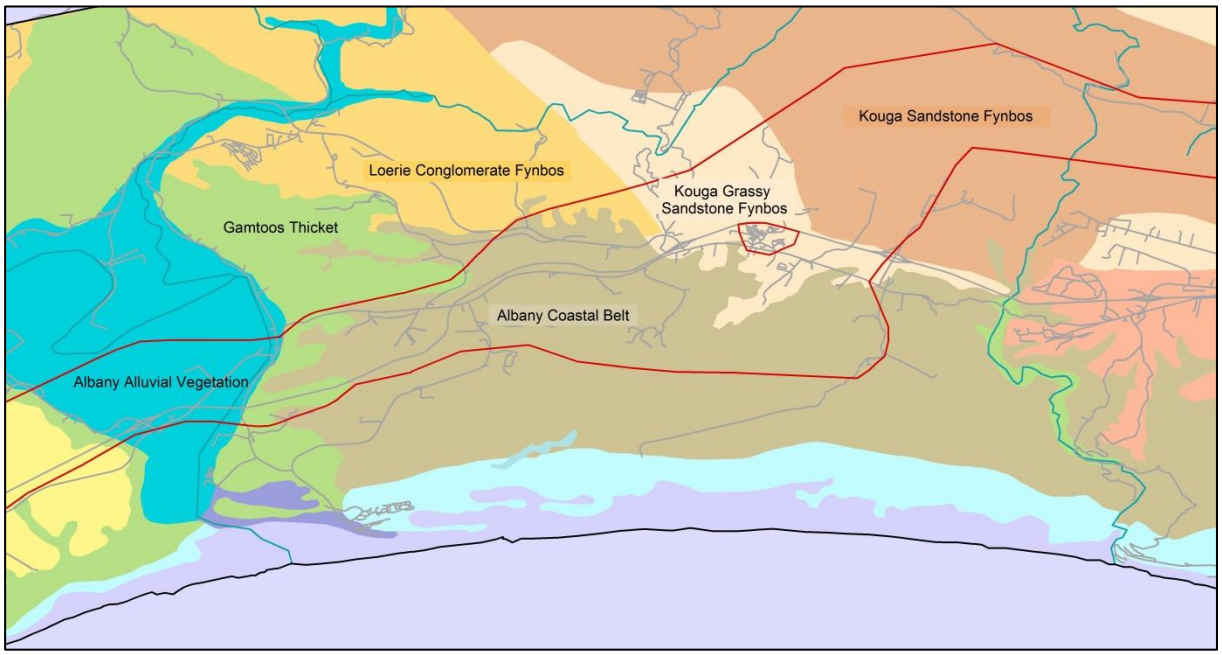

Figure 20. Overview map of the grid corridor from the Gamtoos River to Van Stadens in the east.

The route corridor between the Gamtoos River and Van Stadens River is dominated by Albany Coastal Belt vegetation, Kouga Grassy Sandstone Fynbos around Thornhill and Kouga Sandstone Fynbos from Thornhill east past the Gamtoos River. There is also some Gamtoos Thicket in the valleys in the west along the Gamtoos River valley. The headlands along the Gamtoos River are considered sensitive and vulnerable to disturbance. Between Thornhill and the R334 the proposed route passes towards the north of the corridor through the MTO Longmore forestry area, through the Van Stadensberg Natural Heritage Site and north of the Lady Slipper Local Authority Nature Reserve. Within the Longmore State Forest area managed by MTO, there are several plant species of concern confirmed present including *Encephalartos longifolius* (NT), *Leucodendron orientale* (EN), *Paranomus reflexus* (EN) and *Euryops ursinoides* (VU). Due to the known presence of these species as well as the general sensitivity of this area, this section of the route was checked in detail to ensure that it is possible for the power line to pass through this area with acceptable impact. Impacts on listed species can be reduced in this area through a preconstruction walk-through of the final development footprint as well as limiting vegetation clearing beneath the power line during operation. The fynbos in this area is generally quite short and it should not be necessary to clear extensively beneath the power line during operation. Anyway areas where there are species of concern within the power line servitude should be demarcated and no wholesale clearing should take place in these sections.

The Thicket communities along the Gamtoos River are dominated by species such as *Euphorbia triangularis, Sideroxylon inerme*, *Schotia afra var. afra*, *Cussonia spicata*, *Aloe Africana*, *Azima tetracantha*, *Rhoicissus digitate*, *Plectranthus verticillatus*, *Portulacaria afra*, *Canthium spinosum*, *Olea europaea subsp. africana, Plumbago auriculata, Asparagus aethiopicus, Ehretia rigida*, *Grewia occidentalis* and *Oedera genistifolia*. These are dense communities where vegetation clearing should be avoided as much as possible. While this is considered to be a sensitive

vegetation type, it tends to the restricted to steep slopes and valleys, where it should be possible to avoid significant impact.

Common and dominant species in the Albany Coastal Belt vegetation includes *Sideroxylon inerme, Erythrina caffra, Acacia natalita, Searsia lucida, Plumbago auriculata, Leonotis leonurus, Celtis africana, Clausena anisata, Rhoicissus tomentosa, Searsia chirindensis, Gymnosporia buxifolia, Ekebergia capensis, Grewia occidentalis, Rhoicissus tomentosa, Cynodon dactylon, Seriphium plumosum* and *Pteridium aquilinum*. The structure and composition of the Albany Coastal Belt varies a lot and ranges from dense low forest to disturbed *Acacia natalita* scrub and secondary grassland. The section of Albany Coastal Belt is however considered to be generally less sensitive than the dense thicket and forest patches that occur along the river crossings and specific avoidance will need to be implemented in these areas to avoid impact to sensitive vegetation. The alignment should run adjacent to the existing lines line these areas as much as possible.

Figure 21. The Gamtoos River is a sensitive feature on the route, but the plains have been transformed and impact would be restricted to the hills above the river. The vegetation of the plains would have been Albany Alluvial vegetation but has almost entirely been lost to agriculture.

Figure 22. Gamtoos Thicket on the hills near to the Gamtoos River. Such dense thicket areas are considered sensitive and impact to these areas should be avoided as much as possible. As the thicket is generally restricted to the slopes, it should be possible to avoid significant impact to this vegetation type.

Figure 23. Albany Coastal Belt vegetation along the corridor east of the Gamtoos River. This area is considered moderate sensitivity, but the clearing beneath the power line should be reduced as much as possible.

Figure 24. Looking south along the proposed alignment towards Thornhill from within the MTO Longmore forestry area. The vegetation consists of Kouga Sandstone Fynbos.

Figure 25. Looking west along the power line alignment from within the Van Stadensberg Natural Heritage site. The vegetation along the lower slopes where the power line would pass is degraded as a result of past disturbance including some cultivation, alien invasion and frequent burning.

Van Stadens to Chatty Substation

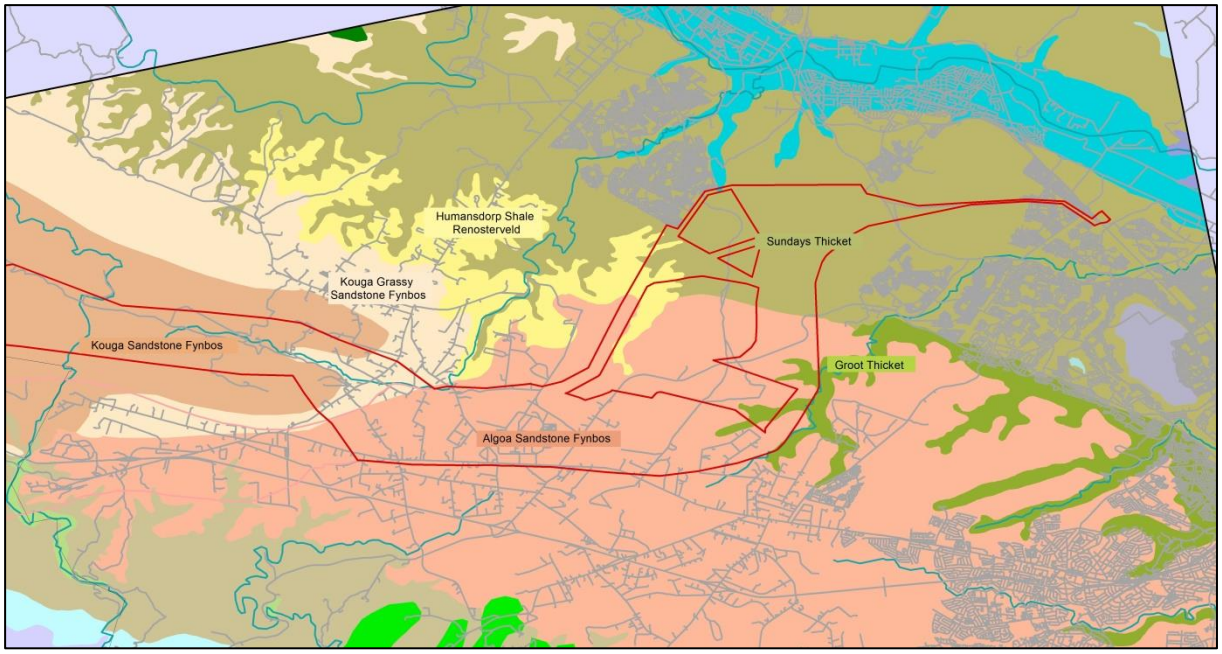

Figure 26. Overview map of the grid corridor from Van Stadens to Chatty Substation in the east.

From the Van Stadens River, the power line corridor consists largely of Algoa Sandstone Fynbos until it nears Booysen Park where it quickly transitions into Motherwell Karroid Thicket and then Sundays Thicket for the final section towards Chatty Substation. The western section of the corridor has been heavily impacted and the majority of this area has been transformed for agriculture. From the Rietkuil Road eastwards, the vegetation is largely intact and consists of Algoa Sandstone Fynbos in varying communities and condition states until it transitions abruptly into Motherwell Karroid Thicket near Booysen Park. From Booysen Park to Chatty substation the vegetation consists of alternating sections of Motherwell Karroid Thicket and Sundays Thicket. In general, the western section the corridor from Van Stadens to the Rietkuil Road is low sensitivity as a result of the extensive transformation this area has experienced, while the eastern section of the corridor is mostly fairly high sensitivity except for the final 5 km of the corridor from the R368 to the Chatty substation. More than 50 different plant species of conservation concern are known from the broad area, including many with localities from within the corridor itself.

Figure 27. Typical agricultural landscape with transformed habitat west of Fitchholme, illustrating the high degree of transformation this area has experienced.

Figure 28. Transformed habitat with various woody aliens along the existing power line corridor near to Rendallton. Transformation in this area has resulted in large sections of the route having a low sensitivity.

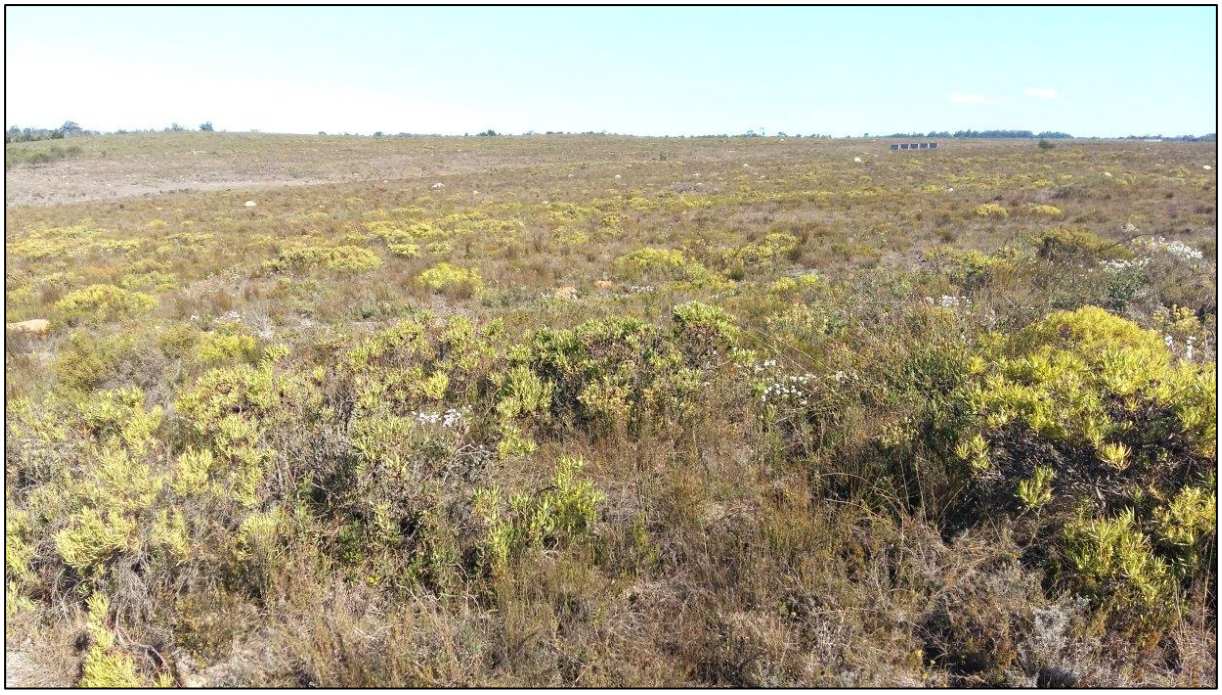

Figure 29. Intact Algoa Sandstone Fynbos vegetation along Rietkuil Road, north of the Wedgewood Golf Estate. Common and dominant species include *Leucodendron salignum*, *Ischyrolepis capensis*, *Syncarpha striata*, *Helichrysum cymosum* and *Metalasia aurea*.

The areas of Algoa Sandstone Fynbos are generally fairly species-poor and homogenous. There is however a clear gradient from east to west, which is related to the lower rainfall in the east as well as the change in land use from private to communal rangeland. Particularly in the east, the Algoa Sandstone Fynbos is restricted to the hilltops with Groot Thicket in the valleys. Common and dominant species include *Searsia pallens, Athanasia dentata, Metalasia aurea, Berkheya heterophylla, Barleria stimulans, Dicerothamnus rhinocerotis, Diospyros dichrophylla, Leucodendron salignum, Leucospermum cuneifolium, Chironia baccifera, Euphorbia stellata, Syncarpha argentea, Aloe ferox, Ischyrolepis capensis, Passerina pendula* and *Brunsvigia gregaria*. The areas of Algoa Sandstone Fynbos are considered less sensitive than the Thicket communities to the east as they have been less impacted by transformation and also contain a lower abundance of species of concern compared to the Thicket and Bontveld areas to the south and east.

Figure 30. Moderate condition Algoa Sandstone Fynbos vegetation southwest of Booysen Park.

Figure 31. Degraded Algoa Sandstone Fynbos vegetation along the corridor in the area southwest of Booysen Park. This area has been significantly impacted by grazing and fire, and is considered reasonably degraded. It is however also transitional with the thicket to the east and retains some thicket elements in sheltered locations.

Figure 32. Clearing of Sundays Valley Thicket vegetation along the existing power line alignments near to the R368 south of Despatch.

Figure 33. Largely intact Sundays Valley Thicket vegetation on the low rolling hills in the corridor east of the R368 south of Despatch, with *Portulacaria afra, Aloe africana, Euclea undulata, Euphorbia grandidens. Pappea capensis, Schotia afra* var. *afra, Cussonia spicata, Sideroxylon inerme, Euclea undulata, Azima tetracantha, Carissa bispinosa* subsp. *bispinosa, Ehretia rigida, Grewia occidentalis, Putterlickia pyracantha, Clausena anisata var. anisata, Lycium horridum, Asparagus burchellii, Sarcostemma viminale, Peronia glauca, Felicia muricata*, *Lantana rugosa* and the alien *Optunia ficus-indica* and *Opuntia inbricata* being prominent species.

Figure 34. Heavily impacted Motherwell Karroid Thicket vegetation along the edge of the New Kwadesi township south of Despatch. New housing is being constructed in this area and it is disturbed by overgrazing as well as mechanical vegetation clearing for the housing developments. Although this is considered to be an endangered vegetation type, within the study area, the impacts and activities which characterise the affected area means that the affected areas are considered low sensitivity.

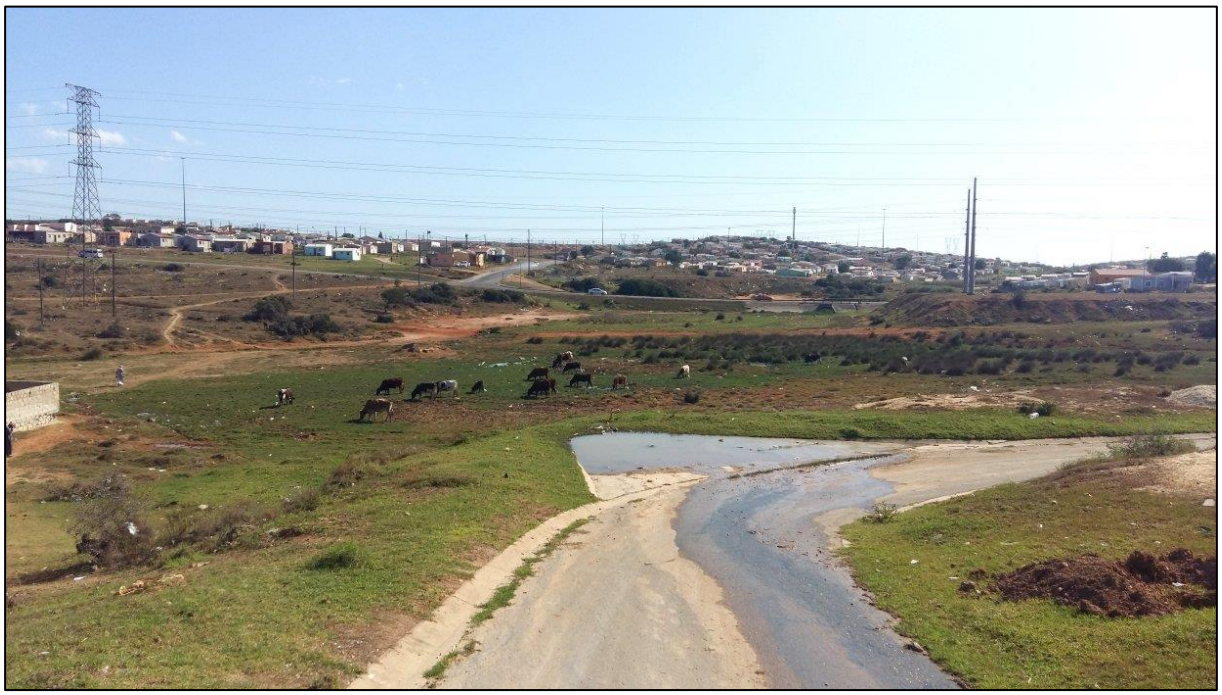

Figure 35. The area near to the Chatty Substation is transformed and urbanised. Although there are some semi-natural areas remaining between the housing, these are highly impacted and not considered sensitive.

Figure 36. Aerial view of the Chatty substation, with the R75 and Kwadwesi township in the background. There is some remnant thicket around the substation, but overall, this area is considered low sensitivity due to the large amount of transformation and urbanisation this area has experienced. Common species in this thicket include *Portulacaria afra, Euclea undulata, Cussonia spicata, Aloe speciosa, Schotia afra* var. *afra, Carissa bispinosa* subsp. *bispinosa*, *Grewia occidentalis, Putterlickia pyracantha, Sarcostemma viminale, Optuntia ficus-indica, Asparagus multiflorus* and *Sansevieria aethiopica*.

3.3. FAUNAL COMMUNITIES

3.3.1. Mammals

According to the MammalMap database, more than 70 terrestrial mammals have been recorded from the broad area around the site. This does however include a variety of introduced extralimital and conservation-dependent species which are not relevant for the current study and the actual number of naturally-occurring mammals present is around 50. Species observed within the three consolidated Impofu Wind Farms area include Aardvark, Bat-eared Fox, Bushpig, Baboon, Black-backed Jackal, Caracal, Common duiker, Bushbuck, Cape Grysbok, Small-spotted Genet, Cape Grey Mongoose, Honey Badger, Blue Duiker, Vervet Monkey, Cape Porcupine, Cape Clawless Otter, Cape Hare, Water Mongoose, Yellow Mongoose and Vaal Rhebok. Smaller mammals trapped in the Sherman traps include Four-striped grass mouse, Woodland Dormouse, Pygmy Mouse and Vlei Rat. This is likely to represent the typical mammalian fauna of much of the power line route as the majority of broad habitats present within the grid connection corridor are also present within the wind farm area. It is only thicket communities that are not represented within the Impofu Wind Farm area and there are no mammals present in these areas that are not likely to be present within the wind farm area.

Species of conservation concern recorded or known to occur in the wider area include the African Striped Weasel *Poecilogale albinucha* (Near Threatened), Leopard *Panthera pardus* (Vulnerable), Cape Clawless Otter *Aonyx capensis* (Near Threatened) and Blue Duiker *Philantomba monticola* (Vulnerable). The Blue Duiker is associated with indigenous forest patches and is confirmed present within the wind farm area and certainly also occurs in the well forested areas within the grid corridor especially in the vicinity of the Van Stadens River. The Leopard would be restricted to the mountainous terrain along the northern margin of the corridor and it is not likely that it would be impacted by the development. The Striped Weasel is present in the area, but the limited extent of long-term habitat loss associated with the power line would not significantly impact this species. The Cape Clawless Otter is also confirmed present and occurs along the coast as well as along the drainage systems of the area. Significant impact to the habitat of the otter is not likely as the drainage features along the power line route will be spanned and no direct impact to the riparian areas should occur.

Habitats of above average significance for mammals along the grid corridor include drainage lines and wetlands, areas of intact valley thicket, forest patches and the dense thicket and forested areas within the Albany Coastal Belt. Although some impact to some of these areas is unavoidable, the local impact of the power line in any specific area is generally low, especially where the power line route aligns with the existing power line routes. The total extent of habitat loss within each habitat along the power line is low and a significant resulting impact on mammals is considered unlikely and no species would likely be disproportionately impacted by the proposed power line. The major impact would occur at the construction phase as a result of habitat loss with impacts during operation likely to be low as there is little scope for negative interaction between the power line and mammals.

3.3.2. Reptiles

According to the ReptileMap database nearly 70 reptiles have been recorded in the broad area around the grid corridor. Species observed during the current study include Rhombic Night Adder, Cross-marked Snake, Cape Girdled Lizard, Cape Grass Lizard, Cape Skink, Variegated Skink and Common Ground Agama. Approximately 20 additional species have been recorded during previous EIA studies in the area and provides a reliable indication that these species would be present along the grid corridor as well.

Listed species known from the area include the Elandsberg Dwarf Chameleon *Bradypodion taeniabronchum* (Endangered), FitzSimons' Long-tailed Seps *Tetradactylus fitzsimonsi* (Vulnerable), Saltmarsh Gecko *Cryptactites peringueyi* (Critically Endangered), Albany Sandveld Lizard *Nucras taeniolata* (Near Threatened) and Albany Adder *Bitis albanica* (Critically Endangered). Several of these species occur outside of the grid corridor or there is no suitable habitat within the corridor. This includes the Saltmarsh Gecko, Albany Adder and Elandsberg Dwarf Chameleon. The Saltmarsh Gecko occurs around the margins of estuaries and would not be affected by the development. The Albany Adder is of high concern, but occurs east of Port Elizabeth towards Coega, associated with Coega Bontveld and this habitat is not present within the grid corridor. The Elandsberg Dwarf Chameleon is generally associated with montane fynbos at high elevation, but has also been found near the coast at St Francis. As such, there is a low possibility that it would be

present in some of the intact fynbos sections of the route. However, this is not likely to be a significant impact and is not considered a significant concern. The Albany Sandveld Lizard is highly likely to occur within the grid corridor in the intact sections of route between the Gamtoos River and Port Elizabeth. It is likely that the development of the power line would result in some habitat loss for this species but this would be of limited extent and not likely to significantly impact this species.

Overall, impacts on reptiles are likely to be relatively low due to the transformation of much of the grid corridor and the low footprint within the intact areas.

3.3.3. Amphibians

A total of 23 frog species have been recorded from the broader area around the grid corridor route. This includes two species of conservation concern, the Giant Bullfrog *Pyxicephalus adspersus* (Near Threatened) and Hewitt's Ghost Frog *Heleophryne hewitti* (Critically Endangered). In the broader study area, Hewitt's Ghost Frog is restricted to a few tributaries of the Gamtoos river in the Elandsberg mountains. Monitoring in this area has revealed that it is restricted to four river systems, the Geelhoutboom, Martins, Klein and Diepkloof rivers. The proposed corridor is well to the south and east of high-lying areas where this species is known to occur and it would not be directly impacted by the power line. This is in line with the information contained within the Longmore Conservation Management Plan. The Giant Bullfrog occurs in the lowland thicket and karroid vegetation types and breeds in shallow, usually vegetated pans or silted-up farm dams. No such features were observed along the grid corridor and if present, these would likely be avoided by the power line.

Species observed to be common in the area include Cape River Frog, Common Caco, Bronze Caco and Raucous Toad (Figure 37). There are numerous earth dams, wetlands and drainage lines present along the grid corridor which represent important habitat for frogs. However, as these features would be avoided as far as possible, direct impact on important amphibian habitats would be low and no significant impacts on any particular species or habitats would occur.

Figure 37. Frogs commonly observed in the area include from top right, Common Caco, Cape River Frog and Raucous Toad.

3.3.4. Invertebrates

Based on the LepiMap database of the Virtual Museum, a total of 117 moths and butterflies have been identified within the study area. This does not include any listed species, suggesting that impacts on butterflies are not likely to be highly significant. As the distribution of butterflies and in particular rare species is generally fairly well known, the database is considered to be a reliable source of information in terms of the potential presence of species of concern. Provided that herbicides and pesticides are not used within the power line corridor, then these features are generally considered to represent favourable environments for many invertebrates. The more open vegetation is favourable for many butterfly species' caterpillar stage as well as other insects such as bees. While high voltage lines such as 765kV power lines can generate fairly powerful electromagnetic fields (EMF) which are known to have some negative impact on fauna including bees, the lower voltage lines such as 132kV lines generate significantly lower EMF levels and are not known to significantly impact insects. There are various studies which have demonstrated the potential benefits of power line corridors on bees including Russel et al. (2018) and Wagner et al. (2014) as well as on butterflies Komonen et al. (2013) and Berg et al. (2016). However, these effects tend to be context specific and while some species benefit, there are also more general negative impacts where there is a loss of intact habitat or where poor management results in habitat degradation. However, based on the literature, it is clear that there is not a universal negative impact on insects such as bees and butterflies from power line infrastructure and such species are not especially vulnerable to lower voltage power lines and their associated impacts. As such, a long-term significant impact of the development on insects is considered unlikely.

3.4. PROTECTED AREAS & CRITICAL BIODIVERSITY AREAS

The combined CBA map for the study area is depicted below in Figure 38. That part of the study area within the Nelson Mandela Bay Municipality (NMBM) is considered significantly more reliable and of greater consequence than the Eastern Cape CBA map. In addition, the NMBM Biodiversity Plan has been gazetted and adopted by the relevant authority with the result that the activities associated with CBAs as listed in the Listing Notices come into effect. In addition, there are also associated land-use guidelines for the different levels of the plan. According to these guidelines, power lines are not considered compatible with CBAs within the NMBM. However, where this aligns with existing infrastructure, this is more likely to be considered acceptable. In the areas outside of the NMBM, the CBAs are considered to be less well supported and include extensive transformed areas which are traditionally not included into CBAs unless they serve a critical function. In the current case, the transformation layer for the area does not appear to have been considered when developing the Eastern Cape CBA layer. Where the areas mapped as CBA have been transformed, development is not considered to significantly impact the CBAs in these areas.

However, there are several sections of the power line route where avoidance of CBAs will not be possible and some habitat loss within the CBAs will occur. Development within CBAs is not recommended as this may result in direct biodiversity loss within the CBA or compromise the ecological functioning of the CBA. It is also important to recognise that the CBA layer is designed to identify an efficient set of Critical Biodiversity Areas (and Ecological Support Areas) that meet the targets for the underlying biodiversity features in as small an area as possible and in areas with least conflict with other activities. Of fundamental importance is that these areas are identified in a configuration that deliberately facilitates the functioning of ecological processes (both currently and in the face of climate change) which are required to ensure that the biodiversity features persist in the long term. A consequence of this is that in many areas, a specific habitat is not substitutable for another area as it may not be able to serve the same role in terms of connectivity and meeting the required targets.

In terms of the implications of the CBA maps for the alignment of the power line, the CBAs within the NMBM should be taken into account as much as possible. However in some sections, the corridor is constrained by various factors and some impact on CBAs is unavoidable. In the NMBM, specific attention should be paid to reducing impact on intact vegetation as much as possible and aligning with existing disturbances as much as possible as novel disturbances to the larger intact CBAs is not desirable. In addition, those CBAs within vegetation types which also have a high conservation status are considered to be of greater concern than CBAs within vegetation types that are classified as Least Concern. The final alignment should be reviewed to ensure that an acceptable impact on CBAs has been achieved. The footprint of the power line in any one place is however low and as a result a significant loss of biodiversity within the CBAs is highly unlikely and the potential for disruption of ecological processes is also very low.

The majority of the western two-thirds of the power line are within the Garden Route Biosphere Reserve. As a Biosphere Reserve, the Garden Route Biosphere Reserve is managed in line with the Lima Action Plan for UNESCO's Man and the Biosphere (MAB) Programme and its World Network of Biosphere Reserves. Of particular relevance to the current study is the following

strategic action area of the plan, "*To enhance the conservation of biodiversity and cultural heritage, maintain ecosystem services and foster the sustainable and equitable use of natural resources*." The purpose of Biosphere Reserves is thus to enhance both human and environmental well-being in the context of living landscapes. The current development does not impact any core areas of the biosphere reserve due to it firstly and foremost being linear in nature and as such has a small impact in any one area, and secondly would not compromise the ecological functioning of the landscape or any of the ecosystem services currently being provided by the affected area. Furthermore, it would service a wind energy development which is an important step in the transition away from fossil fuel-derived energy that the country currently relies very heavily on. As such, the development is seen as being compatible with the overall goals associated with Biosphere Reserves.

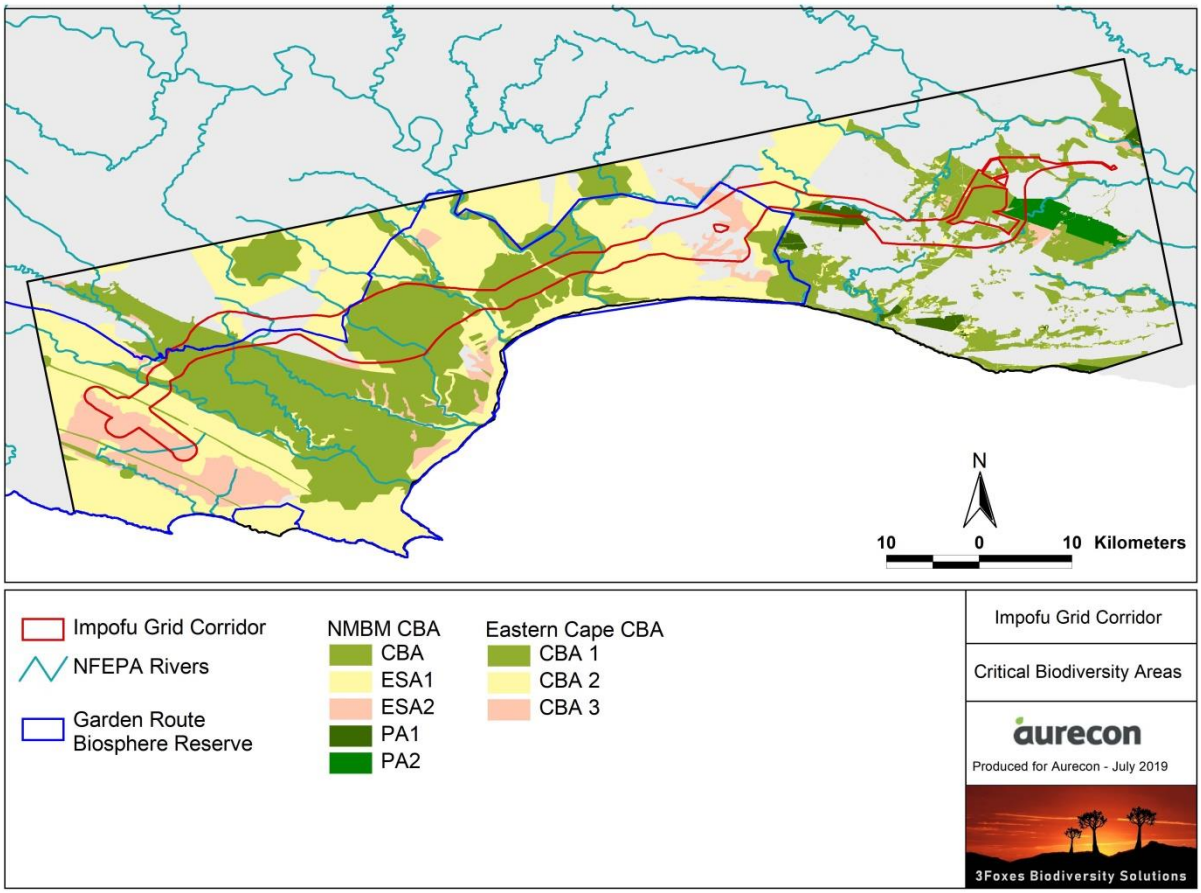

Figure 38. Critical Biodiversity Areas map for the Impofu Grid Corridor. The NMBM CBA map is considered of greater significance than the Eastern Cape CBA which was made a coarse scale compared to the NMBM CBA. The map also shows the boundaries of the Garden Route Biosphere Reserved which includes much of the route.

3.5. LISTED ECOSYSTEMS

Listed ecosystems for the study area have been derived from several sources, including the Nelson Mandela Bay Municipality Conservation Assessment, the STEP programme and the National List of Threatened Ecosystems. The combined map is illustrated below and indicates the remaining extent to listed ecosystems within the study area (Figure 39). While large areas fall within listed ecosystems, many of these areas have experienced large amounts of transformation with the result

that the power line can frequently be routed through these areas with minimal impact on remaining intact vegetation fragments. There are however several areas where there are extensive intact tracts of vegetation that cannot be avoided and where some impact on listed vegetation will occur. In such areas, it is recommended that the line is located adjacent to the existing power lines or next to roads or other existing linear disturbance. As the indigenous vegetation along the route is generally short, clearing beneath the power line should not be required, with the result that habitat loss and transformation would be restricted largely to pylon foundations and access roads. Consequently, the total loss within any particular vegetation type would be low and distributed in a linear manner along the power line. The overall impact of the power line is therefore considered to be relatively low, but impact to critically endangered ecosystems should be avoided as much as possible as impact to these areas cannot be well mitigated.

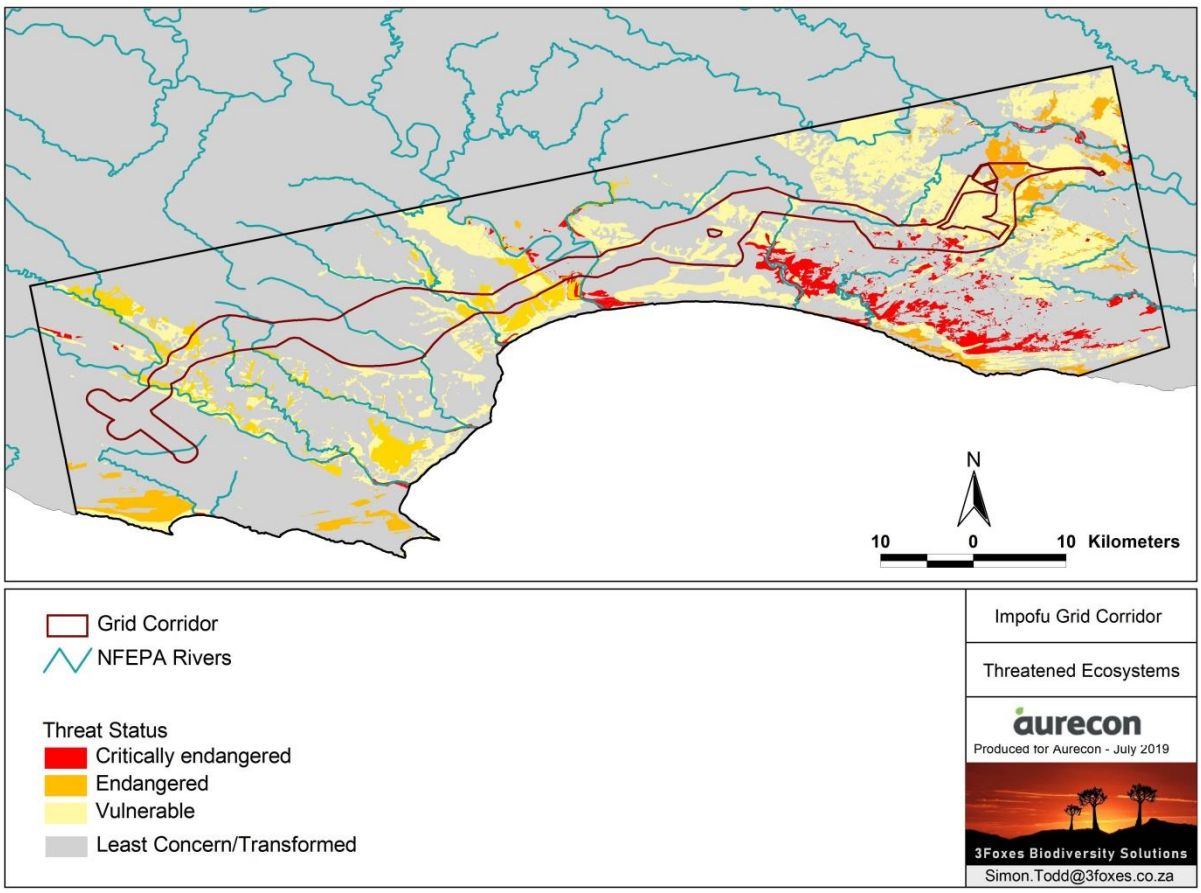

Figure 39. Listed ecosystems map for the study area, based on several sources including the National List of Threatened Ecosystems and NMBM Conservation Assessment, illustrating the high level of transformation that these areas have experienced.

3.6. CUMULATIVE IMPACTS

The Impofu Grid Connection is part of the Impofu Wind Farms development and as such, the power line is not independent of the wind farms as it would require at least one of these wind farms to be built for it to also be built. As such, the consideration of cumulative impact should consider the

potential contribution of the power line as well as at least one or more of the Impofu Wind Farms. An analysis that considers the regional context and contribution of the different Impofu phases as well as the power line to cumulative impact in the area is provided below.

Table 2. Existing wind-farm related power line in the area, which are considered as part of the baseline conditions for the study area.

Project	Overhead power line	Length	Status
Baseline conditions			
Kouga Wind Energy Facility grid connection	132 kV double circuit distribution line from the existing Melkhout Substation to a new substation close to Oyster Bay, Eastern Cape	±30 km	Operational
Gibson Wind Energy Facility grid connection	132 kV line from Gibson Bay Wind Energy Facility to existing Wittekleibosch substation (Tsitsikamma Wind Energy Facility), Eastern Cape	±18 km	Operational
Tsitsikamma Community Wind Energy Facility grid connection / Wittekleibosch-Dieprivier	132 kV line from Tsitsikamma Community Wind Energy Facility to the new extension of the existing Dieprivier substation, Tsitsikama, Eastern Cape / 132 kV line from existing Wittekleibosch substation to existing Dieprivier substation, Eastern Cape	±13 km	Operational

Cumulative impacts resulting from the grid connection are considered in light of the existing baseline impacts in the area (See Table 2) as well as the potential additional impacts of the Impofu Project as a whole and then the specific contribution of the Impofu Grid Connection. The existing wind farms in the area are considered to inform the baseline status of the area and the impacts associated with these existing wind farms and grid lines is also used to inform the likely impacts associated the current development. The existing distribution of impact in relation to the location of the current site is also considered to be an important factor in evaluating cumulative impact as the affected environment becomes increasingly different as one moves away from the site.

In terms of the existing baseline, the Kouga Wind Farm is located immediately east of the Impofu Wind Farm site and the Gibson Bay Wind Farm immediately west of the site. The impact of the Kouga Wind Farm on terrestrial ecosystems is seen as low, as the impact on natural to near natural habitats from this development was very low. The Gibson Bay Wind Farm has had a larger impact on intact Southern Cape Dune Fynbos and the extent of habitat loss from this development is estimated at 50 ha of natural to near-natural vegetation, which is considered to represent a moderate local impact. The Tsitsikamma Community Wind Farm is located 5 km west of the site and is located on Tsitsikamma Sandstone Fynbos which would also be affected by the Impofu Wind Farm. The contribution of the Tsitsikama Community Wind Farm to habitat loss is estimated at 30 ha. The Jeffreys Bay Wind Farm is located approximately 20 km east of the Impofu site and is also seen to generate moderate impacts in the order of 40 ha. Given the nature and extent of the impact of the above wind farms on the natural environment, the overall current levels of habitat loss resulting from wind farm development can be seen to be relatively low when compared to other sources of

cumulative impact. The major driver and contributor to existing impact is clearly agricultural transformation and wind farm development has had a relatively minor role to date. The extent and distribution of habitat loss that has occurred to date is important to consider as this provides an indication of existing impact as well as the vulnerability of the system to further impact. Overall, the ecological baseline for the area is considered to be significantly impacted by transformation and the remaining intact vegetation corridors are considered especially important for the maintenance of ecological functioning of the landscape.

The potential contribution of the Impofu Project as a whole to cumulative impact is considered to be relatively low. The total extent of habitat loss from all three Impofu WEFs is estimated at less than 20 ha of Tsitsikamma Sandstone Fynbos and less than 10ha of Southern Cape Dune Fynbos, much of which is within highly degraded habitat. Given that there is still a relatively large remaining extent of Tsitsikamma Sandstone Fynbos, the habitat loss within this vegetation unit is not considered to be of high significance, especially as this is spread as numerous small footprints across a large area and includes a large proportion of highly degraded areas. The Impofu East project is the only one that results in habitat loss within the Southern Cape Dune Fynbos vegetation type with the result that the whole contribution is associated with the Impofu East WEF and the other two projects do not contribute to impacts within this vegetation type. It is important to consider the spatial arrangement of impact resulting from all three Impofu Projects as there is a risk that important ecological corridors and processes may be disrupted. However, the footprint within intact vegetation is spread across a very wide area and is composed of many small footprint areas. The result of this is that there are no important corridors or other ecological processes that are likely to be significantly impacted by the Impofu Wind Farms. Similarly, the overall impact on species of concern would also be low as the density of such species within the footprint was observed to be low, overall and within each individual project. The power line however traverses some sensitive habitats that cannot be avoided and some residual impact on habitats and vegetation of high value cannot be avoided. The linear nature of the power line however means that impacts within any one area is relatively low and as a result, the total cumulative impact generated along the power line also remains low.

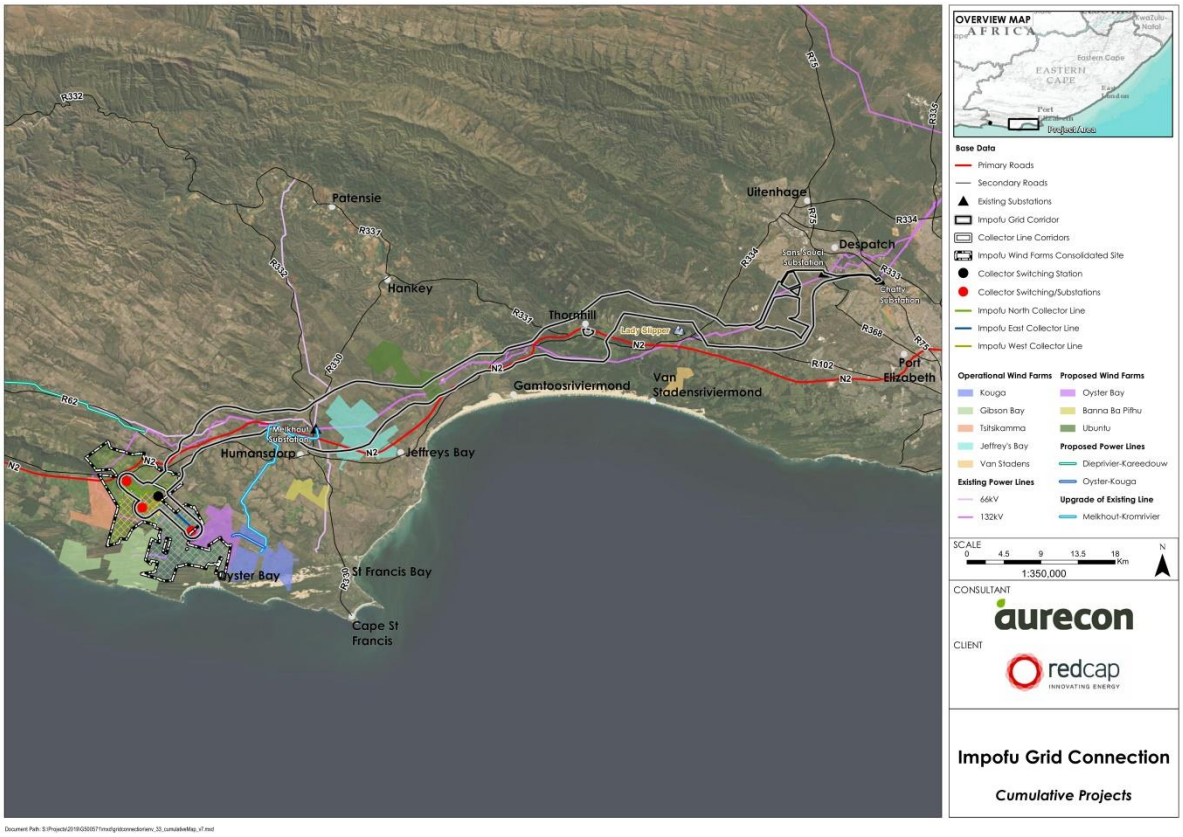

Figure 40. Map of other renewable energy and linear developments in the corridor area.

3.7. SITE SENSITIVITY ASSESSMENT

The ecological sensitivity map for the study area is illustrated below in Figure 41. The sensitivity of the route varies a lot and is driven primarily by the high degree of transformation that some areas have experienced and the contrasting high conservation value of the some of the remaining intact areas. The on-site and collector substation positions are all located within areas that are transformed or highly degraded and no significant impacts from this component of the development is likely. The power line itself is relatively long and as a result traverses a wide range of habitats and ecosystems including a variety of listed or sensitive ecosystems. In many areas, impact to these features can likely be avoided through careful route planning. However, there are also some constrained sections of the route, where some impact on high-value natural habitats is highly likely to occur. However, due to the linear nature of the power line, the impact in any one place is low and significant habitat loss or impact within sensitive areas can be reduced through careful placement of the pylons and reducing the development footprint as much as possible.

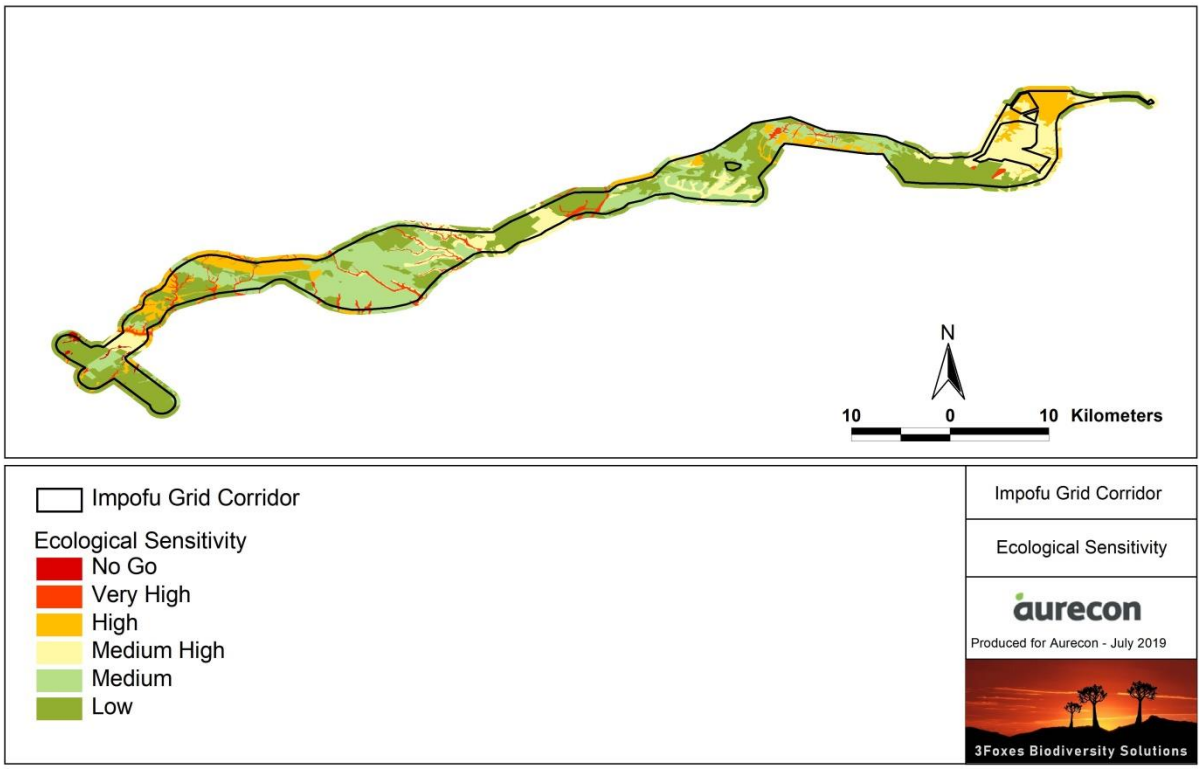

Figure 41. Ecological sensitivity map for the Impofu Grid Connection corridor as well as a 500m buffer around the corridor.

4. IMPACT ASSESSMENT

4.1. IDENTIFICATION OF KEY POTENTIAL IMPACTS

The major impact of the development would result from the loss of currently intact habitat. The actual extent of habitat loss would generally be restricted to the disturbed areas around the pylon foundations, but may also result from the construction of access roads as well as general clearing of taller vegetation beneath the line to ensure compliance with power line safety standards. As such, the impact of power lines tends to be greatest in dense taller vegetation types such as forest and relatively low in shorter fynbos where active vegetation clearing beneath the line is not required. Vegetation clearing may impact plant species of conservation concern as well as impact fauna directly through mortality and indirectly through habitat loss. The following potential impacts are identified as possibly resulting from the development of the power line and associated infrastructure:

- Impacts on vegetation and plant species of conservation concern
- Direct and indirect faunal impacts
- Increased erosion
- Impacts on Critical Biodiversity Areas
- Cumulative impacts on habitat loss and broad-scale ecological processes

The following potential impacts are assessed within each phase of the development:

4.1.1. Construction Phase

- Impacts on vegetation and plant species of conservation concern
- Direct and indirect faunal impacts

4.1.2. Operational Phase

- Increased soil erosion
- Impacts on Critical Biodiversity Areas

4.1.3. Decommissioning Phase

- Faunal Impacts
- Increased soil erosion

4.1.4. Cumulative impacts

- Cumulative impacts on habitat loss and broad-scale ecological processes

4.1.5. No-go Alternative

This entails consideration of what would happen to the site if the development does not go ahead and the current trends in land use continue on their current trajectories.

4.2. IMPACT ASSESSMENT CRITERIA

A summary of the impact assessment approach and methodology is provided below. A full description of the methodology is provided in the main BA Report and is not repeated in full here.

For each predicted impact, certain criteria are applied to establish the likely significance of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place. These criteria include the intensity (size or degree scale), which also includes the type of impact, being either a positive or negative impact; the duration (temporal scale); and the extent (spatial scale). The consequence of the impact is calculated as follows:

Consequence = type x (intensity + duration + extent).

To calculate the significance of an impact, the probability (or likelihood) of that impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as negligible, minor, moderate or major, and the type would be either positive or negative.

4.3. ASSESSMENT OF IMPACTS

The assessment of impacts and recommendation of mitigation measures to be applied to reduce impacts is detailed below.

4.3.1. Construction Phase Impact 1. Impacts on vegetation and plant species of conservation concern

The abundance of plant species of conservation concern is generally low although there are several sections of the corridor with the known presence of SCC or with protected species such as Milkwoods (*Sideroxylon inerme)* present. Although a preconstruction walk-through of the final power line alignment could reduce impact on such species, it is likely that there will be some unavoidable residual impact on species of concern. However, as the footprint of the power line is largely linear in nature, impact in any one area is likely to be low and it is not likely that any species would be significantly compromised or reduced as a result of the power line.

Project phase	Construction			
Impact	Impacts on vegetation and plant SCC			
Description of impact	Impact on vegetation and plant SCC due to construction of the power line and associated infrastructure.			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	• The final power line route, should be designed so as to avoid areas of high sensitivity and CBAs as far as possible. • The final power line route should be reviewed by the specialist to ensure that impacts are acceptable and that there are no parts of the power line within no-go areas. • Existing roads and access routes should be used wherever possible. • There should be a preconstruction walk-through of the power line corridor to identify species of conservation concern that should be avoided or translocated. • Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. • Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. • Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. • Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However caution should be exercised to avoid using material that might entangle fauna.			
Assessment	Without mitigation		With mitigation	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Low	The affected environment will not be able to recover from the impact - permanently modified
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	Moderate - negative		Minor - negative	
Comment on significance	While there is some scope for avoidance of sensitive species and habitats, some vegetation loss is an inevitable consequence of development that cannot be avoided.			
Cumulative impacts	The area is considered vulnerable to cumulative impacts on vegetation, but the contribution of the Impofu grid connection to such cumulative impacts is considered low because of the linear nature of the power line and the resulting low local impacts.			

4.3.2. Construction Phase Impact 2. Direct and indirect faunal impacts

The construction of the power line will result in some localised habitat loss, noise and disturbance along the power line route. This will lead to direct and indirect disturbance of fauna. Some slow-moving or retiring species such as many reptiles may not be able to escape the construction machinery and would be killed. There are also several species present which are vulnerable to poaching and there is a risk that these species may be targeted. This impact would be caused by the presence and operation of construction machinery and personnel during construction and this impact would be largely transient and restricted to the construction period as a result. It is not likely that any species would be disproportionately impacted or their local populations compromised as a result of the power line construction.

Project phase	**Construction**			
Impact	**Direct and indirect faunal impacts**			
Description of impact	Construction phase impact on fauna			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	• Preconstruction walk-through of the powerline corridor to identify areas of faunal sensitivity. • Any fauna threatened by construction activities should be removed to safety by the ECO or other suitably qualified person. • Existing roads and access routes should be used wherever possible. • During construction all vehicles should adhere to demarcated tracks or roads and the speed limit should not exceed 40km/h on larger roads and should be 20-30km/h on smaller access tracks. • All construction staff should undergo environmental induction before construction commences in order to raise awareness and reduce potential faunal impacts. • To avoid impacts on amphibians, all spills of hazardous material should be cleared in the appropriate manner according to the nature and identity of the spill and all contaminated soil removed from the site. • Avoid the use of machinery within sensitive faunal habitats such as drainage lines and wetlands. • No fires should be allowed within the site as there is a risk of runaway veld fires. • If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards. • All hazardous materials 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.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Short term	impact will last between 1 and 5 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Almost certain /	It is most likely that the impact will	Likely	The impact may occur
Confidence	High	Substantive supportive data exists	High	Substantive supportive data exists
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Minor - negative**	
Comment on significance	While there is some scope for avoidance of sensitive habitats, some disturbance and habitat loss is an inevitable consequence of development that cannot be entirely avoided.			
Cumulative impacts	Cumulative impacts on fauna are predicted to be to low because of the linear nature of the power line and low likely impact on high-value faunal habitats such as riparian areas.			

4.3.3. Operational Phase Impact 1. Increased soil erosion risk during operation

The disturbance created during construction of the power line may leave parts of the grid connection corridor vulnerable to soil erosion. Erosion has negative consequences for fauna and flora in the areas where soil is being lost and may also impact aquatic ecosystems through high silt inputs. This will need to be managed in the operational phase to ensure that vulnerable areas are stabilised.

Project phase	**Operation**			
Impact	**Increased soil erosion risk**			
Description of impact	Soil erosion as a result of the disturbance created during construction			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	• Disturbance within or near the drainage lines should be kept to a minimum. No pylons should be located within drainage lines or the adjacent floodplains. • Any roads along slopes should have water diversion structures placed at regular intervals to ensure that they do not capture overland flow and become eroded. • Any erosion problems observed along the power line servitude should be rectified as soon as possible using the appropriate revegetation and erosion control works.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Long term	Impact will last between 10 and 15 years	Medium term	Impact will last between 5 and 10 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Low	The affected environment will not be able to recover from the impact - permanently modified
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Minor - negative**	
Comment on significance	With mitigation, this impact can be well avoided and erosion reduced to a low level.			
Cumulative impacts	Erosion would contribute to habitat degradation in the area.			

4.3.4. Operational Phase Impact 2. Impacts on Critical Biodiversity Areas

Several parts of the power line will be located within CBAs and Ecological Support Areas. This is of potential concern especially where the CBAs are related to the presence of listed ecosystems which have already experienced a high degree of transformation and which would consequently be more vulnerable to additional impact. However, in most cases, the linear nature of power line development results in low local post-mitigation impacts and it is highly unlikely that the power line would significantly compromise the biodiversity or ecological functioning of any of the CBAs present along the route.

Project phase	**Operation**			
Impact	**Impacts on Critical Biodiversity Areas**			
Description of impact	Operational phase impact on Critical Biodiversity Areas and ESAs.			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	• CBAs should be avoided by the final power line alignment as much as possible, especially where these related to listed ecosystems or sensitive habitats such as forest or wetlands. • The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas as far as possible. • The taller woody vegetation should only be cleared where this is necessary for operational safety of the power line. Taller succulent species such as euphorbias should be left in place as they do not pose a fire risk as such species do not burn. • The final power line route should be checked by the specialist to ensure that impacts are acceptable and that no areas of high sensitivity would be significantly impacted by the development.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	On-going	Impact will last between 15 and 20 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Minor - negative**	
Comment on significance	Impacts of the power line are largely local in nature as a result of the linear nature of the power line.			
Cumulative impacts	Cumulative impacts on CBAs are seen as highly undesirable as many areas of CBAs within the broader study area have already been lost to agricultural transformation since the map was made and the overall ecological functioning of the area is being compromised as a result. The contribution of the current development to such transformation is however low due to the linear nature of the power line.			

4.3.5. Decommissioning Phase Impact 1. Faunal impacts due to decommissioning

Decommissioning will likely require the use of heavy machinery along the power line to remove the pylons, which may impact fauna present within these areas. This would however be a localised impact and likely restricted to the immediate vicinity of the pylons.

Project phase	**Decommissioning**			
Impact	**Faunal impacts due to decommissioning**			
Description of impact	Impact on fauna due to decommissioning			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	- Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities. - All hazardous materials 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 vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. - No excavated holes or trenches should be left open for extended periods as fauna may fall in become trapped. - All above-ground infrastructure should be removed from the site.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Short term	impact will last between 1 and 5 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Minor - negative**	
Comment on significance	Decommissioning will be of short duration and no long-term impacts are likely.			
Cumulative impacts	Decommissioning will contribute towards cumulative impacts in the area, but this would be transient and no long-term impacts from decommissioning are likely to occur.			

4.3.6. Decommissioning Phase Impact 2. Increased soil erosion risk following decommissioning

The disturbance created during decommissioning of the power line may leave parts of the power line route vulnerable to soil erosion. Erosion has negative consequences for fauna and flora in the areas where soil is being lost and may also impact aquatic ecosystems through high silt inputs. This will need to be managed in the operational phase to ensure that vulnerable areas are stabilised

Project phase	**Decommissioning**			
Impact	**Increased soil erosion risk**			
Description of impact	Soil erosion as a result of the disturbance created during decommissioning			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	• Disturbance within or near the drainage lines should be kept to a minimum. • Any roads along slopes should have water diversion structures placed at regular intervals to ensure that they do not capture overland flow and become eroded. •Erosion should be monitored annually for at least 3 years after decommissioning and any erosion problems observed along the power line servitude should be rectified as soon as possible using the appropriate revegetation and erosion control works.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Medium term	Impact will last between 5 and 10 years	Short term	impact will last between 1 and 5 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Likely	The impact may occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	With mitigation, erosion risk can be reduced to a low level			
Cumulative impacts	Eorsion would contribute to habitat degradation in the area			

4.3.7. Cumulative Impact 1. Cumulative habitat loss and impact on broad-scale ecological processes

The affected area has a high level of existing impact and there are also several other operational wind energy developments in the area. The current power line development would potentially contribute to further cumulative impacts on habitat loss and fragmentation and negative impact on broad-scale ecological processes such as dispersal and climate change resilience. However, the current levels of cumulative impact which can be attributed to wind farm and power line development within the area remains low.

Project phase	**Operation**			
Impact	**Cumulative habitat loss and impact on broad-scale ecological processes**			
Description of impact	Cumulative impact on broad-scale ecological processes			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	• 'Avoid and minimise impact to restricted and specialised habitats such as forest or wetlands. • Minimise the development footprint within CBAs as far as possible. • Minimise clearing along the power line servitude to the minimum required to meet the required standards. • Use existing access roads wherever possible.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Municipal area	Impacts felt at a municipal level	Municipal area	Impacts felt at a municipal level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Likely	The impact may occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Minor - negative**	
Comment on significance	The low contribution of the current development to cumulative impact is facilitated by the linear nature and low local footprint of the power line			
Cumulative impacts	There are already several poer lines in the affected area with the result that cumulative impacts from power line construction is increasing in the area. The contribution of the current development to cumulative impact is considered to be fairly low as much of the route will run adjacent to existing linear disturbance.			

4.3.8. No-go alternative

Under the no-go alternative the power line would not be built and the route from Impofu to the Chatty substation would not be affected. As such, the current use of these areas would continue unaffected. In some areas, there is significant land use change currently underway, such as the expansion of informal settlements or housing developments. In most areas, land use is however relatively stable and there would be little change over the near future. The power line would however

have little impact on land use and once built, would not affect surrounding land uses. As such, there is little difference between the construction of the power line and no-go alternative in the long-term, apart from the small amount of habitat loss that would occur due to the construction of the power line.

5. CONCLUSIONS AND RECOMMENDATIONS

The Impofu Grid Connection traverses a wide range of habitats and ecosystems between the Impofu Wind Farms development area and the Chatty Substation. The sensitivity of the route corridor varies a lot and is driven primarily by the high degree of transformation that some areas have experienced and the contrasting high conservation value of many of the remaining intact areas. The impact within the transformed and highly degraded areas would be minimal and is not considered to be a significant concern for fauna and flora. There are however also numerous high-value ecosystems along the route corridor that may be impacted. In many areas, impact to these features can likely be avoided through careful route planning. However, there are also some constrained sections of the route, where some impact on high-value natural habitats is highly likely to occur. Areas of particular potential concern include the areas immediately east of the Gamtoos River as well as the area between Thornhill and the R334 where numerous plant species of concern occur. Due to the linear nature of the power line, the impact in any one place is low and significant habitat loss or impact within sensitive areas can be reduced through careful placement of the pylons and reducing the development footprint as much as possible.

Although there are some listed fauna known from the area, most of these occur outside the proposed corridor and would not be impacted by the development. A few species of moderate concern are likely to be present within the corridor, but impact to their habitats would generally be low and a significant long-term impact on the local populations of any fauna of concern would be low. In terms of the vegetation, avoidance and careful route planning can significantly reduce the impact of the development on vegetation. The route should align with the existing power line routes through the area as much as possible and new alignments should be avoided as far as possible as this generates a novel impact area. As the current study was for a corridor of variable width, it is recommended that the final route is verified and commented on by the specialist to ensure that a favourable final route has been identified and that impacts, locally and overall are considered acceptable.

Based on the corridor provided and the recommended avoidance measures suggested in this study, there are no negative impacts associated with the development that cannot be mitigated to a low level. As the impacts associated with the development of the Impofu Grid Connection are likely to be of low significance after mitigation, there are no fatal flaws or high post-mitigation impacts associated with the development. As such there are no terrestrial ecological reasons to oppose the development of the Impofu Grid Connection.

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7. APPENDICES

7.1.1. Appendix 1. List of Plants

List of plant species of conservation concern (SCC) derived for the different sections of the Impofu grid corridor, from the SANBI POSA database.

Family	Genus	Species	var.	Sub	Status	Route Section
Ericaceae	*Erica*	*humansdorpensis*			CR	Impofu-Melkhout
Fabaceae	*Lessertia*	*kensitii*			DD	Impofu-Melkhout
Fabaceae	*Argyrolobium*	*crassifolium*			EN	Impofu-Melkhout
Amaryllidaceae	*Brunsvigia*	*litoralis*			EN	Impofu-Melkhout
Ericaceae	*Erica*	*glandulosa*	subsp.	*breviflora*	EN	Impofu-Melkhout
Asteraceae	*Felicia*	*westae*			EN	Impofu-Melkhout
Proteaceae	*Leucospermum*	*truncatulum*			NT	Impofu-Melkhout
Iridaceae	*Moraea*	*australis*			NT	Impofu-Melkhout
Proteaceae	*Protea*	*coronata*			NT	Impofu-Melkhout
Rutaceae	*Agathosma*	*hirta*			NT	Impofu-Melkhout
Asphodelaceae	*Aloe*	*micracantha*			NT	Impofu-Melkhout
Hypoxidaceae	*Pauridia*	*minuta*			NT	Impofu-Melkhout
Fabaceae	*Polhillia*	*pallens*			VU	Impofu-Melkhout
Ericaceae	*Erica*	*glandulosa*	subsp.	*fourcadei*	VU	Impofu-Melkhout
Fabaceae	*Indigofera*	*hispida*			VU	Impofu-Melkhout
Ericaceae	*Erica*	*chloroloma*			VU	Impofu-Melkhout
Fabaceae	*Podalyria*	*cordata*			VU	Impofu-Melkhout
Celastraceae	*Gymnosporia*	*elliptica*			VU	Impofu-Melkhout
Iridaceae	*Bobartia*	*macrocarpa*			VU	Impofu-Melkhout
Fabaceae	*Aspalathus*	*pinguis*	subsp.	*australis*	VU	Impofu-Melkhout
Ericaceae	*Erica*	*glumiflora*			VU	Impofu-Melkhout
Ericaceae	*Erica*	*simulans*	var.	*tetragona*	DD	Melkhout-Gamtoos
Aizoaceae	*Lampranthus*	*zeyheri*			DD	Melkhout-Gamtoos
Asteraceae	*Berkheya*	*caffra*			DD	Melkhout-Gamtoos
Amaryllidaceae	*Cyrtanthus*	*clavatus*			DD	Melkhout-Gamtoos
Santalaceae	*Thesium*	*selagineum*			DD	Melkhout-Gamtoos
Fabaceae	*Lessertia*	*kensitii*			DD	Melkhout-Gamtoos
Asteraceae	*Arctotis*	*hispidula*			DD	Melkhout-Gamtoos
Aizoaceae	*Trichodiadema*	*rogersiae*			DD	Melkhout-Gamtoos
Aizoaceae	*Bergeranthus*	*multiceps*			DD	Melkhout-Gamtoos
Fabaceae	*Argyrolobium*	*crassifolium*			EN	Melkhout-Gamtoos
Aizoaceae	*Lampranthus*	*dilutus*			EN	Melkhout-Gamtoos
Amaryllidaceae	*Brunsvigia*	*litoralis*			EN	Melkhout-Gamtoos
Ericaceae	*Erica*	*glandulosa*	subsp.	*breviflora*	EN	Melkhout-Gamtoos
Myrsinaceae	*Rapanea*	*gilliana*			EN	Melkhout-Gamtoos
Orchidaceae	*Holothrix*	*pilosa*			NT	Melkhout-Gamtoos
Iridaceae	*Moraea*	*australis*			NT	Melkhout-Gamtoos
Iridaceae	*Tritonia*	*dubia*			NT	Melkhout-Gamtoos
Fabaceae	*Indigofera*	*tomentosa*			NT	Melkhout-Gamtoos
Hypoxidaceae	*Pauridia*	*minuta*			NT	Melkhout-Gamtoos
Ericaceae	*Erica*	*glandulosa*	subsp.	*fourcadei*	VU	Melkhout-Gamtoos

Amaryllidaceae	*Apodolirion*	*macowanii*			VU	Melkhout-Gamtoos
Ericaceae	*Erica*	*chloroloma*			VU	Melkhout-Gamtoos
Iridaceae	*Gladiolus*	*huttonii*			VU	Melkhout-Gamtoos
Asteraceae	*Othonna*	*rufibarbis*			VU	Melkhout-Gamtoos
Fabaceae	*Lotononis*	*acuminata*			VU	Melkhout-Gamtoos
Alliaceae	*Tulbaghia*	*maritima*			VU	Melkhout-Gamtoos
Rutaceae	*Agathosma*	*stenopetala*			VU	Melkhout-Gamtoos
Geraniaceae	*Pelargonium*	*suburbanum*	subsp.	*suburbanum*	VU	Melkhout-Gamtoos
Scrophulariaceae	*Selago*	*rotundifolia*			VU	Melkhout-Gamtoos
Poaceae	*Pentameris*	*longipes*			VU	Melkhout-Gamtoos
Asteraceae	*Othonna*	*membranifolia*			DD	Gamtoos-Van Stadens
Fabaceae	*Argyrolobium*	*trifoliatum*			EN	Gamtoos-Van Stadens
Ericaceae	*Erica*	*baueri*	subsp.	*baueri*	EN	Gamtoos-Van Stadens
Ericaceae	*Erica*	*sagittata*			EN	Gamtoos-Van Stadens
Proteaceae	*Leucadendron*	*orientale*			EN	Gamtoos-Van Stadens
Aizoaceae	*Ruschia*	*leptocalyx*			EN	Gamtoos-Van Stadens
Asteraceae	*Cineraria*	*lobata*	subsp.	*platyptera*	NT	Gamtoos-Van Stadens
Amaryllidaceae	*Cyrtanthus*	*staadensis*			NT	Gamtoos-Van Stadens
Proteaceae	*Leucospermum*	*cordifolium*			NT	Gamtoos-Van Stadens
Rutaceae	*Agathosma*	*leptospermoides*			VU	Gamtoos-Van Stadens
Asteraceae	*Cullumia*	*cirsioides*			VU	Gamtoos-Van Stadens
Ericaceae	*Erica*	*glumiflora*			VU	Gamtoos-Van Stadens
Ericaceae	*Erica*	*zeyheriana*			VU	Gamtoos-Van Stadens
Asteraceae	*Euryops*	*ursinoides*			VU	Gamtoos-Van Stadens
Aizoaceae	*Glottiphyllum*	*linguiforme*			VU	Van Stadens-Chatty
Aizoaceae	*Lampranthus*	*algoensis*			DD	Van Stadens-Chatty
Aizoaceae	*Lampranthus*	*lavisii*			DD	Van Stadens-Chatty
Aizoaceae	*Mestoklema*	*albanicum*			NT	Van Stadens-Chatty
Amaryllidaceae	*Brunsvigia*	*litoralis*			EN	Van Stadens-Chatty
Amaryllidaceae	*Crinum*	*campanulatum*			NT	Van Stadens-Chatty
Amaryllidaceae	*Crinum*	*lineare*			VU	Van Stadens-Chatty
Amaryllidaceae	*Cyrtanthus*	*clavatus*			DD	Van Stadens-Chatty
Amaryllidaceae	*Cyrtanthus*	*helictus*			DD	Van Stadens-Chatty
Amaryllidaceae	*Cyrtanthus*	*spiralis*			EN	Van Stadens-Chatty
Amaryllidaceae	*Cyrtanthus*	*staadensis*			NT	Van Stadens-Chatty
Asphodelaceae	*Aloe*	*micracantha*			NT	Van Stadens-Chatty
Asteraceae	*Amphiglossa*	*corrudifolia*			VU	Van Stadens-Chatty
Asteraceae	*Euryops*	*ericifolius*			EN	Van Stadens-Chatty

Asteraceae	*Euryops*	*linearis*			NT	Van Stadens-Chatty
Asteraceae	*Othonna*	*membranifolia*			DD	Van Stadens-Chatty
Asteraceae	*Senecio*	*hirtifolius*			CR	Van Stadens-Chatty
Asteraceae	*Senecio*	*neoviscidulus*			DD	Van Stadens-Chatty
Asteraceae	*Syncarpha*	*sordescens*			VU	Van Stadens-Chatty
Celastraceae	*Gymnosporia*	*elliptica*			VU	Van Stadens-Chatty
Ericaceae	*Erica*	*glumiflora*			VU	Van Stadens-Chatty
Ericaceae	*Erica*	*zeyheriana*			VU	Van Stadens-Chatty
Fabaceae	*Argyrolobium*	*crassifolium*			EN	Van Stadens-Chatty
Fabaceae	*Aspalathus*	*angustifolia*	subsp.	*robusta*	VU	Van Stadens-Chatty
Fabaceae	*Aspalathus*	*globosa*			VU	Van Stadens-Chatty
Fabaceae	*Aspalathus*	*intermedia*			NT	Van Stadens-Chatty
Fabaceae	*Aspalathus*	*marginalis*			DD	Van Stadens-Chatty
Fabaceae	*Aspalathus*	*recurvispina*			CR	Van Stadens-Chatty
Fabaceae	*Aspalathus*	*salteri*			NT	Van Stadens-Chatty
Fabaceae	*Cyclopia*	*genistoides*			NT	Van Stadens-Chatty
Fabaceae	*Cyclopia*	*pubescens*			CR	Van Stadens-Chatty
Fabaceae	*Podalyria*	*sericea*			VU	Van Stadens-Chatty
Fabaceae	*Psoralea*	*angustifolia*			VU	Van Stadens-Chatty
Geraniaceae	*Pelargonium*	*burtoniae*			DD	Van Stadens-Chatty
Hypoxidaceae	*Pauridia*	*minuta*			NT	Van Stadens-Chatty
Iridaceae	*Gladiolus*	*huttonii*			VU	Van Stadens-Chatty
Lobeliaceae	*Lobelia*	*zwartkopensis*			CR	Van Stadens-Chatty
Molluginaceae	*Psammotropha*	*marginata*			DD	Van Stadens-Chatty
Myrothamnaceae	*Myrothamnus*	*flabellifolius*			DD	Van Stadens-Chatty
Orchidaceae	*Disa*	*lugens*	var.	*lugens*	VU	Van Stadens-Chatty
Orchidaceae	*Holothrix*	*longicornu*			CR	Van Stadens-Chatty
Orchidaceae	*Holothrix*	*pilosa*			NT	Van Stadens-Chatty
Polygalaceae	*Muraltia*	*brevicornu*			VU	Van Stadens-Chatty
Proteaceae	*Leucadendron*	*orientale*			EN	Van Stadens-Chatty
Proteaceae	*Leucadendron*	*tinctum*			NT	Van Stadens-Chatty
Proteaceae	*Leucospermum*	*gerrardii*			NT	Van Stadens-Chatty
Rutaceae	*Agathosma*	*gonaquensis*			CR	Van Stadens-Chatty
Rutaceae	*Agathosma*	*hirta*			NT	Van Stadens-Chatty
Rutaceae	*Agathosma*	*pulchella*			VU	Van Stadens-Chatty
Rutaceae	*Agathosma*	*stenopetala*			VU	Van Stadens-Chatty
Santalaceae	*Thesium*	*patersoniae*			DD	Van Stadens-Chatty
Scrophulariaceae	*Nemesia*	*fourcadei*			DD	Van Stadens-Chatty
Scrophulariaceae	*Selago*	*polycephala*			CR	Van Stadens-Chatty
Scrophulariaceae	*Selago*	*rotundifolia*			VU	Van Stadens-Chatty

7.1.2. Appendix 2. List of Mammals

List of Mammals know from the broad area around the Impofu Grid Connection site, based on the MammalMap Database (http://vmus.adu.org.za). **Species in Bold are those confirmed present at the site.**

Family	Genus	Species	Common name	Red list category	No. records
Bovidae	*Oreotragus*	*oreotragus*	Klipspringer	Least Concern	197
Bovidae	*Pelea*	*capreolus*	Vaal Rhebok	Least Concern	2
Bovidae	***Philantomba***	***monticola***	**Blue Duiker**	**Vulnerable**	**3**
Bovidae	*Raphicerus*	*campestris*	Steenbok	Least Concern	8
Bovidae	***Raphicerus***	***melanotis***	**Cape Grysbok**	**Least Concern**	**76**
Bovidae	***Redunca***	***fulvorufula***	**Mountain Reedbuck**	**Least Concern**	**194**
Bovidae	***Sylvicapra***	***grimmia***	**Bush Duiker**	**Least Concern**	**121**
Bovidae	***Tragelaphus***	***scriptus***	**Bushbuck**	**Least Concern**	**994**
Canidae	***Canis***	***mesomelas***	**Black-backed Jackal**	**Least Concern**	**21**
Canidae	***Otocyon***	***megalotis***	**Bat-eared Fox**	**Least Concern**	**5**
Cercopithecidae	***Chlorocebus***	***pygerythrus***	**Vervet Monkey**	***Least Concern***	**13**
Cercopithecidae	***Papio***	***ursinus***	**Chacma Baboon**	**Least Concern**	**319**
Felidae	***Caracal***	***caracal***	**Caracal**	**Least Concern**	**9**
Felidae	*Felis*	*nigripes*	Black-footed Cat	Least Concern	4
Felidae	*Felis*	*silvestris*	Wildcat	Least Concern	4
Felidae	*Panthera*	*pardus*	Leopard	Least Concern	162
Herpestidae	***Cynictis***	***penicillata***	**Yellow Mongoose**	**Least Concern**	**4**
Herpestidae	*Herpestes*	*ichneumon*	Egyptian Mongoose	Least Concern	1
Herpestidae	***Herpestes***	***pulverulentus***	**Cape Gray Mongoose**	**Least Concern**	**5**
Herpestidae	*Suricata*	*suricatta*	Meerkat	Least Concern	4
Hyaenidae	*Proteles*	*cristata*	Aardwolf	Least Concern	5
Hystricidae	***Hystrix***	***africaeaustralis***	**Cape Porcupine**	**Least Concern**	**3**
Leporidae	***Lepus***	***capensis***	**Cape Hare**	**Least Concern**	**1**
Leporidae	*Lepus*	*saxatilis*	Scrub Hare	Least Concern	6
Macroscelididae	*Macroscelides*	*proboscideus*	Short-eared Elephant Shrew	Least Concern	1
Muridae	*Acomys*	*subspinosus*	Cape Spiny Mouse	Least Concern	1
Muridae	*Aethomys*	*namaquensis*	Namaqua Rock Mouse	Least Concern	55
Muridae	*Gerbilliscus*	*paeba*	Paeba Hairy-footed Gerbil	Least Concern	12
Muridae	*Mastomys*	*natalensis*	Natal Mastomys	Least Concern	22
Muridae	***Mus***	***minutoides***	**Southern African Pygmy Mouse**	**Least Concern**	**1**
Muridae	*Myomyscus*	*verreauxi*	Verreaux's Mouse	Least Concern	3
Muridae	***Otomys***	***irroratus***	**Southern African Vlei Rat**	**Least Concern**	**6**
Muridae	*Otomys*	*unisulcatus*	Karoo Bush Rat	Least Concern	12
Muridae	*Parotomys*	*brantsii*	Brants's Whistling Rat	Least Concern	3
Muridae	***Rhabdomys***	***pumilio***	**Xeric Four-striped Grass Rat**	**Least**	**65**

Family	Genus	Species	Common name	Red list category	No. records
				Concern	
Mustelidae	***Aonyx***	***capensis***	**African Clawless Otter**	**Near Threatened**	**7**
Mustelidae	***Ictonyx***	***striatus***	**Striped Polecat**	**Least Concern**	**4**
Mustelidae	***Mellivora***	***capensis***	**Honey Badger**	**Least Concern**	**31**
Nesomyidae	*Saccostomus*	*campestris*	Southern African Pouched Mouse	Least Concern	1
Pedetidae	*Pedetes*	*capensis*	South African Spring Hare	Least Concern	1
Procaviidae	*Procavia*	*capensis*	Cape Rock Hyrax	Least Concern	4
Soricidae	*Crocidura*	*flavescens*	Greater Red Musk Shrew	Data Deficient	3
Suidae	***Potamochoerus***	***porcus***	**Bush Pig**	**Least Concern**	**19**
Viveridae	*Genetta*	*maculata*	Common Large-spotted Genet	Least Concern	1
Viverridae	*Genetta*	*genetta*	Common Genet	Least Concern	1
Viverridae	*Genetta*	*tigrina*	Cape Genet	Least Concern	1

7.1.3. Appendix 3. List of Reptiles

List of Reptiles known from the vicinity of the Impofu Grid Connection site, based on records from the ReptileMap database. Conservation status is from Bates et al. 2013. **Species in BOLD are those observed at the site in the current study or during previous studies on adjacent sites.**

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Agamidae	**Agama**	**aculeata**	**aculeata**	**Common Ground Agama**	**Least Concern**	**9**
Agamidae	**Agama**	**atra**		**Southern Rock Agama**	**Least Concern**	**40**
Chamaeleonidae	Bradypodion	damaranum		Knysna Dwarf Chameleon	Least Concern	7
Chamaeleonidae	Bradypodion	sp. (barbatulum)		Beardless Dwarf Chameleon	Not Evaluated	5
Chamaeleonidae	Bradypodion	sp. (Baviaans)		Baviaanskloof Dwarf Chameleon	Not Evaluated	8
Chamaeleonidae	Bradypodion	sp. (Groendal)		Groendal Dwarf Chameleon	Not Evaluated	2
Chamaeleonidae	Bradypodion	sp. (Jagersbos)		Dwarf Chameleon sp. 2	Not Evaluated	10
Chamaeleonidae	Bradypodion	taeniabronchum		Elandsberg Dwarf Chameleon	Endangered	12
Chamaeleonidae	**Bradypodion**	**ventrale**		**Eastern Cape Dwarf Chameleon**	**Least Concern**	**4**
Colubridae	**Crotaphopeltis**	**hotamboeia**		**Red-lipped Snake**	**Least Concern**	**12**
Colubridae	Dasypeltis	scabra		Rhombic Egg-eater	Least Concern	6
Colubridae	Dispholidus	typus	typus	Boomslang	Least Concern	8
Colubridae	Philothamnus	hoplogaster		South Eastern Green Snake	Least Concern	2
Colubridae	**Philothamnus**	**natalensis**	**occidentalis**	**Western Natal Green Snake**	**Least Concern**	**8**
Colubridae	Philothamnus	semivariegatus		Spotted Bush Snake	Least Concern	3
Cordylidae	**Chamaesaura**	**anguina**	**anguina**	**Cape Grass Lizard**	**Least Concern**	**7**
Cordylidae	**Cordylus**	**cordylus**		**Cape Girdled Lizard**	**Least Concern**	**31**
Cordylidae	Karusasaurus	polyzonus		Karoo Girdled Lizard	Least Concern	4
Cordylidae	Ninurta	coeruleopunctatus		Blue-spotted Girdled Lizard	Least Concern	2
Cordylidae	Pseudocordylus	microlepidotus	microlepidotus	Cape Crag Lizard	Least Concern	24
Elapidae	Aspidelaps	lubricus	lubricus	Coral Shield Cobra	Not Evaluated	1
Elapidae	**Hemachatus**	**haemachatus**		**Rinkhals**	**Least Concern**	**2**
Elapidae	Naja	nivea		Cape Cobra	Least Concern	6
Gekkonidae	Afrogecko	porphyreus		Marbled Leaf-toed Gecko	Least Concern	18
Gekkonidae	Chondrodactylus	bibronii		Bibron's Gecko	Least Concern	5
Gekkonidae	Cryptactites	peringueyi		Saltmarsh Gecko	Critically Endangered	30
Gekkonidae	Goggia	essexi		Essex's Pygmy Gecko	Least Concern	2
Gekkonidae	Goggia	hewitti		Hewitt's Pygmy Gecko	Least Concern	8
Gekkonidae	**Hemidactylus**	**mabouia**		**Common Tropical House Gecko**	**Least Concern**	**2**
Gekkonidae	**Lygodactylus**	**capensis**	**capensis**	**Common Dwarf Gecko**	**Least Concern**	**1**
Gekkonidae	**Pachydactylus**	**maculatus**		**Spotted Gecko**	**Least Concern**	**20**
Gerrhosauridae	Tetradactylus	fitzsimonsi		FitzSimons' Long-tailed Seps	Vulnerable	2
Lacertidae	Nucras	lalandii		Delalande's Sandveld Lizard	Least Concern	3
Lacertidae	Pedioplanis	burchelli		Burchell's Sand Lizard	Least Concern	6
Lacertidae	Pedioplanis	lineoocellata	pulchella	Common Sand Lizard	Least Concern	7
Lacertidae	Pedioplanis	namaquensis		Namaqua Sand Lizard	Least Concern	3
Lacertidae	Tropidosaura	gularis		Cape Mountain Lizard	Least Concern	4
Lamprophiidae	**Boaedon**	**capensis**		**Brown House Snake**	**Least Concern**	**11**
Lamprophiidae	**Duberria**	**lutrix**	**lutrix**	**South African Slug-eater**	**Least Concern**	**11**

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Lamprophiidae	**Homoroselaps**	**lacteus**		**Spotted Harlequin Snake**	**Least Concern**	**6**
Lamprophiidae	Lamprophis	guttatus		Spotted House Snake	Least Concern	2
Lamprophiidae	Lycodonomorphus	inornatus		Olive House Snake	Least Concern	7
Lamprophiidae	Lycodonomorphus	rufulus		Brown Water Snake	Least Concern	10
Lamprophiidae	Lycophidion	capense	capense	Cape Wolf Snake	Least Concern	5
Lamprophiidae	Prosymna	sundevallii		Sundevall's Shovel-snout	Least Concern	2
Lamprophiidae	**Psammophis**	**crucifer**		**Cross-marked Grass Snake**	**Least Concern**	**4**
Lamprophiidae	**Psammophis**	**notostictus**		**Karoo Sand Snake**	**Least Concern**	**4**
Lamprophiidae	**Psammophylax**	**rhombeatus**	**rhombeatus**	**Spotted Grass Snake**	**Least Concern**	**18**
Lamprophiidae	Pseudaspis	cana		Mole Snake	Least Concern	1
Leptotyphlopidae	Leptotyphlops	nigricans		Black Thread Snake	Least Concern	14
Pelomedusidae	Pelomedusa	galeata		South African Marsh Terrapin	Not evaluated	2
Pelomedusidae	Pelomedusa	subrufa		Central Marsh Terrapin	Least Concern	1
Scincidae	Acontias	meleagris		Cape Legless Skink	Least Concern	4
Scincidae	Acontias	orientalis		Eastern Legless Skink	Least Concern	2
Scincidae	Scelotes	anguineus		Algoa Dwarf Burrowing Skink	Least Concern	13
Scincidae	**Trachylepis**	**capensis**		**Cape Skink**	**Least Concern**	**13**
Scincidae	**Trachylepis**	**homalocephala**		**Red-sided Skink**	**Least Concern**	**13**
Scincidae	Trachylepis	sulcata	sulcata	Western Rock Skink	Least Concern	26
Scincidae	**Trachylepis**	**variegata**		**Variegated Skink**	**Least Concern**	**12**
Testudinidae	**Chersina**	**angulata**		**Angulate Tortoise**	**Least Concern**	**12**
Testudinidae	Chersobius	boulengeri		Karoo Padloper	Near Threatened	1
Testudinidae	Homopus	areolatus		Parrot-beaked Tortoise	Least Concern	6
Testudinidae	Psammobates	tentorius	verroxii	Verrox's Tent Tortoise	Not Evaluated	1
Testudinidae	Stigmochelys	pardalis		Leopard Tortoise	Least Concern	32
Typhlopidae	**Rhinotyphlops**	**lalandei**		**Delalande's Beaked Blind Snake**	**Least Concern**	**7**
Varanidae	Varanus	albigularis	albigularis	Rock Monitor	Least Concern	3
Varanidae	Varanus	niloticus		Water Monitor	Least Concern	7
Viperidae	**Bitis**	**arietans**	**arietans**	**Puff Adder**	**Least Concern**	**14**
Viperidae	**Causus**	**rhombeatus**		**Rhombic Night Adder**	**Least Concern**	**6**

7.1.4. Appendix 4. List of Amphibians

List of Amphibians known from the vicinity of the Impofu Grid Connection site, based on records from the FrogMap database. Conservation status is from Minter et al. 2004. **Species in Bold are those confirmed present at the site.**

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Brevicepitidae	*Breviceps*	*adspersus*		Bushveld Rain Frog	Least Concern	8
Brevicepitidae	*Breviceps*	*fuscus*		Plain Rain Frog	Least Concern	6
Bufonidae	***Sclerophrys***	***capensis***		**Raucous Toad**	**Least Concern**	**36**
Bufonidae	*Sclerophrys*	*pardalis*		Leopard Toad	Least Concern	12
Bufonidae	*Vandijkophrynus*	*angusticeps*		Sand Toad	Least Concern	2
Bufonidae	*Vandijkophrynus*	*gariepensis*	*gariepensis*	Karoo Toad (subsp. gariepensis)	Least Concern	10
Heleophrynidae	*Heleophryne*	*hewitti*		Hewitt's Ghost Frog	Critically Endangered	6
Heleophrynidae	*Heleophryne*	*regis*		Southern Ghost Frog	Least Concern	4
Hyperoliidae	*Hyperolius*	*horstockii*		Arum Lily Frog	Least Concern	1
Hyperoliidae	*Hyperolius*	*marmoratus*		Painted Reed Frog	Least Concern	54
Hyperoliidae	*Hyperolius*	*semidiscus*		Yellowstriped Reed Frog	Least Concern	1
Hyperoliidae	*Kassina*	*senegalensis*		Bubbling Kassina	Least Concern	1
Hyperoliidae	*Semnodactylus*	*wealii*		Rattling Frog	Least Concern	5
Pipidae	***Xenopus***	***laevis***		**Common Platanna**	**Least Concern**	**14**
Pyxicephalidae	*Amietia*	*delalandii*		Delalande's River Frog	Least Concern	41
Pyxicephalidae	***Amietia***	***fuscigula***		**Cape River Frog**	**Least Concern**	**45**
Pyxicephalidae	***Cacosternum***	***boettgeri***		**Common Caco**	**Least Concern**	**41**
Pyxicephalidae	*Cacosternum*	*nanum*		Bronze Caco	Least Concern	70
Pyxicephalidae	*Strongylopus*	*fasciatus*		Striped Stream Frog	Least Concern	22
Pyxicephalidae	*Strongylopus*	*grayii*		Clicking Stream Frog	Least Concern	77
Pyxicephalidae	*Tomopterna*	*delalandii*		Cape Sand Frog	Least Concern	15
Pyxicephalidae	*Tomopterna*	*tandyi*		Tandy's Sand Frog	Least Concern	6

Annexure D2

Avifauna

BIRD IMPACT ASSESSMENT

IMPOFU 132kV GRID CONNECTION

April 2018
Revised August 2019

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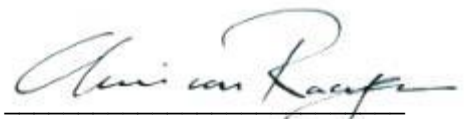
PROFESSIONAL EXPERIENCE

Chris van Rooyen

Chris has 20 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in more than 100 power line and 25 wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2015) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

DECLARATION OF INDEPENDENCE

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, and working under the supervision of and in association with Albert Froneman (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence (as well as that of Chris van Rooyen Consulting) as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of the Basic Assessment for the proposed Mpofu 132kV Grid Connection other than fair remuneration for the specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2014.



Full Name: Chris van Rooyen
Title / Position: Director

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Basic Assessment (BA) process for the 132kV Mpofu Grid Connection Project, in the Eastern Cape, South Africa.

Specialist: Contact person: Postal address: Postal code: Telephone: E-mail: Professional affiliation(s) (if any)	**Chris van Rooyen Consulting**	
	Chris van Rooyen	
	30 Roosevelt Street, Robindale, Randburg	
	2194	**Cell: 0824549570**
		Fax:
	Vanrooyen.chris@gmail.co	
	-	
Project Consultant: Contact person: Postal address: Postal code: Telephone: E-mail:	**Aurecon South Africa (Pty) Ltd**	
	Charles Norman	
	PO Box 509, George	
	6530	Cell: -
	044 805 5433	Fax: -
	Charles.norman@aurecongroup.com	

4.2 The specialist appointed in terms of the Regulations_

I, Chris van Rooyen declare that -- General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Chris van Rooyen Consulting
Name of company (if applicable):

21 August 2019
Date:

NEMA requirements for Specialist Reports		
Appendix 6	**Specialist Report content as required by the NEMA 2014 EIA Regulations, as amended**	**Section**
1 (1)(a)	(i) the specialist who prepared the report; and	Pg. 2
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg. 3-4
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	2
(cA)	an indication of the quality and age of the base data used for the specialist report;	3
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	4, 7
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	3
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	3
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	10
(g)	an identification of any areas to be avoided, including buffers;	10
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	10
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	11
(k)	any mitigation measures for inclusion in the EMPr;	9
(l)	any conditions for inclusion in the environmental authorisation;	9
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	9
(n)	a reasoned opinion-	11
	(i) whether the proposed activity or portions thereof should be authorised; and	
	(iA) regarding the acceptability of the proposed activity or activities; and	
	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	3
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See BA report
(q)	any other information requested by the competent authority.	n/a
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

EXECUTIVE SUMMARY

To evacuate the power generated by the proposed Impofu North, Impofu West and Impofu East Wind Farms, a grid connection is required in the form of an approximately 120km length of 132kV overhead power line between the wind farm project area and Port Elizabeth. The transmission line includes three short, separate 132kV high voltage overhead power lines that emanate from the proposed Impofu North, Impofu West and Impofu East substations. Alongside each substation will be a switching station. The three short, separate 132kV HV lines link each of the three switching stations on the wind farms to a combined central “collector switching station” (Impofu collector switching station).

The avifaunal habitat in which the proposed Impofu 132kV grid connection powerline corridor is located, ranges from low to very high sensitivity. There is a broad gradient from highly sensitive to least sensitive from west to east, with the habitat west of the Gamtoos River being significantly more sensitive than the habitat east of the Gamtoos River. The study area contains a rich complement of Red Data species, 23 of which have been recorded west, and 19 east of the of the Gamtoos River.

Potential impacts affecting avifauna relating to the construction and operation of the proposed power line include:

- Displacement as a result of habitat transformation and disturbance during the construction of the powerline; and
- Electrocution of large raptors on some of the proposed 132kV structures.
- Mortality due to collision of large terrestrial birds, waterbirds and raptors with the overhead power line during the operational phase;

The impact of **displacement due to disturbance** is rated as **Minor (pre-mitigation)**, and it can be further reduced to **Negligible** through the application of mitigation measures. Although the impact cannot be avoided through mitigation, except in the case of very specific instances e.g., an individual Red Data nest, the significance of the displacement due to disturbance is tempered by the temporary nature of the impact.

The impact of **displacement due to habitat destruction** is rated as **Minor (pre-mitigation)**, and it will remain at a **Minor** level, despite the application of mitigation measures. The most significant consequence of this impact is the permanent nature of the fragmentation caused by its linear nature. The displacement effect associated with the fragmentation of the habitat cannot be mitigated.

The impact of the **mortality due to collisions** with the powerline during the operational phase is rated as **Moderate (pre-mitigation)**, but it can be reduced to **Minor** after the application of mitigation measures. Collision mortality of Red Data species is likely to be the most significant impact of the proposed powerline, especially in the section west of the Gamtoos River. Mitigation in the form of Bird Flappers could reduce the impact for most avifauna, but it will have limited effectiveness for Denham's Bustard.

The impact of **mortality due to electrocutions** during the operational phase is rated as **Minor (pre-mitigation)**, but it can be reduced to **Negligible** after the application of mitigation measures. The potential mortality due to electrocution can have a significant regional impact if apex predators like Martial Eagle and African Crowned-Eagle is killed. However, the probability of it happening is low, and it should be mitigatable.

It is concluded that the construction and operation of the proposed 132kV powerline should result in manageable impacts on Red Data avifauna, provided the recommended mitigation measures are diligently implemented, including the monitoring requirements as detailed in the Environmental Management Programme (EMPr).

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Grid Connection Route

To evacuate the power generated by the proposed Impofu North, Impofu West and Impofu East Wind Farms, a grid connection is required in the form of an approximately 120 km length 132kV overhead power line between the wind farm project area and Port Elizabeth (PE). The transmission line includes three short separate 132kV high voltage (HV) overhead power lines that emanate from the Impofu North, Impofu West and Impofu East substations. Alongside each substation will be a switching station. The three short separate 132kV HV lines link each of the three switching stations on the wind farms to a combined central "collector switching station" (Impofu collector switching station). The role of the collector switching station is to consolidate the three power lines from the wind farms into one, such that a single line continues from here onwards. This will also allow Eskom more control over the management of the wind farms' connections into the national grid. The whole grid connection including the wind farm switching stations, the HV line to the collector switching stations, the collector switching station and the HV line back to PE all will be transferred to Eskom once construction is complete.

From the Impofu collector switching station, a single 132kV HV power line will continue towards PE via the Eskom Melkhout Substation. Due to the complex nature of navigating linear infrastructure, this assessment considers that a 31m servitude will be required for the construction of the powerline, but may occur within an area demarcated by a 2km buffer. Within this corridor, a single 132kV HV power line continues to the existing Eskom Melkhout substation, located to the north of the N2 and north of the town of Humansdorp. Thereafter, the corridor continues through and around the Jeffrey's Bay Wind Farm, across the Mondplaas area and Gamtoos River valley (roughly following the existing Eskom 132kV lines that come down from PE to Melkhout) towards Thornhill. It then passes through the Thornhill area, veers north and crosses the upper reaches of the Van Stadens River, then runs north of the Lady Slipper mountain area. From there, the corridor passes through the St Alban's correctional facility, continuing around the Hopewell Conservation Estate, and connects into the Nelson Mandela Bay Metropolitan Municipality (NMBM) Sans Souci substation. From Sans Souci substation the corridor then continues to the NMBM Chatty substation where the grid connection terminates. The reason the power line goes through the Eskom Melkhout substation and the NMBM Sans Souci substation is to improve the evacuation capacity and technical parameters of the grid connection, as well as improving the overall stability and reliability of the Eskom and NMBM networks.

This power line will be transferred to Eskom once constructed. From west to east, the line will pass through the Kou-Kamma Local Municipality and the Kouga Local Municipality (both falling within the Sarah Baartman District Municipality) and will terminate in NMBM.

No alternatives, other than the No-Go option, were assessed. The location/ route alternatives for the grid corridor were the subject of a Multi Criteria Decision Making (MCDM) Workshop that took place on 14 September 2017. The 2km grid corridor that is assessed in this impact assessment report emerged as the preferred alternative. All other route alignments were screened out of the project scope in the Screening Phase. In addition, there are no activity or technology alternatives for the proposed grid connection. All six possible pylons options discussed in this report are required for the project. However, the 247 type lattice structure would only be used if a landowner specifically asked for it or it is required to get the power line over a significant river crossing/ gorge rather than using the triple monopole option. There are also no layout alternatives since it is a linear project. Micro-siting of the transmission line route and pylons will take place during the detailed design phase of the project.

See Figure 1 for a map of the study area, indicating the 2km assessment corridor.

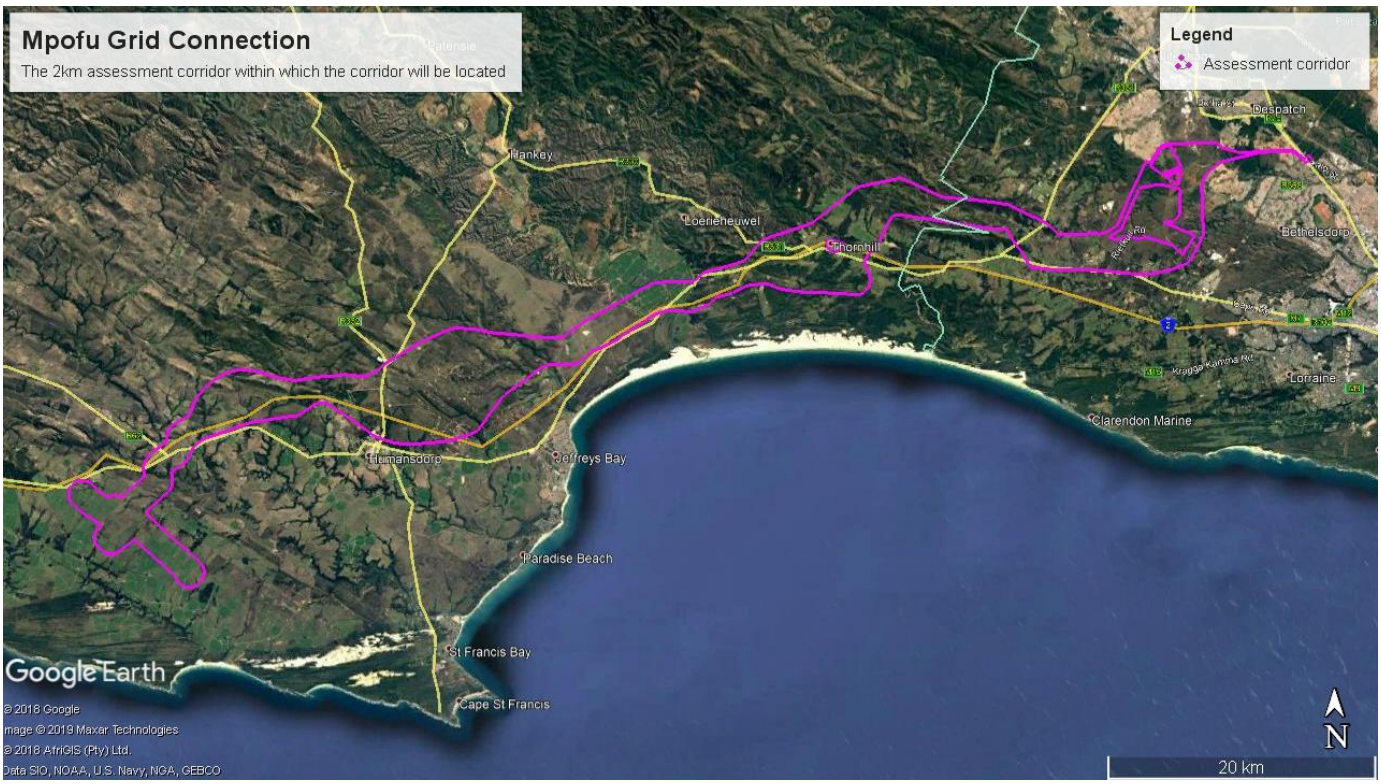


Figure 1: The 2km assessment corridor for the proposed 132kV Impofu grid connection.

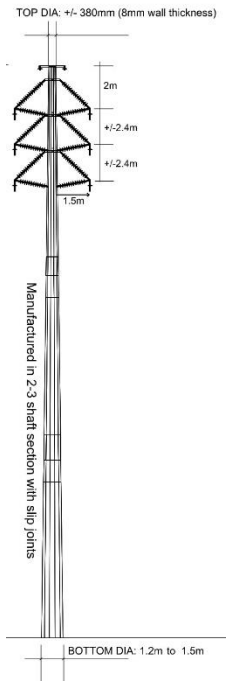
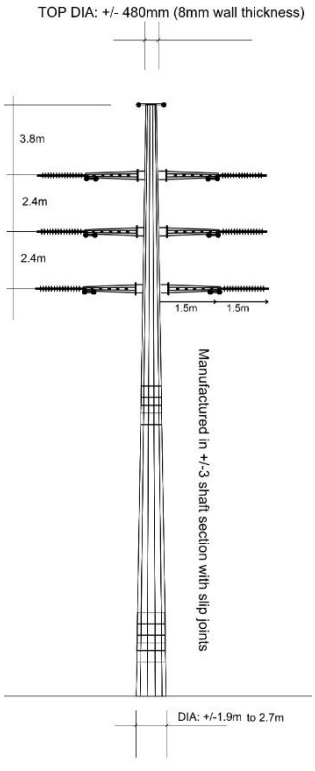
1.2 Infrastructure

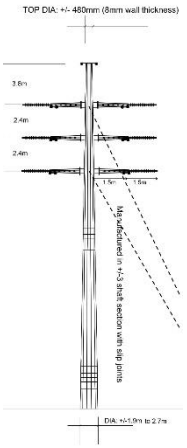
Each wind farm application will include an on-site substation with transformer. The transformer will convert the power received from the turbines from either above ground or underground medium voltage (MV) lines (33kV or lower) to high voltage (HV) 132kV. The three on-site substations are assessed as part of the wind farm applications and therefore do not form part of this assessment. Adjacent to each substation will be a switching station, which will be owned by Eskom. The Eskom switching stations will each have a total footprint of approximately 150 x 75 m (11,250 m²). The single collector switching station will have a total footprint of approximately 150 x 150 m (22,500 m²).

1.3 Pylons

There are six potential types of pylons that may be used for the 132kV high voltage overhead line. The descriptions are included in Table 1 below. The spans (distance between pylons) on the monopole structure (without stays) will be on average 260 m, whilst the spans between the triple poles in the case of valley crossings may be up to 800 m. The type of pylon and distance of the spans depend on the topography and alignment of the line. The length of the stand-off insulators will be 1.5m.

Table 1: Types of pylons to be used for the double circuit twin tern 132kV Impofu grid connection

	Pylon Type	Description and purpose	Graphic
1.	Monopole intermediate Double Circuit with Twin Tern Conductors	Self-supporting galvanised steel Suspension structure with no stays/anchors. For general use as intermediate structures between turning/angle points. Height: 26-32 m Base diameter: 1.2m to 1.5m	 
2.	Monopole strain (0º-30º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvinised steel Strain Angle structure with no stays/anchors. For general use up to 30º turning/angle points Height: 26-32 m Base diameter: 1.9m to 2.7m	 

	Pylon Type	Description and purpose	Graphic
3.	Monopole strain (30º-90º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvanised steel Strain Angle structure with additional stays/anchors. For general use between 30º to 90º at turning/angle points. Height: 26-32 m Base diameter: 1.9m to 2.7m 5 to 7 stays/anchors	 
4.	Monopole strain (30º- 90º angle) 2 x Single Circuit Twin Tern Conductor	2 x Strain Angle galvanised steel structure with stays/anchors. Two single circuit monopoles installed 10m apart to accommodate a twin Tern Conductor attachment each. For general use between 30º to 90at turning/angle points and where it is acceptable for the landowner. Height: 20m - 24m 5 to 7 stays/anchors	
5.	Triple pole structure. 2 x Single circuit with Twin Tern Conductor	For long spans (>350m to 500m) across valleys and rivers. Strain structure with three single monopoles per circuit. 5-9 stays per triple pole structure depending on angle configuration. Typical 18 to 16m in length. In a double circuit configuration it will be a triple pole structure per circuit place at 10m-15m apart	

	Pylon Type	Description and purpose	Graphic
6.	Strain Lattice Tower (247 type) for Double Circuit Twin Tern Conductor	For very long spans (>500m) across valleys and rivers. Lattice structure with four legs Height: 28m to 32m Base of the tower with 4 legs in general 15m x 15m area.	

2 TERMS OF REFERENCE

The terms of reference for this assessment report are as follows:

- Describe the affected environment and avifauna in the broader area, with a particular focus on regionally and globally Red Listed species.
- Identify and discuss potential impacts of the proposed project on regionally and globally Red Listed avifauna during construction and operation.
- Identify information gaps and limitations.
- Discuss and assess the potential impacts of the proposed powerline on birds.
- Suggest mitigation measures to reduce the potential impacts, and
- Identify actions to be included in the construction and operational Environmental Management Plans.

3 STUDY APPROACH

3.1 Definitions

- 2km corridor: This refers to a corridor of approximately 2km in diametre within which the proposed line should ideally be situated. This area forms the focus of this impact assessment report (see Figure 1).
- Initial assessment corridor: This refers to the broader area which was assessed for purposes of the screening exercise performed in October 2017. The corridor is approximately 110km long and ranges from 7 – 25km wide. It includes both the 5km and the 2km corridor.

3.2 Data sources

The study made use of the following data sources:

- Bird distribution data of the South African Bird Atlas 2 (SABAP2) was obtained from the Animal Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the initial assessment corridor. The initial assessment corridor was divided into two sections i.e. the area between Impofu and the Gamtoos River (western section), and the area between the Gamtoos River and PE (eastern section), based on overall avifaunal sensitivity. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. The western section comprises roughly 29 pentads, and the eastern section 19 pentads. Between 2007 and 2017, a total of 1 427 full protocol cards (i.e. bird surveys lasting a minimum of two hours each) were completed for the western section, and a total of 864 full protocol cards were completed for the eastern section.
- The Important Bird Areas project data was consulted to get an overview of important bird areas (IBAs) which may be impacted by the proposed powerline (Marnewick *et al*. 2015).
- The Coordinated Waterbird Counts project (CWAC) of the Animal Demography Unit at UCT was consulted to identify waterbodies and wetlands registered as CWAC sites in the assessment corridor.
- The power line bird mortality incident database of the Endangered Wildlife Trust (1996 to 2007) was consulted to determine which of the species is typically impacted upon by power lines (Jenkins *et al.* 2010).
- The Wildlife and Energy Programme Manager at the Endangered Wildlife Trust was consulted on the electrocution potential of the proposed pylon structures.
- Data on biomes was obtained from the National Vegetation Map (2009) on the SANBI website.
- Data on wetlands and waterbodies were obtained from the National Freshwater Ecosystem Priority Areas Project (NFEPA) wetlands database (SANBI 2012).
- The avifaunal conservation status was determined as per the most recent iteration of the South African Red Data list for birds (Taylor *et al.* (eds) 2016), the 2017.2 IUCN Red List of Threatened Species and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- Pre-construction monitoring and impact assessment reports for other wind energy projects and powerlines in the initial assessment corridor, have also been used to supplement the data that is available from SABAP2. These projects include the Oyster Bay Wind Farm, Jeffreys Bay Wind Farm, Banna ba Phifu Wind Farm, Ubuntu Wind Farm, Kouga Wind Farm, Gibson Bay Wind Farm, Happy Valley Wind Farm, Gibson Bay to Tsitsikamma 132kV powerline, Oyster Bay to Melkhout 132kV powerline and the Thyspunt – Grassridge 400kV transmission lines. Information from the avifaunal pre-construction monitoring currently taking place at the proposed Impofu North, Impofu West and Impofu East Wind Farms was also taken into account.
- Road counts conducted by the St Francis Bay Bird Club between March 2012 and May 2014 in and around the Banna ba Phifu, Deep River, Gibson Bay, Happy Valley, Jeffreys Bay, Kouga, Oyster Bay, Tsitsikamma and Ubuntu wind farms were used as an additional source of information on bird/habitat associations.
- The habitat sensitivity map for Denham's Bustard, Blue Crane and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province, compiled in December 2013 (Van Rooyen & Froneman 2013), was used extensively to assist with the definition of avifaunal habitat classes and the location of Denham's Bustard leks.
- The delineation of habitat in the western section of the corridor was mainly based on the work done by Van Rooyen & Froneman (2013), while the habitat delineation in the eastern section was based largely

on BGIS 2009 landcover database for the NMBM supplemented with Google Earth satellite imagery and field surveys, including a helicopter survey.

- A field visit to the initial assessment corridor was conducted on 11-15 September 2017 and included a helicopter fly-over. Data from previous field visits to various renewable energy and powerline developments in the initial assessment corridor, over several seasons, in the period 2009 – 2015, was also consulted in identifying likely bird/habitat associations, and potential interactions. An additional site visit was conducted on 5 July 2019 to the Thornhill area. All these site visits were conducive in forming an accurate impression of the avifaunal dynamics in the study area in all seasons of the year.

3.3 Assumptions and limitations

This study made the following assumptions:

- The coverage by SABAP2 has been extensive, with a total of 2 291 full protocol checklists (i.e. surveys lasting between 4 hours and 5 days) completed since 2007 for the pentads where the initial assessment corridor is located, which give a comprehensive record of the birds currently occurring there. In view of this, the reporting rates for the species in the initial assessment corridor are regarded as an accurate guideline, approximating actual densities on the ground.
- Assessments in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances; therefore, professional judgment played an important role in this assessment. It should also be noted that the impact of power lines on birds has been well researched with a robust body of published research stretching over forty years.
- The report focused on the potential impact of the proposed infrastructure on nationally and/or globally threatened (Red Data) avifauna. These species serve as surrogates for a wide range of non-threatened avifauna which could also potentially be impacted by the powerline. The proposed mitigation measures will also effectively mitigate for the non-threatened avifauna.

4 STUDY AREA

4.1 Important Bird Areas (IBAs)

Some sites are exceptionally important for maintaining the taxa dependent upon the habitats and ecosystems in which they occur. Vigorous protection of the most critical sites is one important approach to conservation. Many species may be effectively conserved by this means. Patterns of bird distribution are such that, in most cases, it is possible to select sites that support many species. These sites, carefully identified on the basis of the bird numbers and species complements they hold, are termed Important Bird Areas (IBAs). IBAs are selected such that, taken together, they form a network throughout the species' biogeographic distributions. IBAs are key sites for conservation – small enough to be conserved in their entirety and often already part of a protected-area network.

The 2km assessment corridor does not overlap with any IBAs. The closest IBA is the Swartkops Estuary - Redhouse and Chatty Saltpans IBA SA 096 (Marnewick *et al*. 2015). While the Chatty Substation is located approximately 1.4km from the IBA at its closest point, it is unlikely that the avifauna associated with the IBA will be directly impacted by the proposed 132kV grid connection. The grid connection will run westwards from the Chatty Substation, while the expected movement of avifauna associated with the IBA is expected to be

along the Swartkops River, which runs in a north-westerly direction, away from the proposed grid connection (see Figure 2).

The 2km assessment corridor runs parallel to the Maitland - Gamtoos Coast IBA SA097 and is situated approximately 2.5 – 3-5km from the IBA at its closest points. This IBA is a stretch of coastal dune field that extends 23km from the Gamtoos River mouth to the Maitland River mouth. It is 0.75km wide and covers approximately 1 800 ha in total. The extensive coastal dune fields of the area consist primarily of open sand and a series of dune slacks, inter-dune hollows and depressions between dunes. The IBA is of particular importance to African Black Oystercatcher *Haematopus moquini.* The BirdLife International data zone puts the total global population of the species at 3 300–4 000 birds (Marnewick *et al*. 2015); Hockey *et al.* (2005) estimates a total of 6 000 birds. Thus, according to latest estimates, this IBA may support at least 5%, and possibly up to 10%, of the global population. The proposed 132kV grid connection is not expected to impact on this IBA, as the bird movement is expected to be along the coastline, and not across the proposed 132kV powerline further north.

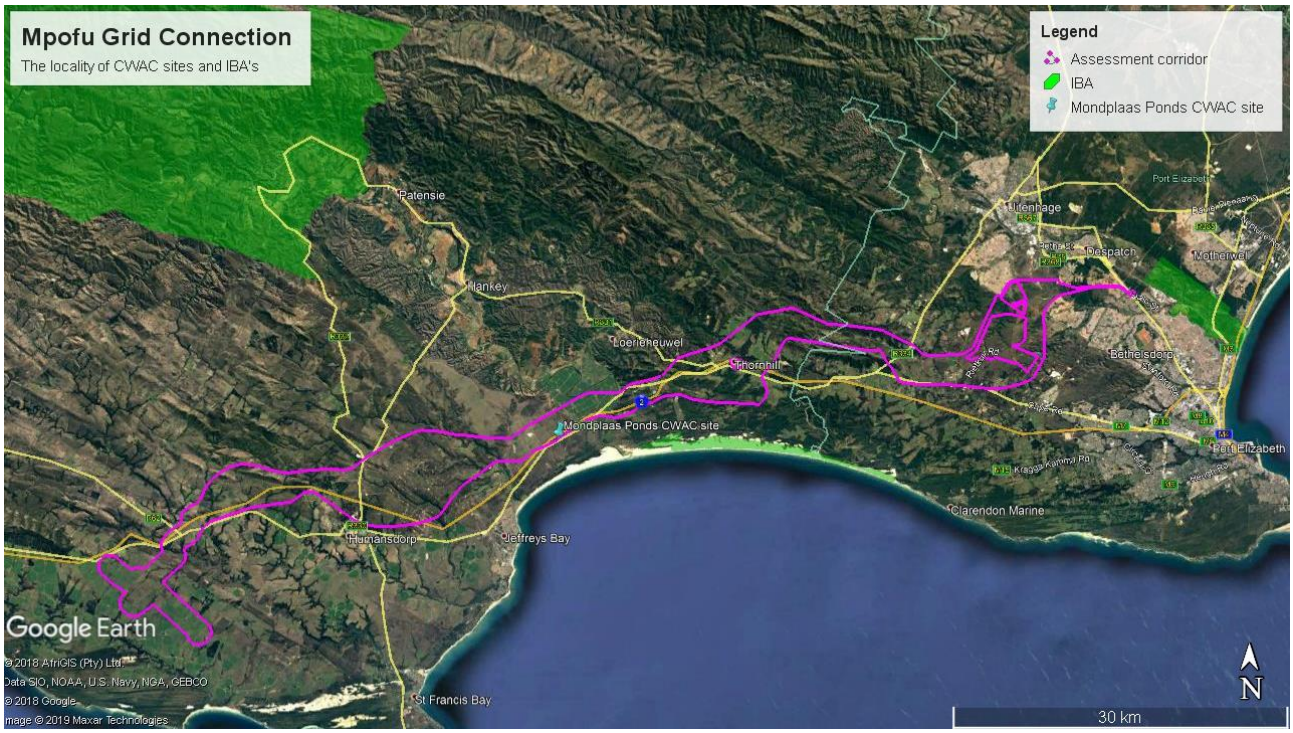


Figure 2: The location of IBAs and CWAC of potential relevance to the proposed 132kV grid connection

4.2 Coordinated Waterbird Count (CWAC) Data

A CWAC site is any body of water, other than the oceans, which supports a significant number (set at approximately 500 individual waterbirds, irrespective of the number of species) of birds which use the site for feeding, and/or breeding and roosting (Harrison *et al*. 2004). This definition includes natural pans, vleis, marshes, lakes, rivers, as well as a range of manmade impoundments (i.e. sewage works). The presence of a CWAC site within the study area is an indication of a large number of bird species occurring there and the overall sensitivity of the area.

There is one CWAC site partially located in the 2km assessment corridor, namely Mondplaas Ponds, which is the name given to a series of pans on the Gamtoos River floodplain (see Figure 2). The pans are just off the N2 highway about 50km west of Port Elizabeth, some 30km east of Humansdorp, and are known for a variety of waterbirds. During the latest count, performed in January 2018, two Red Data species, i.e. African Marsh-harrier and Caspian Tern, were recorded (ADU 2018).

4.3 Existing powerlines

The initial grid assessment corridor contains between 500km and 600km (probably closer to 600km) of existing high voltage lines (some running parallel), as well as a multitude of medium voltage reticulation lines[1]. Very little information on the impact of the existing powerlines on avifauna is available, but given that many collision sensitive Red Data species occur, or could potentially occur within initial grid assessment corridor (see Tables 3 and 4 below), it is assumed that collisions with existing lines will be a relatively regular occurrence, especially with some of the older lines which are not mitigated at all for bird collisions.

4.4 Description of bird habitat classes in the 2km assessment corridor

The 2km assessment corridor extends over four primary vegetation divisions (biomes), namely Fynbos, Azonal Vegetation, Forest and Albany Thicket (National Vegetation Map BGIS 2009). It is generally accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (Harrison *et al.* 1997).

The following bird habitat classes were defined in the 2km assessment corridor. The habitat descriptions are based largely on Van Rooyen & Froneman 2013, field observations, the BGIS 2009 landcover database for the NMBM, and additional mapping using Google Earth satellite imagery. See Appendix 1 for images of the bird habitat described below.

- Azonal: Included in this class are inland vegetation types which deviate from the typical surrounding zonal vegetation. Examples of this are freshwater wetlands and alluvial vegetation.
- Forest: This includes both Afromontane and coastal forest and is predominantly situated in the western part of the corridor. The tree-canopy cover in forests is continuous and mainly comprises evergreen tree species. Below the canopy, vegetation is multi-layered. The tall dense trees result in little ground vegetation and a thick leaf litter. Forest occurs mainly in deep gorges along drainage lines in the western section of the corridor e.g. along the Geelhoutboom River, the Seekoei River and the Kromme River.

[1] This figure is based on information received from Aurecon.

- Dams: Included in this class are man-made impoundments, ranging in size from large state impoundments to small farm dams.
- Pastures: These include cultivated grass species such as Smutsfinger, Rhodes and witbuffel grass which comprise tall pastures (30 - 60cm) cultivated primarily for extensive beef production and are most prevalent in shale areas with an annual precipitation of 500 - 650mm. Tall pastures are predominantly grown in areas that were cleared for wheat in the past and are kept clear through periodic removal of shrub (every 3 - 4 years). These lands often take on the character of grassland with varying levels of shrub. Rye-grass and kikuyu are defined as short pastures (5 – 30cm tall) cultivated primarily for intensive dairy production in irrigated pivots, but also through dryland methods on sandy soils, particularly in areas with an average annual precipitation of around 850 - 950mm. Maize pivots, which are grown as supplementary fodder, are also included under short pastures.
- Fynbos (including Renosterveld): This class is dominated by low shrubs and is characterized by *restioid*, *ericoid* and *proteoid* vegetation components. Renosterveld is dominated by low shrubs and specifically Renosterbos *Elytropappus rhinocerotis* as the dominant species, with geophytes and some grasses.
- Heavy alien degradation: This habitat class mainly comprises areas where uncontrolled afforestation has taken place through the spread of invasive alien species of tree and shrub, particularly Australian *Acacia* species.
- Plantation: These refer to areas where commercial afforestation is practiced, which is a specialized form of crop farming comprising mostly *Pinus* species.
- Savanna: Savanna has thorny *Vachellia* trees and a grass understory, usually together with thicket elements.
- Thicket: This class comprises dense, closed shrubland with poorly developed grass cover. In the western section it is fragmented and depending on its location in the landscape it is mixed with other vegetation types e.g. savanna, forest or fynbos. In the eastern section it occurs in solid stands and is the dominant natural vegetation type around Port Elizabeth.
- Urban and industrial: Includes towns, industrial areas, mines, dumping areas, recreational open spaces and roads.
- Cliffs: Cliffs are present on some of the riverine gorges e.g., along the Van Stadens River.

4.5 Red Data species potentially occurring in and along the 2km assessment corridor

The Red Data species which could potentially occur in and along the 2km assessment corridor are listed in Tables 2 below. For each species, the potential for occurring in a specific habitat class is indicated, as well as the type of impact (if any) that could potentially affect the species. See also Appendix 2 for a comprehensive species list of all birds that could potentially occur in the 2km assessment corridor.

Table 2: Red Data species that could potentially occur in the 2km assessment corridor.

EN = Endangered VU = Vulnerable NT = Near-threatened LC = Least concern

AREA WEST OF GAMTOOS RIVER																				
				Habitat class													Impact			
Species	Taxonomic name	Reporting rate	Global status (IUCN 2017)	Local status (Taylor *et al.* 2015)	Azonal	Dams	Pastures	Forest	Fynbos	Cliffs	Grassland	Alien degradation	Plantation	Savanna	Thicket	Urban/industrial	Collisions	Disturbance	Habitat destruction	Electrocution
Crane, Blue	*Anthropoides paradiseus*	37.35	VU	NT		x	x				x						x	x	x	
Harrier, Black	*Circus maurus*	6.59	VU	EN			x		x		x						x	x	x	
Secretarybird	*Sagittarius serpentarius*	4.7	VU	VU			x		x		x			x			x	x	x	
Eagle, Martial	*Polemaetus bellicosus*	2.52	VU	EN		x	x		x			x		x			x	x	x	x
Korhaan, Southern Black	*Afrotis afra*	0.21	VU	VU					x								x	x	x	
Bustard, Denham's	*Neotis denhami*	34.69	NT	VU			x		x		x						x	x	x	
Flamingo, Lesser	*Phoenicopterus minor*	1.54	NT	NT	x	x											x	x		
Eagle, African Crowned	*Stephanoaetus coronatus*	0.98	NT	VU				x					x				x	x	x	x
Duck, Maccoa	*Oxyura maccoa*	0.49	NT	NT		x											x			
Harrier, Pallid	*Circus macrourus*	0.21	NT	NT			x				x			x			x		x	
Falcon, Red-footed	*Falco vespertinus*	0.07	NT	NT			x				x									
Marsh-harrier, African	*Circus ranivorus*	25.02	LC	EN	x		x		x		x						x	x	x	
Flamingo, Greater	*Phoenicopterus ruber*	16.26	LC	NT	x	x											x	x		
Korhaan, White-bellied	*Eupodotis senegalensis*	10.58	LC	VU			x		x		x			x			x	x	x	
Kingfisher, Half-collared	*Alcedo semitorquata*	3.43	LC	NT	x													x		
Falcon, Lanner	*Falco biarmicus*	2.8	LC	VU			x		x	x	x	x		x			x			
Eagle, Verreaux's	*Aquila verreauxii*	0.63	LC	VU					x (mountains)	x							x			x
Rock-jumper, Cape	*Chaetops frenatus*	0.49	LC	NT					x (mountains)	x								x		
Roller, European	*Coracias garrulus*	0.49	LC	NT										x	x					
Finfoot, African	*Podica senegalensis*	0.14	LC	VU	x													x		
Flufftail, Striped	*Sarothrura affinis*	0.14	LC	VU			x		x		x									
Painted-snipe, Greater	*Rostratula benghalensis*	0.14	LC	NT	x													x		
Grass-owl, African	*Tyto capensis*	0.07	LC	VU			x				x						X	x	x	

AREA EAST OF GAMTOOS RIVER																				
			Habitat classes														Impact			
Species	Taxonomic name	Reporting rate	Global status (IUCN 2017)	Local status (Taylor *et al.* 2015)	Azonal	Dams	Pastures	Forest	Fynbos	Cliffs	Alien degradation	Plantation	Savanna	Thicket	Urban/industrial	Collisions	Disturbance	Habitat destruction	Electrocution
Flamingo, Greater	*Phoenicopterus ruber*	34	LC	NT	x	x										x			
Flamingo, Lesser	*Phoenicopterus minor*	18	NT	NT	x	x										x			
Marsh-harrier, African	*Circus ranivorus*	11	LC	EN	x		x		x							x	x	x	
Kingfisher, Half-collared	*Alcedo semitorquata*	5.8	LC	NT	x												x		
Falcon, Lanner	*Falco biarmicus*	4.3	LC	VU			x		x	x	x		x			x			
Bustard, Denham's	*Neotis denhami*	3.2	NT	VU			x		x							x	x	x	
Harrier, Black	*Circus maurus*	2.3	VU	EN			x		x							x	x	x	
Eagle, African Crowned	*Stephanoaetus coronatus*	2.3	NT	VU				x				x				x	x	x	x
Duck, Maccoa	*Oxyura maccoa*	1.5	NT	NT		x										x			
Secretarybird	*Sagittarius serpentarius*	1.4	VU	VU			x		x				x			x	x	x	
Eagle, Martial	*Polemaetus bellicosus*	0.9	VU	EN		x	x		x		x		x			x	x	x	x
Grass-owl, African	*Tyto capensis*	0.6	LC	VU			x									x	x	x	
Crane, Blue	*Anthropoides paradiseus*	0.5	VU	NT		x	x									x	x	x	
Korhaan, Southern Black	*Afrotis afra*	0.4	VU	VU					x							x	x	x	
Blackcap, Bush	*Lioptilus nigricapillus*	0.1	NT	VU				x						x					
Eagle, Verreaux's	*Aquila verreauxii*	0.1	LC	VU					x (mountains)	x						x			x
Korhaan, Karoo	*Eupodotis vigorsii*	0.1	LC	NT					x							x	x	x	
Pelican, Great White	*Pelecanus onocrotalus*	0.1	LC	VU		x										x	x		
Roller, European	*Coracias garrulus*	0.1	LC	NT									x	x					

5 DESCRIPTION OF EXPECTED IMPACTS

Because of their size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines. (Ledger and Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs and Ledger 1986b; Ledger, Hobbs and Smith, 1992; Verdoorn 1996; Kruger and Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Anderson 2001; Shaw 2013).

5.1 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution risk is strongly influenced by the power line voltage and design of the pole structure and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components on smaller distribution lines, or energized and earthed components.

Impofu 132kV Grid Connection:

See Table 3 below for a summary of the potential electrocution risk that the proposed powerline designs pose to avifauna potentially occurring in or near the 2km assessment corridor.

Table 3: Pole designs, electrocution potential and proposed mitigation

Design	Phase to phase clearance	Phase to earth clearance	Species at risk	Comments	Proposed mitigation
Monopole intermediate Double Circuit with Twin Tern Conductors	2.4m	1.5m	• Martial Eagle • African Crowned Eagle • African Fish-Eagle • Verreaux's Eagle	The risk of phase to earth electrocution is limited to a scenario where the bird chooses to perch on one of the horizontal stand-off insulators. This is not likely to be a regular occurrence.	Mitigation is not required.

Design	Phase to phase clearance	Phase to earth clearance	Species at risk	Comments	Proposed mitigation
Monopole strain (0º-30º angle) Double Circuit with Twin Tern Conductor	2.4m	1.5m	• Martial Eagle • African Crowned Eagle • African Fish-Eagle • Verreaux's Eagle	The risk of phase to earth electrocution is limited to a scenario where the bird chooses to perch on one of the horizontal stand-off insulators. This is not likely to be a regular occurrence.	• Mitigation is not required.
Monopole strain (30º-90º angle) Double Circuit with Twin Tern Conductor	2.4m	1.5m	• Martial Eagle • African Crowned Eagle • African Fish-Eagle • Verreaux's Eagle	The risk of phase to earth electrocution is limited to a scenario where the bird chooses to perch on one of the horizontal stand-off insulators. This is not likely to be a regular occurrence.	Mitigation is not required.
Monopole strain (30º 90º angle) 2 x Single Circuit Twin Tern Conductor	2.4m	1.5m	• Martial Eagle • African Crowned Eagle • African Fish-Eagle • Verreaux's Eagle	The risk of phase to earth electrocution is limited to a scenario where the bird chooses to perch on one of the horizontal stand-off insulators. This may happen more regularly than with the intermediate poles, as there is unrestricted access to the insulators, which may be viewed as "branches".	• Bird perch to be added to the pole top • Bird discouragers to be fitted above the stand-off insulators to prevent a large bird from attempting to perch on the insulators. This measure is subject to the electrical engineers confirming that the BIL of the pole will not be compromised.

Design	Phase to phase clearance	Phase to earth clearance	Species at risk	Comments	Proposed mitigation
Triple pole structure 'Twin tern'	>2.4m	1.5m	• Martial Eagle • African Crowned Eagle • African Fish-Eagle • Verreaux's Eagle	The risk of phase to earth electrocution is limited to a scenario where the bird chooses to perch on one of the horizontal stand-off insulators. This may happen more regularly than with the intermediate poles, as there is unrestricted access to the insulators, which may be viewed as "branches".	• Bird perch to be added to the pole top • Bird discouragers to be fitted above the stand-off insulators to prevent a large bird from attempting to perch on the insulators. This measure is subject to the electrical engineers confirming that the BIL of the pole will not be compromised.
245A self-supporting tower	3.9m (To be confirmed)	2.5m between conductor and cross-arm below (To be confirmed)	• None	There is no electrocution risk associated with this tower.	Mitigation is not required.

5.2 Collisions

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Anderson 2001; Shaw 2013).

In her PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

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

bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Bevanger 1994).”

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin *&* Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the

direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to power line collisions.

Thus, visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite speculation that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters (BFDs) can reduce the collision mortality rates (Sporer *et al.* 2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Even bustards have been found to benefit from powerline marking (Raab *et al*. 2012). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012).

Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A recent study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. In an experiment in the Karoo, the Endangered Wildlife Trust found that the application of Bird Flappers significantly reduced the mortality of Blue Cranes, although the effect was less marked with Ludwig's Bustard (C. Hoogstad pers.comm 2017)[2].

[2] The results of this experiment are currently being written up for publication.

Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

Quantifying the impact of collisions in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the Endangered Wildlife Trust: Wildlife & Energy Programme it is possible to give a measure of what species are susceptible to collision impacts (Figure 3). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

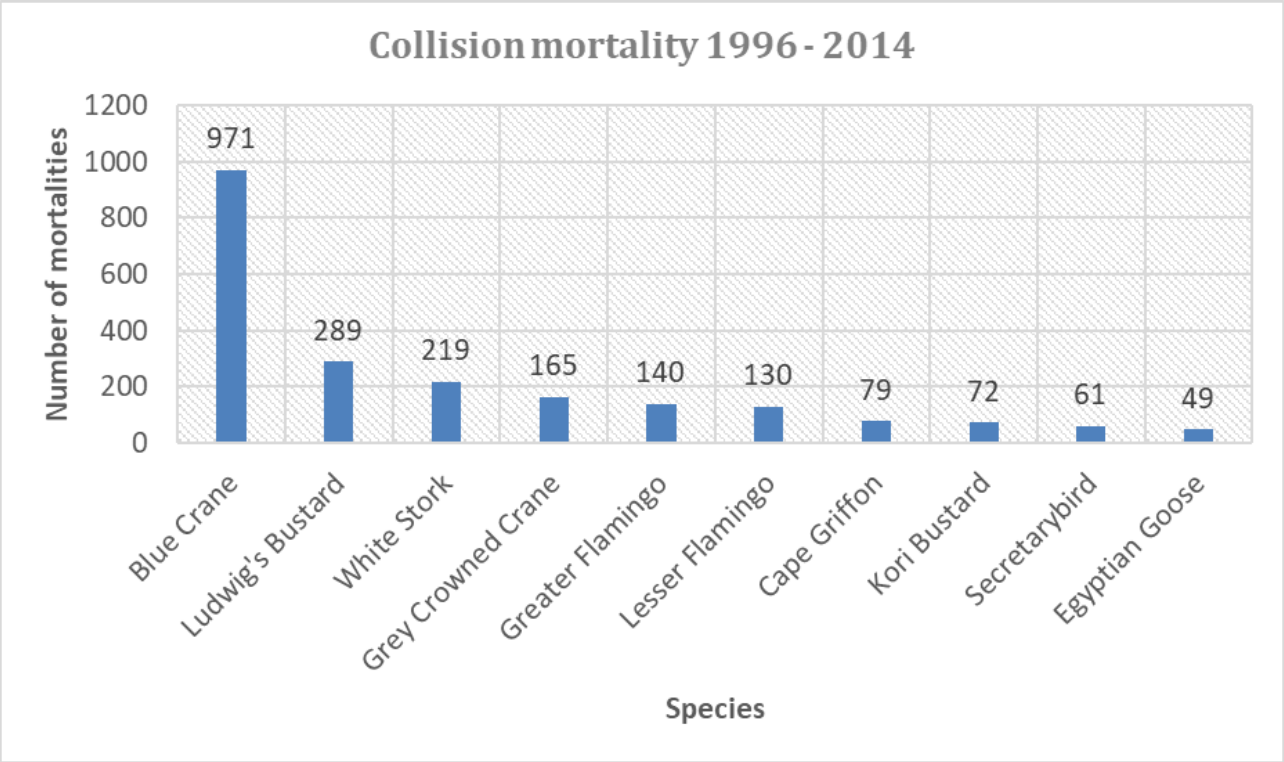


Figure 3: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom-EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data).

Impofu 132kV Grid Connection:

Table 4 below provides a breakdown of the potential collision risks per Red Data species per habitat type in the 2km assessment corridor.

Table 4: Red Data species collision risk table

Species	Magnitude of risk	High risk habitat in the 2km corridor
Flamingo, Greater	Medium	Waterbodies
Flamingo, Lesser	Medium	Waterbodies

Species	Magnitude of risk	High risk habitat in the 2km corridor
Marsh-Harrier, African	Medium	Wetlands
Falcon, Lanner	Low	Gorges, fynbos and pastures
Bustard, Denham's	High	Pastures in general, and display sites in particular. Also areas of natural fynbos.
Harrier, Black	Medium	Fynbos
Eagle, African Crowned	Medium	Gorges, forests, plantations
Duck, Maccoa	High	Waterbodies
Secretarybird	High	Fynbos and pastures
Eagle, Martial	Medium	Gorges, forest, fynbos, pastures, waterbodies
Grass-owl, African	Medium	Wetlands
Crane, Blue	High	Pastures and waterbodies (roost sites in particular). Supplementary grain feeding spots for livestock are also high risk due to cranes congregating around these areas.
Korhaan, Southern Black	Medium	Fynbos
Korhaan, Karoo	Low	Fynbos
Pelican, Great White	Low	Waterbodies
Korhaan, White-bellied	Medium	Fynbos and pastures
Harrier, Pallid	Low	Pastures and wetlands
Kingfisher, Half-collared	Negligible	n/a
Eagle, Verreaux's	Medium	Gorges and cliffs
Rock-jumper, Cape	Negligible	n/a
Roller, European	Negligible	n/a
Finfoot, African	Negligible	n/a
Blackcap, Bush	Negligible	n/a

It is important to note that in the case of flamingos and Blue Crane, the collision risk is aggravated due to their habit of flying on low light conditions, e.g. flamingos fly habitually at night between waterbodies, while Blue Cranes arrive and depart from roosts at waterbodies after sunset and before dawn.

5.3 Displacement due to habitat transformation and disturbance

During the construction phase and maintenance of power lines and sub- and/or switching stations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. In some habitats, servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude and/or sub/switching stations through transformation of habitat, which could result in temporary or permanent displacement.

However, the results of habitat transformation may be subtler, whereas the actual footprint of the development be small in absolute terms, the effects of the habitat fragmentation may be more significant. Sometimes Great Bustard *Otis tarda* can be seen close to or under power lines, but a study done in Spain (Lane *et al*. 2001)

indicates that the total observation of Great Bustard flocks was significantly higher further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard generally avoid the immediate proximity of roads within a 500m buffer. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al*. 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Alan *et al*. 1997). In contrast to the findings of the studies above, it is notable that Strugnell (2017) did not find any significant displacement of large terrestrial species, and Denham's Bustard in particular, at the Kouga wind Farm, which is located just east of the proposed Impofu wind farms. This indicates that there may be significant interspecies variation with regard to displacement thresholds, even for closely related species.

The potential displacement impact of the habitat transformation caused by the construction of the three switching stations associated with the three proposed wind farms (Impofu West, Impofu North and Impofu East) and the proposed Eskom collector switching station will be low. Since the three on-site substations will form part of the wind farm, and the switching component will be owned by Eskom, there will be a physical barrier between the two in the form of a fence. The Eskom switching stations will each have a total footprint of approximately 150 x 75 m (11,250 m^2). The single collector switching station will have a total footprint of approximately 150 x 150 m (22,500 m^2). All of these proposed switching stations will be situated in either short pastures or fynbos. From an avifaunal impact perspective, the impact will be low, as the actual footprint is small and there is ample similar habitat available within the immediate surroundings, which means that the displacement impact on Red Data species should be very low.

Some birds could also be displaced due to disturbance during the construction phase of the powerline and sub- and/or switching stations. While this is usually temporary, if it results in the interruption of a breeding cycle, at the critical time, could result in the death of the eggs or nestlings. In the case of slow reproducing species with long breeding seasons, e.g. large eagles, the interruption of a single breeding season could have a more marked effect than for smaller, fast reproducing species, e.g. passerines, which can more easily lay a replacement clutch. Some sensitive species might also abandon a specific breeding site permanently due to disturbance.

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Tables 5 and 6 below provide a breakdown of the potential displacement risks per Red Data due to disturbance and habitat destruction in the 2km assessment corridor.

Table 5: Red Data species displacement risk table: habitat destruction

Species	**Magnitude of risk**	**High risk habitat/localities in the assessment corridor**
Flamingo, Greater	Negligible	n/a
Flamingo, Lesser	Negligible	n/a
Marsh-Harrier, African	Low	Wetlands
Falcon, Lanner	Negligible	n/a
Bustard, Denham's	Medium	Pastures and fynbos (fragmentation)
Harrier, Black	Medium	Fynbos (fragmentation)
Eagle, African Crowned	Low	Forests and plantations

Species	Magnitude of risk	High risk habitat/localities in the assessment corridor
Duck, Maccoa	Negligible	n/a
Secretarybird	Medium	Savanna, pastures and fynbos (fragmentation)
Eagle, Martial	Low	Savanna, pastures and fynbos (fragmentation)
Grass-owl, African	Low	Wetlands
Crane, Blue	Low	Pastures and wetlands (fragmentation)
Korhaan, Southern Black	Low	Fynbos (fragmentation)
Korhaan, Karoo	Low	Fynbos (fragmentation)
Pelican, Great White	Negligible	n/a
Korhaan, White-bellied	Medium	Fynbos (fragmentation)
Harrier, Pallid	Low	Pastures and wetlands (fragmentation)
Blackcap, Bush	Low	Thicket
Eagle, Verreaux's	Negligible	n/a
Kingfisher, Half-collared	Low	Riverine vegetation in gorges
Rock-jumper, Cape	Low	Fynbos on slopes (fragmentation)
Roller, European	Low	Savanna (fragmentation)
Finfoot, African	Low	Riverine vegetation in gorges

Table 6: Red Data species displacement risk table: Disturbance

Species	Magnitude of risk	High risk habitat/localities in the assessment corridor
Flamingo, Greater	Low	Waterbodies
Flamingo, Lesser	Low	Waterbodies
Marsh-Harrier, African	Medium	Wetlands
Falcon, Lanner	Low	Gorges and cliffs
Bustard, Denham's	Low	Pastures and fynbos, particularly at display sites.
Harrier, Black	Medium	Fynbos
Eagle, African Crowned	Low	Gorges, forests and plantations
Duck, Maccoa	Low	Waterbodies
Secretarybird	Medium	Savanna, pastures and fynbos
Eagle, Martial	Low	Gorges, savanna, pastures and fynbos (fragmentation). There is an existing Martial Eagle nest at the Jeffrey's Bay Wind Farm, which falls within the 2km assessment corridor. However, the nest has not been active in the 2017 breeding season. The reason for that is not clear, as it could either be because of mortality caused by the wind farm, or disturbance caused by the landowner

		who constructed a game fence within a few hundred metres from the nest (Simmons, R pers. comm).
Grass-owl, African	Medium	Wetlands
Crane, Blue	Medium	Pastures and wetlands
Korhaan, Southern Black	Medium	Fynbos
Korhaan, Karoo	Low	Fynbos
Pelican, Great White	Negligible	n/a
Korhaan, White-bellied	Medium	Fynbos
Harrier, Pallid	Low	Pastures and wetlands
Blackcap, Bush	Low	Thicket
Eagle, Verreaux's	Low	Gorges and cliffs
Kingfisher, Half-collared	Low	Riverine vegetation in gorges
Rock-jumper, Cape	Low	Fynbos on slopes
Roller, European	Low	Savanna
Finfoot, African	Low	Riverine vegetation in gorges

6 ASSESSMENT OF POTENTIAL IMPACTS

The methodology for assessing the potential impacts of the proposed 132kV grid connection is attached as Appendix 3. The impact assessment tables below provide a summary of the assessment process for each impact.

Table 7: Displacement due to disturbance: Construction Phase

Impact	**Disturbance**			
Description of impact	**Displacement of Red Data species due to disturbance associated with the construction of the powerline**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	**Construction activity should be restricted to the immediate footprint of the infrastructure. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red Listed species. Measures to control noise should be applied according to current best practice in the industry. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. The recommendations of the ecological specialist study must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. The final powerline alignment must be inspected on foot by the avifaunal specialist prior to construction to ascertain if any Red Listed species nests are present. All relevant detail must be recorded i.e. species, coordinates and nest status. Should any nests be recorded, it would require management of the potential impacts on the breeding birds once construction commences, which would necessitate the involvement of the avifaunal specialist and the Environmental Control Officer. An effective communication strategy should be implemented whereby the avifaunal specialist is provided with a construction schedule which will enable him/her to ascertain when and where such breeding Red Data species could be impacted by the construction activities. This could then be addressed through the timing of construction activities during critical periods of the breeding cycle, once it has been established that a particular nest is active.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	Although the impact cannot be avoided through mitigation, except in the case of very specific instances e.g, an individual Martial Eagle nest, the significance of the displacement due to disturbance is tempered by the temporary nature of the impact.			
Cumulative impacts	Minor negative			

Table 8: Displacement due to habitat destruction: Construction Phase

Project phase	**Construction**			
Impact	**Habitat transformation**			
Description of impact	**Displacement of Red Data species due to habitat transformation associated with the construction of the powerline**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	**Construction activity should be restricted to the immediate footprint of the infrastructure. Access to the remainder of the site should be strictly controlled to prevent unnecessary destruction of habitat. Measures to control noise should be applied according to current best practice in the industry. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Regional	Impacts felt at a regional / provincial level	Regional	Impacts felt at a regional / provincial level
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	High	Natural and/ or social functions and/ or processes are notably altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Low	The affected environment will not be able to recover from the impact - permanently modified
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Minor - negative**		**Minor - negative**	
Comment on significance	The most significant consequence of this impact is the permanent nature of the fragmentation caused by its linear nature. The displacement effect associated with the fragmentation of the habitat cannot be mitigated.			
Cumulative impacts	Moderate negative			

Table 9: Mortality due to electrocution: Operational Phase

Project phase	**Operation**			
Impact	**Electrocution**			
Description of impact	**Electrocution of Red Data species on some of the proposed poles on the 132kV powerline**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• Bird perch to be added to the pole top of selected poles • Bird discouragers to be fitted above the stand-off insulators on selected poles to prevent a large bird from attempting to perch on the insulators. This measure is subject to the electrical engineers confirming that the BIL of the pole will not be compromised .**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	The potential mortality due to electrocution can have a significant regional impact if apex predators like Martial Eagle and African Crowned-Eagle is killed. However, the probability of it happening is low, and it should be mitigatable.			
Cumulative impacts	Minor negative			

Table 10: Mortality due to collisions: Operational Phase

Project phase	**Operation**			
Impact	**Collisions**			
Description of impact	**Mortality of Red Data species due to collisions with the 132kV powerline**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**High risk sections of power line must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized. If power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 4). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively (see Appendix 5). These devices must be installed as soon as the conductors are strung. In specific instances, i.e. high risk waterbodies (to be identified during the walk-through phase), the new experimental PLP LED (light emitting diode) BFD is recommended to increase the efficacy of the device during low light conditions for waterbirds and cranes.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Very high	Natural and/ or social functions and/ or processes are majorly altered	High	Natural and/ or social functions and/ or processes are notably altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Moderate - negative**		**Minor - negative**	
Comment on significance	Collision mortality of Red Data species is likely to be the most significant impact of the proposed powerline, especially in the section west of the Gamtoos River. Mitigation in the form of Bird Flappers could reduce the impact for most avifauna, but it will have limited effectiveness for Denham's Bustard.			
Cumulative impacts	Moderate - negative			

Table 11: Displacement due to disturbance: Decommissioning Phase

Project phase	**Decommissioning**			
Impact	**Disturbance**			
Description of impact	**Displacement of Red Data species due to disturbance associated with the decommisioning of the powerline**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**Decommissioning activity should be restricted to the immediate footprint of the infrastructure. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red Listed species. Measures to control noise should be applied according to current best practice in the industry. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. The recommendations of the ecological specialist study must be strictly implemented, especially as far as limitation of the footprint and rehabilitation of disturbed areas is concerned. The final powerline alignment must be inspected on foot by the avifaunal specialist prior to decommissioning to ascertain if any Red Listed species nests are present. All relevant detail must be recorded i.e. species, coordinates and nest status. Should any nests be recorded, it would require management of the potential impacts on the breeding birds once decommissioning commences, which would necessitate the involvement of the avifaunal specialist and the Environmental Control Officer. An effective communication strategy should be implemented whereby the avifaunal specialist is provided with a activity schedule which will enable him/her to ascertain when and where such breeding Red Data species could be impacted by the activities. This could then be addressed through the timing of activities during critical periods of the breeding cycle, once it has been established that a particular nest is active**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Brief	Impact will not last longer than 1 year	Brief	Impact will not last longer than 1 year
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance	Although the impact cannot be avoided through mitigation, except in the case of very specific instances e.g, an individual Martial Eagle nest, the significance of the displacement due to disturbance is tempered by the temporary nature of the impact.			
Cumulative impacts	Minor negative			

7 ASSESSMENT OF CUMULATIVE IMPACT

The cumulative impacts for the project were considered for any planned linear infrastructure with a valid Environmental Authorisation over and above the existing powerlines in the initial assessment area.

According to the National Environmental Management Act (Act 107 of 1998) (NEMA), a cumulative impact, in relation to an activity, means the past, current and reasonable foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonable foreseeable impacts eventuating from similar or diverse activities.

Table 12 lists the planned HV lines that were considered from a cumulative impact perspective, which constitute approximately 66km of line. The proposed project will add another approximately 120km to this network of HV lines.

Impofu 132kV Grid Connection:

The planned powerlines listed in Table 12, together with the proposed Impofu Grid Connection will constitute around 186km of new HV lines, in addition to the approximately 600km of existing HV lines in the initial assessment area. This constitute an increase of approximately 30% to the existing HV grid. However, many of the existing lines run in parallel, and it is planned to also locate the new Impofu 132kV line next to existing lines as far as possible. This materially reduces the impacts on avifauna because lines running parallel effectively constitute a single impact as far as birds are concerned. It is therefore important not to view the 30% increase in the HV network as a similar-sized increase in the collision or displacement risk to avifauna. The mitigation planned for the new lines will further reduce the impact of the lines on avifauna (see Table 12).

Assuming that the proposed Impofu 132kV Grid Connection will be routed mostly along existing lines, and assuming that all the other mitigation measures will be implemented on all the planned powerlines as recommended by the avifaunal specialists, it is concluded that the construction of these lines will not materially increase the impact of the existing powerline network in the initial assessment area. The combined cumulative post-mitigation impact of the proposed Impofu 132kV Grid Connection, together with the planned lines listed in Table 12, is therefore rated as **Low**.

Table 12: Proposed high voltage lines in the initial assessment corridor

Project	Overhead power line	Length	Status	Avifaunal related mitigation measures proposed by avifaunal specialist
Melkhout-Kromrivier	132kV line from Melkhout substation to Kromrivier substation, Eastern Cape – Upgrade existing line to a double circuit line to accommodate Oyster Bay	± 26 km	EA issued, out to tender	• None could be located
Oyster Bay Wind Energy Facility grid connection	132kV line from Oyster Bay Wind Energy Facility to Melkhout substation	±4.3 km	EA issued; Construction to commence in 2018	• Mark with Bird Flight Diverters (BFDs), on the earth wire of the line, five metres apart, alternating black and white. The recommended BFD is the new experimental PLP LED (light emitting diode) BFD.
Dieprivier-Kareedouw	Construction of 132kV distribution lines from Dieprivier to Kareedouw, Sarah Baartman District Municipality (formerly Cacadu District Municipality)	±36 km	Amendment authorised in May 2017	• Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. • Mark identified sections of the line (indicated in specialist report) with anti-collision marking devices on the earth wire (as per Eskom guidelines) to increase the visibility of the line and reduce likelihood of collisions. • These sections of line will need to be verified by an avifaunal walk through/site specific EMPr once the final route is selected and tower positions are finalized. • Whilst electrocution is possible on 132kV lines, the proposed tower structures (lattice structure with phase-phase of 2000mm and cross arm of 2550mm) should be safe for the birds in area. • Construction work should be completed outside the bird breeding season. • Re-location of birds' nests to be conducted according to Eskom's Guidelines for Bird Nests and by avifauna specialist.

8 NO-GO OPTION

Should the proposed 132kV powerline not be constructed, the ecological integrity of the area as it currently exists will be maintained as far as avifauna is concerned. No additional negative impacts on avifauna are foreseen as a result of the development not taking place.

9 ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	• Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • The recommendations of the ecological specialist study must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. • Prior to construction commencing, a walk-through should be performed by the avifaunal specialist to record any Red Data species nests that could be impacted by the construction of the proposed powerline • Should any nests be recorded, it would require management of the potential impacts on the breeding birds once construction commences, which would	Construction manager Environmental Control Officer Avifaunal Specialist	Construction	Yes	None

	necessitate the involvement of the avifaunal specialist, and the Environmental Control Officer. An effective communication strategy should be implemented whereby the avifaunal specialist is provided with a construction schedule which will enable him/her to ascertain when and where breeding could be impacted by the construction activities. This could then be addressed through the timing of construction activities during critical periods of the breeding cycle, once it has been established that a particular nest is active				
Collisions of Red Data avifauna with the earthwire of the proposed 132kV powerlines	• A walk-through must be conducted by the avifaunal specialist after final pole positions have been determined, to demarcate sections of line that will need to be mitigated with Bird Flight Diverters (BFDs).	Construction manager Environmental Control Officer Site management Avifaunal specialist	Construction and Operation	Yes	• The powerline should be inspected once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality, which may require additional mitigation. Thereafter the frequency of inspections will be informed by the results of the first two years. • The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection.
Electrocution of Red Data avifauna on the powerlines	• Bird perch to be added to the pole top of selected poles • Bird discouragers to be fitted above the stand-off insulators on selected poles to prevent a large bird from attempting to	Design Engineers Construction manager	Construction	Yes	The powerline should be inspected once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant electrocution mortality, which may require additional mitigation. Thereafter the

	perch on the insulators. This measure is subject to the electrical engineers confirming that the BIL of the pole will not be compromised.	Avifaunal Specialist			frequency of inspections will be informed by the results of the first two years.

10 SENSITIVITY MAPPING

The 2km grid corridor was mapped according to avifaunal sensitivity, based on the potential for an impact to occur within a specific habitat type (see Table 13 and Figures 4 and 5). The impacts considered were:

- Collisions with the proposed powerline,
- Displacement due to the fragmentation of the natural habitat,
- Displacement due to disturbance, and
- Electrocutions

Table 13: The various sensitivity classes occurring within the 2km corridor.

SENSITIVITY CRITERIA					
Section of study area	No-go areas[3]	Very high sensitivity areas	High sensitivity areas	Medium sensitivity areas	Low sensitivity areas
West of Gamtoos River	• Active Martial Eagle nest (2km buffer[4]) • Black Harrier communal roost (2km buffer) • Denham's Bustard display sites (1km buffer)	• Artificial waterbodies (500m buffer)	• Pastures (actual area)	Fynbos (actual area)	• Forest • Heavy Alien Degradation • Savanna • Thicket • Urban and industrial
East of Gamtoos River	• IBAs	• Artificial waterbodies (500m buffer)	n/a	Pastures and Fynbos (actual area)	• Thicket • Heavy Alien Degradation • Urban and industrial • Forest

Datasets used for the sensitivity mapping:

- ECOSOL land cover as adapted for Kouga avifaunal regional assessment (Van Rooyen & Froneman 2013);
- Specific focal points derived from Kouga avifaunal regional assessment (Van Rooyen & Froneman 2013) and pre-construction monitoring of wind farms (see Section 7 References);
- IBAs (Marnewick *et al*. 2015);
- BGIS 2009 landcover database for the Nelson Mandela Bay Municipality supplemented with additional mapping using Google Earth satellite imagery;
- National Freshwater Ecosystem Priority Areas Project (NFEPA) wetlands database (2012), obtained from SANBI.

[3] No-Go areas are not applicable in cases where the specialist has assessed the specific area and approved it, or the alignment follows an existing overhead power line for the majority of the no go area and if it deviates for a short section, this section does not significantly further fragment the No-Go area.

[4] In the case of the Martial Eagle nest subsequently discovered by Jon Smallie, the bird specialist doing the pre-construction monitoring at the proposed wind farm site, next to the Impofu Dam, a no-go buffer zone of 1.5km is deemed to be adequate as the nest is in a deep kloof, out of line of sight of any future powerline construction activities.

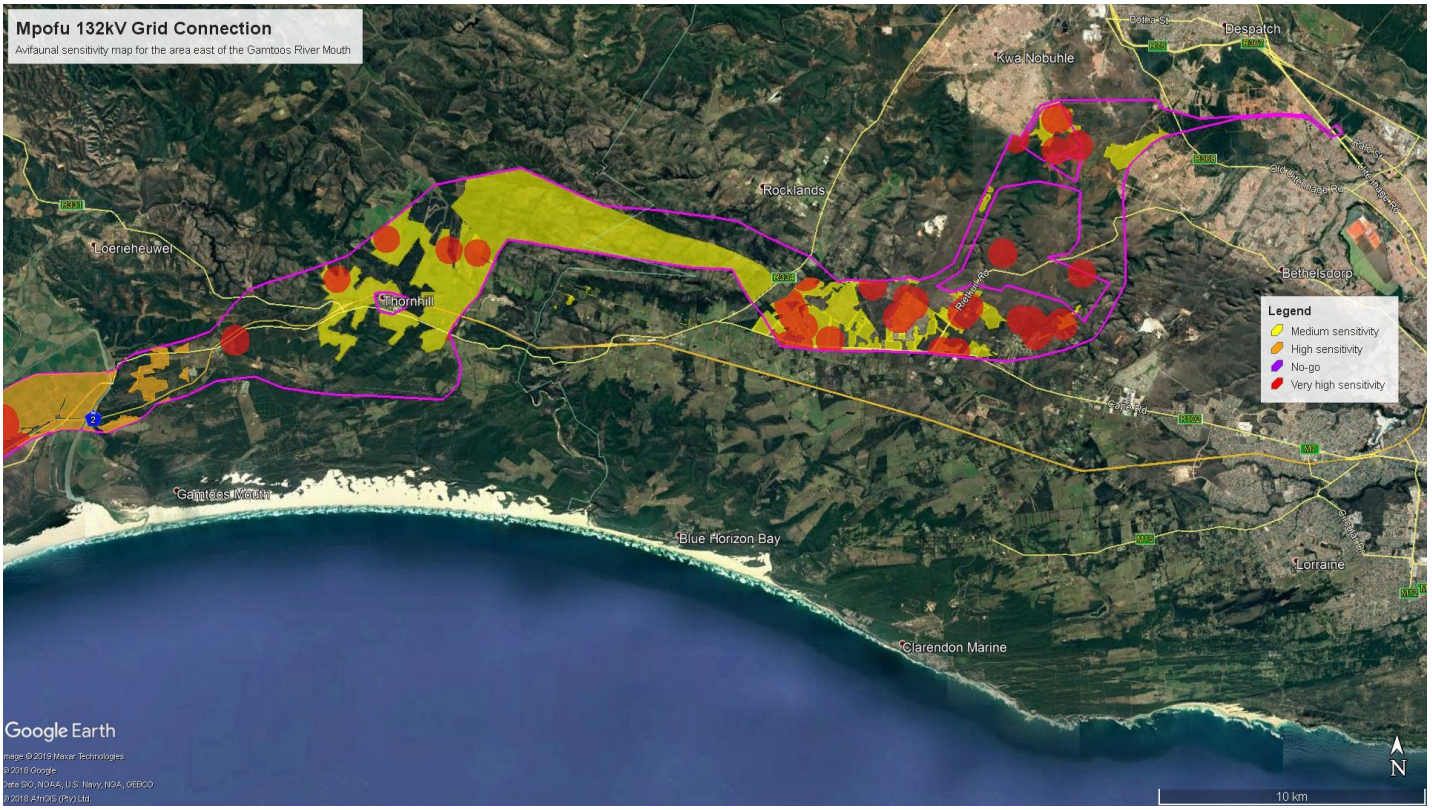

Figure 4: Sensitivity map for the 2km corridor west of the Gamtoos River mouth.

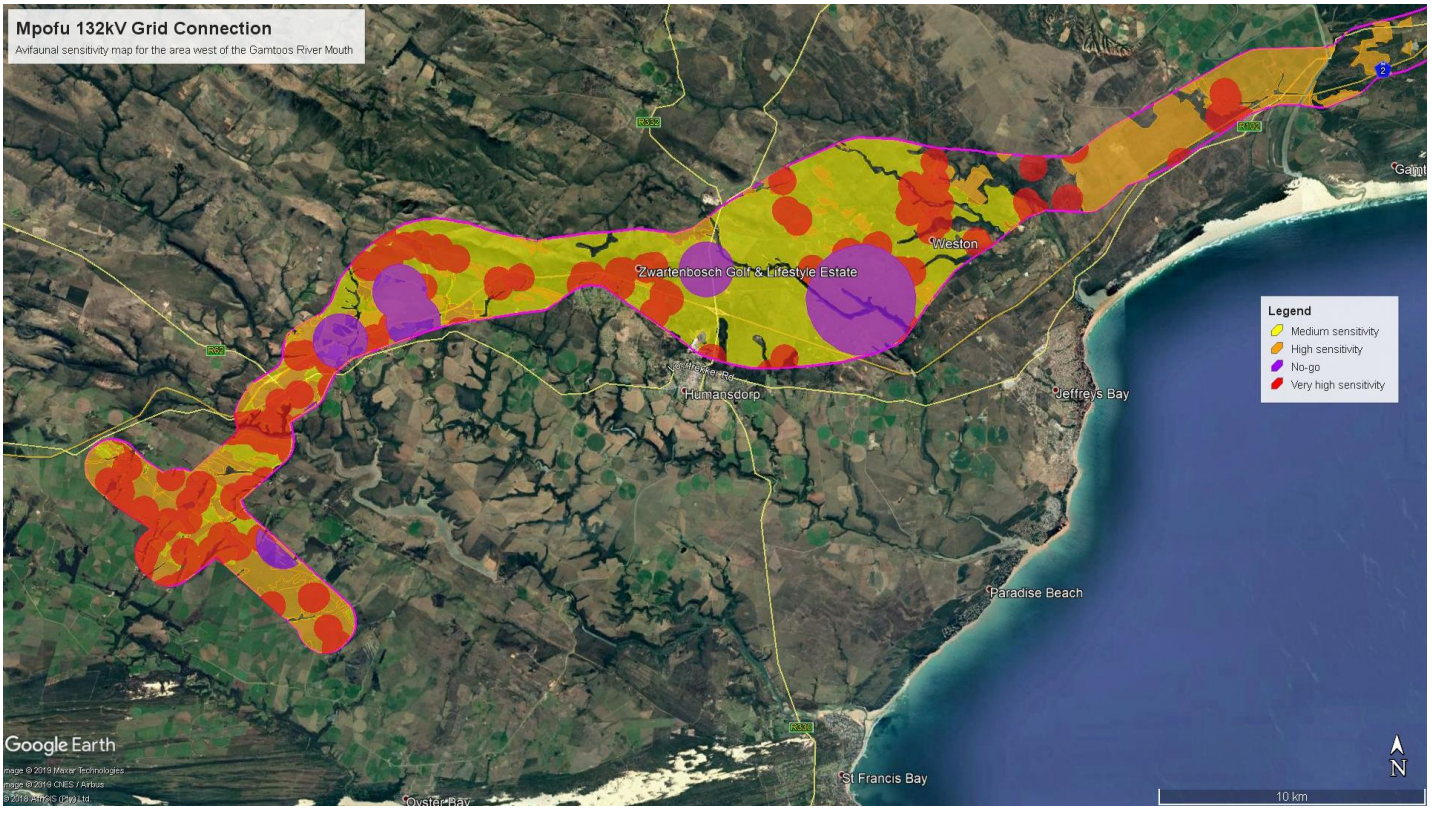

Figure 5: Sensitivity map for the 2km corridor east of the Gamtoos River mouth.

11 CONCLUSIONS

The avifaunal habitat in which the proposed Impofu 132kV Grid Connection powerline corridor is located ranges from low to very high sensitivity. There is a broad gradient from highly sensitive to least sensitive from west to east, with the habitat west of the Gamtoos River being significantly more sensitive than the habitat east of the Gamtoos River. The study area contains a rich complement of avifauna, including Red Data species, 23 of which have been recorded west, and 19 east of the of the Gamtoos River.

Potential impacts affecting avifauna relating to the construction and operation of the proposed power line include:

- Mortality due to collision of large terrestrial birds, waterbirds and raptors with the overhead power line during the operational phase;
- Displacement as a result of habitat transformation and disturbance during the construction of the powerline; and
- Electrocution of large raptors on some of the proposed 132kV structures.

The impact of **displacement due to disturbance** is rated as **Minor (pre-mitigation)**, and it can be further reduced to **Negligible** through the application of mitigation measures. Although the impact cannot be avoided through mitigation, except in the case of very specific instances e.g., an individual Red Data nest, the significance of the displacement due to disturbance is tempered by the temporary nature of the impact.

The impact of **displacement due to habitat destruction** is rated as **Minor (pre-mitigation)**, and it will remain at a **Minor** level, despite the application of mitigation measures. The most significant consequence of this impact is the permanent nature of the fragmentation caused by its linear nature. The displacement effect associated with the fragmentation of the habitat cannot be mitigated, but may not affect all species.

The impact of the **mortality due to collisions** with the powerline during the operational phase is rated as **Moderate (pre-mitigation)**, but it can be reduced to **Minor** after the application of mitigation measures. Collision mortality of Red Data species is likely to be the most significant impact of the proposed powerline, especially in the section west of the Gamtoos River. Mitigation in the form of Bird Flappers could reduce the impact for most avifauna, but it will have limited effectiveness for Denham's Bustard.

The impact of **mortality due to electrocutions** during the operational phase is rated as **Minor (pre-mitigation)**, but it can be reduced to **Negligible** after the application of mitigation measures. The potential mortality due to electrocution can have a significant regional impact if apex predators like Martial Eagle and African Crowned-Eagle is killed. However, the probability of it happening is low, and it should be mitigatable.

It is concluded that the construction and operation of the proposed 132kV powerline should result in manageable impacts on Red Data avifauna, provided the recommended mitigation measures are diligently implemented, including the monitoring requirements as detailed in the EMPr.

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APPENDIX 1: BIRD HABITATS

Figure 1: Short pastures west of the Gamtoos River.

Figure 2: Tall pastures west of the Gamtoos River

Figure 3: A typical mosaic of habitats west of the Gamtoos River, showing fynbos, alien tree stands and short pastures.

Figure 4: Riverine forest on the banks of the Kromme River, at the Impofu Dam.

Figure 5: Short pastures and alien trees east of the Gamtoos River.

Figure 6: Plantations east of the Gamtoos River.

Figure 7: Thicket with elements of Afro-montane forest east of the Gamtoos River.

Figure 8: A dam west of the Gamtoos River, surrounded by short pastures and forest.

Figure 9: Typical thicket habitat near Port Elizabeth.

APPENDIX 2: SPECIES LIST

BETWEEN THE KOUGA RIVER MOUTH AND PORT ELIZABETH

Species	Taxonomic name	SABAP 2 Reporting rate
Apalis, Bar-throated	*Apalis thoracica*	73.73
Apalis, Yellow-breasted	*Apalis flavida*	17.59
Avocet, Pied	*Recurvirostra avosetta*	25.23
Barbet, Acacia Pied	*Tricholaema leucomelas*	9.95
Barbet, Black-collared	*Lybius torquatus*	36.92
Batis, Cape	*Batis capensis*	34.84
Batis, Chinspot	*Batis molitor*	0.23
Bee-eater, White-fronted	*Merops bullockoides*	1.27
Bishop, Southern Red	*Euplectes orix*	36
Bishop, Yellow	*Euplectes capensis*	6.13
Bittern, Little	*Ixobrychus minutus*	2.08
Blackcap, Bush	*Lioptilus nigricapillus*	0.12
Bokmakierie, Bokmakierie	*Telophorus zeylonus*	61.23
Boubou, Southern	*Laniarius ferrugineus*	62.62
Brownbul, Terrestrial	*Phyllastrephus terrestris*	27.78
Bulbul, Cape	*Pycnonotus capensis*	49.42
Bulbul, Dark-capped	*Pycnonotus tricolor*	0.35
Bunting, Cape	*Emberiza capensis*	1.74
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	0.69
Bunting, Golden-breasted	*Emberiza flaviventris*	1.74
Bush-shrike, Grey-headed	*Malaconotus blanchoti*	0.23
Bush-shrike, Olive	*Telophorus olivaceus*	22.92
Bustard, Denham's	*Neotis denhami*	3.24
Buzzard, Forest	*Buteo trizonatus*	9.84
Buzzard, Jackal	*Buteo rufofuscus*	27.89
Buzzard, Steppe	*Buteo vulpinus*	11.46
Camaroptera, Green-backed	*Camaroptera brachyura*	24.54
Camaroptera, Grey-backed	*Camaroptera brevicaudata*	0.12
Canary, Brimstone	*Crithagra sulphuratus*	22.22
Canary, Cape	*Serinus canicollis*	21.41
Canary, Forest	*Crithagra scotops*	19.79
Canary, White-throated	*Crithagra albogularis*	1.16
Canary, Yellow	*Crithagra flaviventris*	0.58
Canary, Yellow-fronted	*Crithagra mozambicus*	13.77
Chat, Familiar	*Cercomela familiaris*	10.07
Cisticola, Cloud	*Cisticola textrix*	1.74
Cisticola, Grey-backed	*Cisticola subruficapilla*	15.05
Cisticola, Lazy	*Cisticola aberrans*	19.56
Cisticola, Levaillant's	*Cisticola tinniens*	31.02
Cisticola, Wailing	*Cisticola lais*	0.69
Cisticola, Wing-snapping	*Cisticola ayresii*	0.35
Cisticola, Zitting	*Cisticola juncidis*	10.07
Cliff-chat, Mocking	*Thamnolaea cinnamomeiventris*	0.35
Coot, Red-knobbed	*Fulica cristata*	47.69
Cormorant, Cape	*Phalacrocorax capensis*	16.2
Cormorant, Reed	*Phalacrocorax africanus*	57.52
Cormorant, White-breasted	*Phalacrocorax carbo*	41.67
Coucal, Burchell's	*Centropus burchellii*	13.31

Species	Taxonomic name	SABAP 2 Reporting rate
Crake, Black	*Amaurornis flavirostris*	11.11
Crane, Blue	*Anthropoides paradiseus*	0.46
Crested-flycatcher, Blue-mantled	*Trochocercus cyanomelas*	16.2
Crombec, Long-billed	*Sylvietta rufescens*	1.04
Crow, Cape	*Corvus capensis*	22.45
Crow, Pied	*Corvus albus*	24.42
Cuckoo, African Emerald	*Chrysococcyx cupreus*	1.5
Cuckoo, Black	*Cuculus clamosus*	8.68
Cuckoo, Diderick	*Chrysococcyx caprius*	11.69
Cuckoo, Jacobin	*Clamator jacobinus*	0.69
Cuckoo, Klaas's	*Chrysococcyx klaas*	10.3
Cuckoo, Red-chested	*Cuculus solitarius*	4.63
Cuckoo-shrike, Black	*Campephaga flava*	4.51
Cuckoo-shrike, Grey	*Coracina caesia*	3.13
Curlew, Eurasian	*Numenius arquata*	2.2
Darter, African	*Anhinga rufa*	18.17
Dove, African Mourning	*Streptopelia decipiens*	0.12
Dove, Laughing	*Streptopelia senegalensis*	44.33
Dove, Lemon	*Aplopelia larvata*	4.86
Dove, Namaqua	*Oena capensis*	1.04
Dove, Red-eyed	*Streptopelia semitorquata*	75.93
Dove, Rock	*Columba livia*	26.16
Dove, Tambourine	*Turtur tympanistria*	12.62
Drongo, Fork-tailed	*Dicrurus adsimilis*	65.39
Duck, African Black	*Anas sparsa*	4.86
Duck, Fulvous	*Dendrocygna bicolor*	1.04
Duck, Hybrid Mallard	*Anas hybrid*	0.81
Duck, Maccoa	*Oxyura maccoa*	1.5
Duck, Mallard	*Anas platyrhynchos*	1.74
Duck, White-backed	*Thalassornis leuconotus*	2.2
Duck, White-faced	*Dendrocygna viduata*	5.09
Duck, Yellow-billed	*Anas undulata*	57.87
Eagle, African Crowned	*Stephanoaetus coronatus*	2.31
Eagle, Booted	*Aquila pennatus*	1.97
Eagle, Long-crested	*Lophaetus occipitalis*	4.4
Eagle, Martial	*Polemaetus bellicosus*	0.93
Eagle, Verreaux's	*Aquila verreauxii*	0.12
Eagle-owl, Spotted	*Bubo africanus*	1.62
Egret, Cattle	*Bubulcus ibis*	52.78
Egret, Great	*Egretta alba*	6.37
Egret, Little	*Egretta garzetta*	39.35
Egret, Yellow-billed	*Egretta intermedia*	2.31
Falcon, Amur	*Falco amurensis*	0.69
Falcon, Lanner	*Falco biarmicus*	4.28
Falcon, Peregrine	*Falco peregrinus*	3.94
Firefinch, African	*Lagonosticta rubricata*	10.3
Fiscal, Common (Southern)	Lanius collaris	83.91
Fish-eagle, African	*Haliaeetus vocifer*	18.4
Flamingo, Greater	*Phoenicopterus ruber*	34.03
Flamingo, Lesser	*Phoenicopterus minor*	17.94
Flufftail, Buff-spotted	*Sarothrura elegans*	0.46

Species	Taxonomic name	SABAP 2 Reporting rate
Flufftail, Red-chested	*Sarothrura rufa*	0.23
Flycatcher, African Dusky	*Muscicapa adusta*	28.82
Flycatcher, Fairy	*Stenostira scita*	0.23
Flycatcher, Fiscal	*Sigelus silens*	42.13
Flycatcher, Spotted	*Muscicapa striata*	0.93
Francolin, Grey-winged	*Scleroptila africanus*	1.27
Francolin, Red-winged	*Scleroptila levaillantii*	2.31
Gannet, Cape	*Morus capensis*	10.42
Godwit, Bar-tailed	*Limosa lapponica*	3.13
Goose, Domestic	*Anser anser*	1.27
Goose, Egyptian	*Alopochen aegyptiacus*	66.67
Goose, Spur-winged	*Plectropterus gambensis*	10.76
Goshawk, African	*Accipiter tachiro*	6.02
Goshawk, Southern Pale Chanting	*Melierax canorus*	0.93
Grassbird, Cape	*Sphenoeacus afer*	15.28
Grass-owl, African	*Tyto capensis*	0.58
Grebe, Black-necked	*Podiceps nigricollis*	15.28
Grebe, Great Crested	*Podiceps cristatus*	0.23
Grebe, Little	*Tachybaptus ruficollis*	39.47
Greenbul, Sombre	*Andropadus importunus*	78.13
Green-pigeon, African	*Treron calvus*	0.35
Greenshank, Common	*Tringa nebularia*	25.46
Guineafowl, Helmeted	*Numida meleagris*	32.41
Gull, Grey-headed	*Larus cirrocephalus*	33.45
Gull, Hartlaub's	*Larus hartlaubii*	8.45
Gull, Kelp	*Larus dominicanus*	50.12
Hamerkop, Hamerkop	*Scopus umbretta*	9.49
Harrier, Black	*Circus maurus*	2.31
Harrier-Hawk, African	*Polyboroides typus*	3.01
Hawk, African Cuckoo	*Aviceda cuculoides*	0.12
Heron, Black-headed	*Ardea melanocephala*	47.22
Heron, Goliath	*Ardea goliath*	15.63
Heron, Grey	*Ardea cinerea*	48.15
Heron, Purple	*Ardea purpurea*	7.06
Heron, Squacco	*Ardeola ralloides*	0.81
Honeybird, Brown-backed	*Prodotiscus regulus*	0.35
Honeyguide, Greater	*Indicator indicator*	1.74
Honeyguide, Lesser	*Indicator minor*	11.69
Honeyguide, Scaly-throated	*Indicator variegatus*	5.67
Hoopoe, African	*Upupa africana*	26.97
Hornbill, Crowned	*Tockus alboterminatus*	6.83
House-martin, Common	*Delichon urbicum*	0.81
Ibis, African Sacred	*Threskiornis aethiopicus*	48.73
Ibis, Glossy	*Plegadis falcinellus*	2.66
Ibis, Hadeda	*Bostrychia hagedash*	72.57
Indigobird, Dusky	*Vidua funerea*	0.23
Jacana, African	*Actophilornis africanus*	6.13
Jaeger, Parasitic	*Stercorarius parasiticus*	0.12
Kestrel, Rock	*Falco rupicolus*	23.96
Kingfisher, Brown-hooded	*Halcyon albiventris*	31.37
Kingfisher, Giant	*Megaceryle maximus*	12.5

Species	Taxonomic name	SABAP 2 Reporting rate
Kingfisher, Half-collared	*Alcedo semitorquata*	5.79
Kingfisher, Malachite	*Alcedo cristata*	10.19
Kingfisher, Pied	*Ceryle rudis*	36.92
Kite, Black-shouldered	*Elanus caeruleus*	10.19
Kite, Yellow-billed	*Milvus aegyptius*	11.81
Knot, Red	*Calidris canutus*	0.69
Korhaan, Karoo	*Eupodotis vigorsii*	0.12
Korhaan, Southern Black	*Afrotis afra*	0.35
Lapwing, Blacksmith	*Vanellus armatus*	61.23
Lapwing, Black-winged	*Vanellus melanopterus*	0.12
Lapwing, Crowned	*Vanellus coronatus*	28.7
Lark, Cape Clapper	*Mirafra apiata*	0.81
Lark, Eastern Clapper	*Mirafra fasciolata*	0.69
Lark, Red-capped	*Calandrella cinerea*	3.82
Lark, Rufous-naped	*Mirafra africana*	6.94
Longclaw, Cape	*Macronyx capensis*	24.77
Mannikin, Bronze	*Spermestes cucullatus*	0.46
Marsh-harrier, African	*Circus ranivorus*	11.46
Martin, Brown-throated	*Riparia paludicola*	45.49
Martin, Rock	*Hirundo fuligula*	17.94
Martin, Sand	*Riparia riparia*	0.12
Moorhen, Common	*Gallinula chloropus*	34.38
Mousebird, Red-faced	*Urocolius indicus*	32.41
Mousebird, Speckled	*Colius striatus*	61.11
Mousebird, White-backed	*Colius colius*	0.23
Neddicky, Neddicky	*Cisticola fulvicapilla*	59.95
Night-Heron, Black-crowned	*Nycticorax nycticorax*	7.18
Night-Heron, White-backed	*Gorsachius leuconotus*	0.12
Nightjar, Fiery-necked	*Caprimulgus pectoralis*	2.31
Olive-pigeon, African	*Columba arquatrix*	6.13
Openbill, African	*Anastomus lamelligerus*	0.35
Oriole, Black-headed	*Oriolus larvatus*	44.21
Osprey, Osprey	*Pandion haliaetus*	3.94
Ostrich, Common	*Struthio camelus*	3.47
Owl, Barn	*Tyto alba*	0.46
Oystercatcher, African Black	*Haematopus moquini*	27.43
Palm-swift, African	*Cypsiurus parvus*	6.13
Paradise-flycatcher, African	*Terpsiphone viridis*	12.73
Peacock, Common	*Pavo cristatus*	0.23
Pelican, Great White	*Pelecanus onocrotalus*	0.12
Penduline-tit, Cape	*Anthoscopus minutus*	0.69
Penguin, African	*Spheniscus demersus*	0.46
Phalarope, Red-necked	*Phalaropus lobatus*	0.23
Pigeon, Speckled	*Columba guinea*	52.66
Pipit, African	*Anthus cinnamomeus*	24.77
Pipit, Long-billed	*Anthus similis*	0.58
Pipit, Plain-backed	*Anthus leucophrys*	12.38
Plover, Chestnut-banded	*Charadrius pallidus*	7.06
Plover, Common Ringed	*Charadrius hiaticula*	16.55
Plover, Greater Sand	*Charadrius leschenaultii*	2.2
Plover, Grey	*Pluvialis squatarola*	15.28

Species	Taxonomic name	SABAP 2 Reporting rate
Plover, Kittlitz's	*Charadrius pecuarius*	25.35
Plover, Lesser Sand	*Charadrius mongolus*	0.35
Plover, Three-banded	*Charadrius tricollaris*	42.25
Plover, White-fronted	*Charadrius marginatus*	10.19
Pochard, Southern	*Netta erythrophthalma*	2.66
Prinia, Karoo	*Prinia maculosa*	52.31
Puffback, Black-backed	*Dryoscopus cubla*	22.45
Quail, Common	*Coturnix coturnix*	1.85
Quailfinch, African	*Ortygospiza atricollis*	0.12
Quelea, Red-billed	*Quelea quelea*	5.56
Rail, African	*Rallus caerulescens*	1.5
Raven, White-necked	*Corvus albicollis*	35.07
Redshank, Common	*Tringa totanus*	0.93
Reed-warbler, African	*Acrocephalus baeticatus*	2.31
Reed-warbler, Great	*Acrocephalus arundinaceus*	0.23
Robin, White-starred	*Pogonocichla stellata*	6.71
Robin-chat, Cape	*Cossypha caffra*	64.35
Robin-chat, Chorister	*Cossypha dichroa*	0.58
Rock-thrush, Cape	*Monticola rupestris*	5.44
Rock-thrush, Sentinel	*Monticola explorator*	0.35
Roller, European	*Coracias garrulus*	0.12
Ruff, Ruff	*Philomachus pugnax*	15.28
Rush-warbler, Little	*Bradypterus baboecala*	20.49
Sanderling, Sanderling	*Calidris alba*	4.75
Sandpiper, Common	*Actitis hypoleucos*	9.95
Sandpiper, Curlew	*Calidris ferruginea*	21.64
Sandpiper, Marsh	*Tringa stagnatilis*	9.26
Sandpiper, Terek	*Xenus cinereus*	2.2
Sandpiper, Wood	*Tringa glareola*	2.89
Saw-wing, Black (Southern race)	*Psalidoprocne holomelaena*	19.68
Scrub-robin, Brown	*Cercotrichas signata*	7.99
Scrub-robin, Karoo	*Cercotrichas coryphoeus*	13.54
Scrub-robin, White-browed	*Cercotrichas leucophrys*	8.91
Secretarybird	*Sagittarius serpentarius*	1.39
Seedeater, Protea	*Crithagra leucopterus*	0.35
Seedeater, Streaky-headed	*Crithagra gularis*	34.61
Shelduck, South African	*Tadorna cana*	26.04
Shoveler, Cape	*Anas smithii*	30.56
Shrike, Red-backed	*Lanius collurio*	0.35
Siskin, Cape	*Crithagra totta*	3.01
Snipe, African	*Gallinago nigripennis*	3.82
Southern Masked-weaver, Southern	*Ploceus velatus*	46.53
Sparrow, Cape	*Passer melanurus*	51.39
Sparrow, House	*Passer domesticus*	32.29
Sparrow, Southern Grey-headed	*Passer diffusus*	26.27
Sparrowhawk, Black	*Accipiter melanoleucus*	6.02
Sparrowhawk, Little	*Accipiter minullus*	3.13
Sparrowhawk, Rufous-chested	*Accipiter rufiventris*	0.23
Spoonbill, African	*Platalea alba*	31.37
Spurfowl, Red-necked	*Pternistis afer*	23.5
Starling, Black-bellied	*Lamprotornis corruscus*	20.37

Species	Taxonomic name	SABAP 2 Reporting rate
Starling, Cape Glossy	*Lamprotornis nitens*	16.78
Starling, Common	*Sturnus vulgaris*	69.1
Starling, Pied	*Spreo bicolor*	21.99
Starling, Red-winged	*Onychognathus morio*	22.8
Starling, Wattled	*Creatophora cinerea*	1.27
Stilt, Black-winged	*Himantopus himantopus*	38.54
Stint, Little	*Calidris minuta*	21.53
Stonechat, African	*Saxicola torquatus*	17.36
Stork, Black	*Ciconia nigra*	0.46
Stork, White	*Ciconia ciconia*	4.86
Sugarbird, Cape	*Promerops cafer*	12.04
Sunbird, Amethyst	*Chalcomitra amethystina*	56.6
Sunbird, Collared	*Hedydipna collaris*	20.72
Sunbird, Greater Double-collared	*Cinnyris afer*	48.26
Sunbird, Grey	*Cyanomitra veroxii*	21.88
Sunbird, Malachite	*Nectarinia famosa*	26.97
Sunbird, Orange-breasted	*Anthobaphes violacea*	3.82
Sunbird, Southern Double-collared	*Cinnyris chalybeus*	34.26
Swallow, Barn	*Hirundo rustica*	36.57
Swallow, Greater Striped	*Hirundo cucullata*	32.18
Swallow, Lesser Striped	*Hirundo abyssinica*	23.84
Swallow, Pearl-breasted	*Hirundo dimidiata*	5.79
Swallow, White-throated	*Hirundo albigularis*	20.14
Swamphen, African Purple	*Porphyrio madagascariensis*	9.84
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*	28.82
Swift, African Black	*Apus barbatus*	1.16
Swift, Alpine	*Tachymarptis melba*	0.58
Swift, Horus	*Apus horus*	0.81
Swift, Little	*Apus affinis*	18.17
Swift, White-rumped	*Apus caffer*	30.79
Tchagra, Southern	*Tchagra tchagra*	14.35
Teal, Cape	*Anas capensis*	33.8
Teal, Hottentot	*Anas hottentota*	1.27
Teal, Red-billed	*Anas erythrorhyncha*	21.53
Tern, Arctic	*Sterna paradisaea*	0.12
Tern, Caspian	*Sterna caspia*	23.15
Tern, Common	*Sterna hirundo*	15.97
Tern, Damara	*Sterna balaenarum*	1.04
Tern, Little	*Sterna albifrons*	7.18
Tern, Roseate	*Sterna dougallii*	0.23
Tern, Sandwich	*Sterna sandvicensis*	6.83
Tern, Swift	*Sterna bergii*	7.41
Tern, Whiskered	*Chlidonias hybrida*	8.8
Tern, White-winged	*Chlidonias leucopterus*	5.32
Thick-knee, Spotted	*Burhinus capensis*	17.82
Thick-knee, Water	*Burhinus vermiculatus*	10.07
Thrush, Olive	*Turdus olivaceus*	23.84
Tinkerbird, Red-fronted	*Pogoniulus pusillus*	26.85
Tit, Grey	*Parus afer*	0.23
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*	9.49
Trogon, Narina	*Apaloderma narina*	1.85

Species	Taxonomic name	SABAP 2 Reporting rate
Turaco, Knysna	*Tauraco corythaix*	34.61
Turnstone, Ruddy	*Arenaria interpres*	11.69
Turtle-dove, Cape	*Streptopelia capicola*	55.67
Wagtail, African Pied	*Motacilla aguimp*	0.81
Wagtail, Cape	*Motacilla capensis*	76.74
Warbler, Knysna	*Bradypterus sylvaticus*	1.85
Warbler, Marsh	*Acrocephalus palustris*	0.23
Warbler, Victorin's	*Cryptillas victorini*	3.59
Warbler, Willow	*Phylloscopus trochilus*	3.13
Waxbill, Common	*Estrilda astrild*	31.94
Waxbill, Swee	*Coccopygia melanotis*	10.65
Weaver, Cape	*Ploceus capensis*	59.03
Weaver, Dark-backed	*Ploceus bicolor*	17.13
Weaver, Spectacled	*Ploceus ocularis*	16.44
Weaver, Thick-billed	*Amblyospiza albifrons*	4.05
Weaver, Village	*Ploceus cucullatus*	1.39
Weaver, Yellow	*Ploceus subaureus*	1.04
Wheatear, Capped	*Oenanthe pileata*	0.23
Whimbrel, Common	*Numenius phaeopus*	21.64
White-eye, Cape	*Zosterops virens*	63.66
Whydah, Pin-tailed	*Vidua macroura*	10.88
Widowbird, Fan-tailed	*Euplectes axillaris*	0.12
Wood-dove, Emerald-spotted	*Turtur chalcospilos*	10.88
Wood-hoopoe, Green	*Phoeniculus purpureus*	10.53
Woodland-warbler, Yellow-throated	*Phylloscopus ruficapilla*	7.99
Wood-owl, African	*Strix woodfordii*	0.23
Woodpecker, Cardinal	*Dendropicos fuscescens*	5.21
Woodpecker, Ground	*Geocolaptes olivaceus*	0.35
Woodpecker, Knysna	*Campethera notata*	13.08
Woodpecker, Olive	*Dendropicos griseocephalus*	21.41
Wryneck, Red-throated	*Jynx ruficollis*	1.04

BETWEEN IMPOFU AND THE KOUGA RIVER MOUTH

Species	Taxonomic name	SABAP2 Reporting rate
Crane, Blue	*Anthropoides paradiseus*	37.35
Harrier, Black	*Circus maurus*	6.59
Secretarybird	*Sagittarius serpentarius*	4.7
Eagle, Martial	*Polemaetus bellicosus*	2.52
Gannet, Cape	*Morus capensis*	2.1
Korhaan, Southern Black	*Afrotis afra*	0.21
Bustard, Denham's	*Neotis denhami*	34.69
Oystercatcher, African Black	*Haematopus moquini*	29.01
Sandpiper, Curlew	*Calidris ferruginea*	21.02
Godwit, Bar-tailed	*Limosa lapponica*	10.02
Curlew, Eurasian	*Numenius arquata*	5.26
Knot, Red	*Calidris canutus*	2.17
Flamingo, Lesser	*Phoenicopterus minor*	1.54
Eagle, African Crowned	*Stephanoaetus coronatus*	0.98
Duck, Maccoa	*Oxyura maccoa*	0.49
Harrier, Pallid	*Circus macrourus*	0.21
Falcon, Red-footed	*Falco vespertinus*	0.07
Plover, Chestnut-banded	*Charadrius pallidus*	0.07
Sandpiper, Buff-breasted	*Tryngites subruficollis*	0.07
Marsh-harrier, African	*Circus ranivorus*	25.02
Flamingo, Greater	*Phoenicopterus ruber*	16.26
Korhaan, White-bellied	*Eupodotis senegalensis*	10.58
Kingfisher, Half-collared	*Alcedo semitorquata*	3.43
Falcon, Lanner	*Falco biarmicus*	2.8
Eagle, Verreaux's	*Aquila verreauxii*	0.63
Rock-jumper, Cape	*Chaetops frenatus*	0.49
Roller, European	*Coracias garrulus*	0.49
Finfoot, African	*Podica senegalensis*	0.14
Flufftail, Striped	*Sarothrura affinis*	0.14
Painted-snipe, Greater	*Rostratula benghalensis*	0.14
Grass-owl, African	*Tyto capensis*	0.07
Cormorant, Cape	*Phalacrocorax capensis*	10.02
Penguin, African	*Spheniscus demersus*	0.07
Ibis, Hadeda	*Bostrychia hagedash*	81.01
Dove, Red-eyed	*Streptopelia semitorquata*	78.56
Goose, Egyptian	*Alopochen aegyptiacus*	75.68
Greenbul, Sombre	*Andropadus importunus*	71.69
Drongo, Fork-tailed	*Dicrurus adsimilis*	69.94
Robin-chat, Cape	*Cossypha caffra*	69.45
Neddicky, Neddicky	*Cisticola fulvicapilla*	68.54
Apalis, Bar-throated	*Apalis thoracica*	68.47
Boubou, Southern	*Laniarius ferrugineus*	67.97
Duck, Yellow-billed	*Anas undulata*	64.96
Lapwing, Blacksmith	*Vanellus armatus*	64.05
Heron, Black-headed	*Ardea melanocephala*	63.28
Pigeon, Speckled	*Columba guinea*	62.3
Cormorant, Reed	*Phalacrocorax africanus*	61.88
Egret, Cattle	*Bubulcus ibis*	61.81
Gull, Kelp	*Larus dominicanus*	58.72
Ibis, African Sacred	*Threskiornis aethiopicus*	58.09

Species	Taxonomic name	SABAP2 Reporting rate
Bulbul, Cape	*Pycnonotus capensis*	57.95
Crow, Cape	*Corvus capensis*	55.64
Mousebird, Speckled	*Colius striatus*	54.03
Prinia, Karoo	*Prinia maculosa*	52.98
Guineafowl, Helmeted	*Numida meleagris*	51.86
Longclaw, Cape	*Macronyx capensis*	51.3
Heron, Grey	*Ardea cinerea*	49.4
Buzzard, Jackal	*Buteo rufofuscus*	49.19
Dove, Laughing	*Streptopelia senegalensis*	48.98
Pipit, African	*Anthus cinnamomeus*	47.37
Barbet, Black-collared	*Lybius torquatus*	47.3
Flycatcher, Fiscal	*Sigelus silens*	46.18
Lapwing, Crowned	*Vanellus coronatus*	46.18
Goose, Spur-winged	*Plectropterus gambensis*	44.85
Coot, Red-knobbed	*Fulica cristata*	43.24
Oriole, Black-headed	*Oriolus larvatus*	41.84
Grebe, Little	*Tachybaptus ruficollis*	41.56
Cormorant, White-breasted	*Phalacrocorax carbo*	40.22
Lark, Rufous-naped	*Mirafra africana*	40.01
Cisticola, Levaillant's	*Cisticola tinniens*	38.05
Kingfisher, Pied	*Ceryle rudis*	36.72
Egret, Little	*Egretta garzetta*	36.44
Kingfisher, Brown-hooded	*Halcyon albiventris*	34.2
Bishop, Southern Red	*Euplectes orix*	34.06
Martin, Brown-throated	*Riparia paludicola*	33.85
Plover, Three-banded	*Charadrius tricollaris*	33.64
Bush-shrike, Olive	*Telophorus olivaceus*	32.8
Canary, Cape	*Serinus canicollis*	32.17
Bishop, Yellow	*Euplectes capensis*	32.1
Raven, White-necked	*Corvus albicollis*	31.81
Grassbird, Cape	*Sphenoeacus afer*	31.6
Moorhen, Common	*Gallinula chloropus*	31.46
Mousebird, Red-faced	*Urocolius indicus*	31.11
Lark, Red-capped	*Calandrella cinerea*	30.97
Hoopoe, African	*Upupa africana*	30.2
Cisticola, Zitting	*Cisticola juncidis*	29.36
Canary, Brimstone	*Crithagra sulphuratus*	29.29
Cisticola, Grey-backed	*Cisticola subruficapilla*	28.73
Coucal, Burchell's	*Centropus burchellii*	28.38
Darter, African	*Anhinga rufa*	28.03
Fish-eagle, African	*Haliaeetus vocifer*	27.89
Greenshank, Common	*Tringa nebularia*	27.89
Cisticola, Cloud	*Cisticola textrix*	27.68
Plover, Grey	*Pluvialis squatarola*	26.98
Martin, Rock	*Hirundo fuligula*	26.7
Rush-warbler, Little	*Bradypterus baboecala*	26
Brownbul, Terrestrial	*Phyllastrephus terrestris*	25.09
Buzzard, Steppe	*Buteo vulpinus*	23.76
Plover, White-fronted	*Charadrius marginatus*	23.55
Batis, Cape	*Batis capensis*	22.63
Plover, Common Ringed	*Charadrius hiaticula*	21.93

Species	Taxonomic name	SABAP2 Reporting rate
Plover, Kittlitz's	*Charadrius pecuarius*	21.65
Duck, White-faced	*Dendrocygna viduata*	20.53
Crake, Black	*Amaurornis flavirostris*	18.99
Sanderling, Sanderling	*Calidris alba*	18.57
Crow, Pied	*Corvus albus*	16.96
Lapwing, Black-winged	*Vanellus melanopterus*	16.54
Cuckoo, Diderick	*Chrysococcyx caprius*	16.33
Flycatcher, African Dusky	*Muscicapa adusta*	14.58
Kite, Black-shouldered	*Elanus caeruleus*	13.17
Heron, Goliath	*Ardea goliath*	13.1
Quelea, Red-billed	*Quelea quelea*	12.75
Kingfisher, Giant	*Megaceryle maximus*	12.68
Kite, Yellow-billed	*Milvus aegyptius*	12.4
Chat, Familiar	*Cercomela familiaris*	11.91
Sandpiper, Wood	*Tringa glareola*	11.7
Dove, Tambourine	*Turtur tympanistria*	11.35
Falcon, Amur	*Falco amurensis*	11.28
Puffback, Black-backed	*Dryoscopus cubla*	11.14
Camaroptera, Green-backed	*Camaroptera brachyura*	11.07
Heron, Purple	*Ardea purpurea*	10.58
Palm-swift, African	*Cypsiurus parvus*	10.44
Sandpiper, Common	*Actitis hypoleucos*	10.3
Gull, Grey-headed	*Larus cirrocephalus*	10.23
Kingfisher, Malachite	*Alcedo cristata*	10.02
Nightjar, Fiery-necked	*Caprimulgus pectoralis*	9.95
Cuckoo, Klaas's	*Chrysococcyx klaas*	9.74
Paradise-flycatcher, African	*Terpsiphone viridis*	9.53
Martin, Banded	*Riparia cincta*	9.32
Cuckoo, Black	*Cuculus clamosus*	9.25
Quail, Common	*Coturnix coturnix*	9.04
Cuckoo, Jacobin	*Clamator jacobinus*	8.9
Kestrel, Rock	*Falco rupicolus*	8.62
Eagle-owl, Spotted	*Bubo africanus*	8.48
Osprey, Osprey	*Pandion haliaetus*	8.27
Pipit, Plain-backed	*Anthus leucophrys*	7.92
Avocet, Pied	*Recurvirostra avosetta*	6.31
Night-Heron, Black-crowned	*Nycticorax nycticorax*	6.17
Lark, Cape Clapper	*Mirafra apiata*	5.75
Canary, Forest	*Crithagra scotops*	5.33
Cuckoo, Red-chested	*Cuculus solitarius*	5.19
Ostrich, Common	*Struthio camelus*	5.19
Sandpiper, Marsh	*Tringa stagnatilis*	5.12
Jacana, African	*Actophilornis africanus*	4.91
Apalis, Yellow-breasted	*Apalis flavida*	4.63
Cisticola, Lazy	*Cisticola aberrans*	4.34
Egret, Great	*Egretta alba*	4.34
Crested-flycatcher, Blue-mantled	*Trochocercus cyanomelas*	4.27
Plover, Greater Sand	*Charadrius leschenaultii*	4.06
Sandpiper, Terek	*Xenus cinereus*	4.06
Rock-thrush, Cape	*Monticola rupestris*	3.92
Firefinch, African	*Lagonosticta rubricata*	3.78

Species	Taxonomic name	SABAP2 Reporting rate
Rail, African	*Rallus caerulescens*	3.78
Olive-pigeon, African	*Columba arquatrix*	3.71
Dove, Rock	*Columba livia*	3.5
Cisticola, Wailing	*Cisticola lais*	3.29
Harrier-Hawk, African	*Polyboroides typus*	3.08
Eagle, Long-crested	*Lophaetus occipitalis*	3.01
Pochard, Southern	*Netta erythrophthalma*	3.01
Ibis, Glossy	*Plegadis falcinellus*	2.73
Bunting, Golden-breasted	*Emberiza flaviventris*	2.66
Dove, Namaqua	*Oena capensis*	2.66
Duck, Mallard	*Anas platyrhynchos*	2.66
Quailfinch, African	*Ortygospiza atricollis*	2.66
Eagle, Booted	*Aquila pennatus*	2.52
Lovebird, Black-cheeked	*Agapornis nigrigenis*	2.52
Goshawk, African	*Accipiter tachiro*	2.45
Francolin, Red-winged	*Scleroptila levaillantii*	2.31
Lovebird, Rosy-faced	*Agapornis roseicollis*	2.31
Honeyguide, Scaly-throated	*Indicator variegatus*	2.17
Hornbill, Crowned	*Tockus alboterminatus*	2.17
Buzzard, Forest	*Buteo trizonatus*	2.1
Duck, White-backed	*Thalassornis leuconotus*	2.1
Honeyguide, Lesser	*Indicator minor*	2.03
Bunting, Cape	*Emberiza capensis*	1.82
Canary, Yellow	*Crithagra flaviventris*	1.82
Chat, Anteating	*Myrmecocichla formicivora*	1.75
Falcon, Peregrine	*Falco peregrinus*	1.75
Peacock, Common	*Pavo cristatus*	1.75
Duck, African Black	*Anas sparsa*	1.61
Honeyguide, Greater	*Indicator indicator*	1.54
Bittern, Little	*Ixobrychus minutus*	1.4
Pipit, Long-billed	*Anthus similis*	1.26
Reed-warbler, African	*Acrocephalus baeticatus*	1.19
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	1.12
Goshawk, Southern Pale Chanting	*Melierax canorus*	1.12
Lark, Large-billed	*Galerida magnirostris*	1.12
Canary, Yellow-fronted	*Crithagra mozambicus*	1.05
Scrub-robin, Brown	*Cercotrichas signata*	0.98
Heron, Squacco	*Ardeola ralloides*	0.91
Lark, Eastern Clapper	*Mirafra fasciolata*	0.91
Plover, Lesser Sand	*Charadrius mongolus*	0.91
Cuckoo, African Emerald	*Chrysococcyx cupreus*	0.84
Honeybird, Brown-backed	*Prodotiscus regulus*	0.84
Openbill, African	*Anastomus lamelligerus*	0.84
Egret, Yellow-billed	*Egretta intermedia*	0.7
Godwit, Hudsonian	*Limosa haemastica*	0.7
Hobby, Eurasian	*Falco subbuteo*	0.7
Courser, Temminck's	*Cursorius temminckii*	0.56
Dove, Lemon	*Aplopelia larvata*	0.56
Flufftail, Red-chested	*Sarothrura rufa*	0.56
Flycatcher, Spotted	*Muscicapa striata*	0.56
Owl, Barn	*Tyto alba*	0.56

Species	Taxonomic name	SABAP2 Reporting rate
Plover, Crab	*Dromas ardeola*	0.56
Robin, White-starred	*Pogonocichla stellata*	0.56
Bulbul, Dark-capped	*Pycnonotus tricolor*	0.49
Petronia, Yellow-throated	*Petronia superciliaris*	0.49
Harrier, Montagu's	*Circus pygargus*	0.42
House-martin, Common	*Delichon urbicum*	0.42
Martin, Sand	*Riparia riparia*	0.42
Pipit, Buffy	*Anthus vaalensis*	0.42
Crombec, Long-billed	*Sylvietta rufescens*	0.35
Eagle-owl, Cape	*Bubo capensis*	0.35
Goshawk, Gabar	*Melierax gabar*	0.35
Honey-buzzard, European	*Pernis apivorus*	0.35
Bunting, Lark-like	*Emberiza impetuani*	0.28
Crake, Baillon's	*Porzana pusilla*	0.28
Grebe, Black-necked	*Podiceps nigricollis*	0.28
Pygmy-Kingfisher, African	*Ispidina picta*	0.28
Rock-thrush, Sentinel	*Monticola explorator*	0.28
Flufftail, Buff-spotted	*Sarothrura elegans*	0.21
Oriole, Eurasian Golden	*Oriolus oriolus*	0.21
Canary, White-throated	*Crithagra albogularis*	0.14
Gallinule, American Purple	*Porphyrio martinicus*	0.14
Lark, Cape Long-billed	*Certhilauda curvirostris*	0.14
Quelea, Red-headed	*Quelea erythrops*	0.14
Reed-warbler, Great	*Acrocephalus arundinaceus*	0.14
Sandpiper, Pectoral	*Calidris melanotos*	0.14
Barbet, Acacia Pied	*Tricholaema leucomelas*	0.07
Batis, Chinspot	*Batis molitor*	0.07
Cisticola, Desert	*Cisticola aridulus*	0.07
Dove, African Mourning	*Streptopelia decipiens*	0.07
Duck, Hybrid Mallard	*Anas hybrid*	0.07
Flycatcher, Southern Black	*Melaenornis pammelaina*	0.07
Grebe, Great Crested	*Podiceps cristatus*	0.07
Green-pigeon, African	*Treron calvus*	0.07
Gull, Lesser Black-backed	*Larus fuscus*	0.07
Hornbill, Trumpeter	*Bycanistes bucinator*	0.07
Indigobird, Dusky	*Vidua funerea*	0.07
Prinia, Drakensberg	*Prinia hypoxantha*	0.07
Robin-chat, Chorister	*Cossypha dichroa*	0.07
Fiscal, Common (Southern)	*Lanius collaris*	88.86
Wagtail, Cape	*Motacilla capensis*	78.14
Weaver, Cape	*Ploceus capensis*	74.91
Bokmakierie, Bokmakierie	*Telophorus zeylonus*	74.7
Turtle-dove, Cape	*Streptopelia capicola*	70.36
Starling, Common	*Sturnus vulgaris*	66.99
White-eye, Cape	*Zosterops virens*	59.29
Stonechat, African	*Saxicola torquatus*	57.81
Sunbird, Greater Double-collared	*Cinnyris afer*	53.12
Swallow, Barn	*Hirundo rustica*	47.79
Waxbill, Common	*Estrilda astrild*	47.3
Swallow, Greater Striped	*Hirundo cucullata*	45.9
Sunbird, Amethyst	*Chalcomitra amethystina*	42.33

Species	Taxonomic name	SABAP2 Reporting rate
Spurfowl, Red-necked	*Pternistis afer*	41.35
Teal, Red-billed	*Anas erythrorhyncha*	38.89
Swift, White-rumped	*Apus caffer*	36.51
Starling, Cape Glossy	*Lamprotornis nitens*	35.25
Sparrow, Southern Grey-headed	*Passer diffusus*	32.45
Starling, Red-winged	*Onychognathus morio*	31.53
Spoonbill, African	*Platalea alba*	30.76
Sparrow, House	*Passer domesticus*	30.06
Saw-wing, Black (Southern race)	*Psalidoprocne holomelaena*	28.31
Seedeater, Streaky-headed	*Crithagra gularis*	28.1
Shoveler, Cape	*Anas smithii*	27.82
Whydah, Pin-tailed	*Vidua macroura*	27.82
Sunbird, Malachite	*Nectarinia famosa*	26.91
Stilt, Black-winged	*Himantopus himantopus*	25.58
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*	25.44
Thick-knee, Water	*Burhinus vermiculatus*	25.3
Teal, Cape	*Anas capensis*	24.95
Tern, Caspian	*Sterna caspia*	24.46
Whimbrel, Common	*Numenius phaeopus*	24.32
Swallow, White-throated	*Hirundo albigularis*	24.18
Swift, Little	*Apus affinis*	21.58
Thrush, Olive	*Turdus olivaceus*	21.58
Southern Masked-weaver, Southern	*Ploceus velatus*	21.09
Thick-knee, Spotted	*Burhinus capensis*	20.46
Starling, Pied	*Spreo bicolor*	19.9
Stint, Little	*Calidris minuta*	19.9
Tern, Common	*Sterna hirundo*	19.06
Tern, Little	*Sterna albifrons*	17.66
Stork, White	*Ciconia ciconia*	17.52
Tern, Sandwich	*Sterna sandvicensis*	17.24
Weaver, Spectacled	*Ploceus ocularis*	16.89
Starling, Black-bellied	*Lamprotornis corruscus*	16.54
Sunbird, Grey	*Cyanomitra veroxii*	16.47
Tern, Swift	*Sterna bergii*	15.84
Swallow, Lesser Striped	*Hirundo abyssinica*	14.51
Tchagra, Southern	*Tchagra tchagra*	14.44
Sunbird, Collared	*Hedydipna collaris*	14.09
Wood-hoopoe, Green	*Phoeniculus purpureus*	13.81
Woodpecker, Knysna	*Campethera notata*	13.03
Shelduck, South African	*Tadorna cana*	12.89
Turnstone, Ruddy	*Arenaria interpres*	11.91
Wood-dove, Emerald-spotted	*Turtur chalcospilos*	11.77
Ruff, Ruff	*Philomachus pugnax*	11.7
Widowbird, Long-tailed	*Euplectes progne*	10.86
Turaco, Knysna	*Tauraco corythaix*	10.72
Woodpecker, Olive	*Dendropicos griseocephalus*	9.74
Sunbird, Southern Double-collared	*Cinnyris chalybeus*	9.46
Swamphen, African Purple	*Porphyrio madagascariensis*	9.39
Swift, Horus	*Apus horus*	8.9
Weaver, Village	*Ploceus cucullatus*	8.48
Snipe, African	*Gallinago nigripennis*	8.27

Species	Taxonomic name	SABAP2 Reporting rate
Tern, Whiskered	*Chlidonias hybrida*	7.78
Swift, Alpine	*Tachymarptis melba*	6.87
Sugarbird, Cape	*Promerops cafer*	6.73
Warbler, Knysna	*Bradypterus sylvaticus*	6.45
Waxbill, Swee	*Coccopygia melanotis*	6.45
Hamerkop, Hamerkop	*Scopus umbretta*	6.38
Sparrow, Cape	*Passer melanurus*	5.12
Sunbird, Orange-breasted	*Anthobaphes violacea*	5.12
Swift, African Black	*Apus barbatus*	5.12
Swallow, Pearl-breasted	*Hirundo dimidiata*	4.27
Scrub-robin, White-browed	*Cercotrichas leucophrys*	4.06
Teal, Hottentot	*Anas hottentota*	4.06
Scrub-robin, Karoo	*Cercotrichas coryphoeus*	3.85
Tinkerbird, Red-fronted	*Pogoniulus pusillus*	3.85
Sparrowhawk, Black	*Accipiter melanoleucus*	3.64
Starling, Wattled	*Creatophora cinerea*	3.36
Warbler, Willow	*Phylloscopus trochilus*	3.36
Weaver, Thick-billed	*Amblyospiza albifrons*	3.22
Wagtail, African Pied	*Motacilla aguimp*	3.08
Weaver, Dark-backed	*Ploceus bicolor*	2.66
Woodland-warbler, Yellow-throated	*Phylloscopus ruficapilla*	2.45
Woodpecker, Cardinal	*Dendropicos fuscescens*	2.31
Cuckoo-shrike, Black	*Campephaga flava*	1.89
Cuckoo-shrike, Grey	*Coracina caesia*	1.75
Siskin, Cape	*Crithagra totta*	1.33
Warbler, Victorin's	*Cryptillas victorini*	1.33
Trogon, Narina	*Apaloderma narina*	1.26
Swift, Common	*Apus apus*	1.19
Tern, White-winged	*Chlidonias leucopterus*	0.91
Sparrowhawk, Little	*Accipiter minullus*	0.84
Tern, Roseate	*Sterna dougallii*	0.77
Wheatear, Capped	*Oenanthe pileata*	0.63
Tern, Damara	*Sterna balaenarum*	0.56
Warbler, Marsh	*Acrocephalus palustris*	0.56
Woodpecker, Ground	*Geocolaptes olivaceus*	0.28
Sparrowhawk, Rufous-chested	*Accipiter rufiventris*	0.21
Wryneck, Red-throated	*Jynx ruficollis*	0.21
Tern, Antarctic	*Sterna vittata*	0.14
Tern, Arctic	*Sterna paradisaea*	0.14
Warbler, Sedge	*Acrocephalus schoenobaenus*	0.14
Shrike, Red-backed	*Lanius collurio*	0.07
Snake-eagle, Black-chested	*Circaetus pectoralis*	0.07
Spurfowl, Cape	*Pternistis capensis*	0.07
Stork, Abdim's	*Ciconia abdimii*	0.07
Tit, Southern Black	*Parus niger*	0.07
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*	0.07
Tropicbird, Red-tailed	*Phaethon rubricauda*	0.07
Wood-owl, African	*Strix woodfordii*	0.07

APPENDIX 3: IMPACT ASSESSMENT METHODOLOGY

This assessment used the following impact assessment methodology provided by Aurecon.

Assessing the Significance of an Impact

Overview

For each predicted impact, criteria are ascribed and these include the **intensity** (size or degree scale), which also includes the **type** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale), as well as the **probability** (likelihood).

When assessing impacts, broader considerations were also taken into account, these include the **confidence** with which the assessment was undertaken, the **reversibility** of the impact and the resource **irreplaceability**.

Calculations

For each predicted impact, certain criteria are applied to establish the likely **significance** of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

These criteria include the **intensity** *(*size or degree scale), which also includes the **type** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale). These numerical ratings are used in an equation whereby the **consequence** of the impact can be calculated. Consequence is calculated as follows:

Consequence = type x (intensity + duration + extent).

To calculate the significance of an impact, the **probability** (or likelihood) of that impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as negligible, minor, moderate or major, and the type would be either positive or negative.

The following tables show the scales used to classify the above variables, and define each of the rating categories.

Intensity

The intensity refers to the degree of alteration of the affected environmental receptor.

Table 1: Description of intensity and assigned numerical values

Numerical Rating	Intensity	
	Category	Description
1	**Negligible**	Natural and/ or social functions and/ or processes are negligibly altered
2	**Very low**	Natural and/ or social functions and/ or processes are slightly altered
3	**Low**	Natural and/ or social functions and/ or processes are somewhat altered
4	**Moderate**	Natural and/ or social functions and/ or processes are moderately altered
5	**High**	Natural and/ or social functions and/ or processes are notably altered
6	**Very high**	Natural and/ or social functions and/ or processes are majorly altered
7	**Extremely high**	Natural and/ or social functions and/ or processes are severely altered

*NOTE: Where applicable, the intensity of the impact is related to a relevant standard or threshold, or is based on specialist knowledge and understanding of that particular field.

Duration

The duration refers to the length of permanence of the impact on the environmental receptor.

Table 2: Description of duration and assigned numerical values

Numerical Rating	Category	Descriptors
1	**Immediate**	Impact will self-remedy immediately
2	**Brief**	Impact will not last longer than 1 year
3	**Short term**	Impact will last between 1 and 5 years
4	**Medium term**	Impact will last between 5 and 10 years
5	**Long term**	Impact will last between 10 and 15 years
6	**On-going**	Impact will last between 15 and 20 years
7	**Permanent**	Impact may be permanent, or in excess of 20 years

Extent

The extent refers to the geographical scale of impact on the environmental receptor.

Table 3: Description of extent and assigned numerical values

Numerical Rating	Category	Descriptors
1	**Very limited**	Limited to specific isolated parts of the site
2	**Limited**	Limited to the site and its immediate surroundings
3	**Local**	Extending across the site and to nearby settlements
4	**Municipal area**	Impacts felt at a municipal level
5	**Regional**	Impacts felt at a regional / provincial level
6	**National**	Impacts felt at a national level
7	**International**	Impacts felt at an international level

Probability

To calculate the significance of an impact, the probability (or likelihood) of that impact occurring is also taken into account.

Table 4: Definition of probability ratings

Numerical Rating	Category	Descriptors
1	**Highly unlikely / None**	Expected never to happen
2	**Rare / improbable**	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
3	**Unlikely**	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
4	**Probable**	Has occurred here or elsewhere and could therefore occur
5	**Likely**	The impact may occur
6	**Almost certain / Highly probable**	It is most likely that the impact will occur
7	**Certain / Definite**	There are sound scientific reasons to expect that the impact will definitely occur

Significance

These are calculated as described above and includes the following categories in Table 5.

Table 5: Application of significance ratings

Range		Significance rating
-147	-109	Major (-)
-108	-73	Moderate (-)
-72	-36	Minor (-)
-35	-1	Negligible (-)
0	0	Neutral
1	35	Negligible (+)
36	72	Minor (+)
73	108	Moderate (+)
109	147	Major (+)

When assessing impacts, broader considerations were also taken into account. These included the level of confidence in the assessment rating; the reversibility of the impact; and the irreplaceability of the resource as set out in Table 6, Table 7 and Table 8 respectively.

Table 6: Definition of confidence ratings

Rating	Descriptor
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Table 7: Definition of reversibility ratings

Rating	Descriptor
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact

Table 8: Definition of irreplaceability ratings

Rating	Descriptor
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere
High	The resource is irreparably damaged and is not represented elsewhere

APPENDIX 4: ESKOM MITIGATION GUIDELINES

Eskom	Technical Bulletin	Technology

Title: **UTILIZATION OF BIRD FLIGHT DIVERTERS ON ESKOM OVERHEAD LINES**

Unique Identifier:	**240-93563150**
Alternative Reference Number:	**n/a**
Area of Applicability:	**Distribution**
Documentation Type:	**Technical Bulletin**
Revision:	**1**
Total Pages:	**6**
Next Review Date:	**n/a**
Disclosure Classification:	**Controlled Disclosure**

Compiled by	Functional Responsibility	Authorized by
Zane Evan	**Bharat Haridass**	**Riaz Vajeth**
Electrical Engineer	**Senior Consultant**	**Line Engineering Manager**
Date: 22/06/2015	Date: 9/7/2015	Date: 9/7/2015

PCM Reference: **240-53458961 Perform Line Engineering**
SCOT Study Committee Number/Name: **Overhead Lines**

Content

Figures

Revision history

This revision cancels and replaces document number 09 TB - 01.

Date	Rev	Compiler	Remarks
June 2015	1	Zane Evan	This TB replaces 09 TB – 01 and is in the new format.

1. Introduction

A bird collision incident happens when a bird physically strikes either the overhead conductor or the overhead ground wire of a power line. In the case of transmission lines, the overhead ground wire is usually involved. It is generally accepted that birds usually avoid the highly visible bundled conductors but often fail to see the thin ground wire. In South Africa, bird collisions with Transmission lines are a major form of unnatural mortality among several threatened species.

Various line marking devices have been developed in the past. The designs of the devices have largely been through the Research and Development of the Manufacturers. This document provides the basic requirements to be adhered to by the bird diverter / flapper manufacturers and outlines products that are acceptable for use on Eskom power lines.

This document is applicable to distribution lines. A transmission guideline to mitigate against bird collisions may be found in document: TRANSMISSION BIRD COLLISION PREVENTION GUIDELINE tgl41-335.

2. Materials to be used

- Steel components must be stainless steel – grade 304
- Plastic components must be UV stable high impacted PVC.
- Connections between moving parts must be re-enforced with stainless steel grommets

2.1 Size, Colour and Weight

Specifications with regards to the size, colour and weight of the supplied bird flight diverter should comply with the criteria set out below:

- The markers should present an effective visual area of not less than 200 cm^2.
- It would be advantageous if the device could extend both above and below the conductor or shield wire
- The markers shall not pose a transverse wind surface area greater than 200 cm^2.
- The colour of the markers must be in contrast with the surrounding area i.e. yellow, white and black and may be manufactured with reflective materials. Reflective stickers will not be permitted.
- The addition of luminescence or fluorescence or solar powered LEDs, for the prevention of night collisions. The glow must be visible throughout the night, especially for early morning bird movements.
- The weight of the device shall not exceed 500g (entire device including the clamping mechanism).
- Movement of the device may be one directional. Multi directional devices must be engineered to be able to cope with the movement and must be prevented from becoming entangled in its own mechanism or resting on top of the conductor.

2.2 Application for use on Eskom Networks

- The device clamping mechanism must not allow any movement at all once installed on the conductor e.g. rotational around conductor, gravitation to another position along the conductor, etc.
- The device may not damage the conductor onto which it is placed.
- The device may not cause corona.
- Devices which make use of a flapper attached to a clamp, the flapper sections must not be able to flip up over the clamp and conductor.
- Connector part mechanisms must be burr free.
- The device must be applied with a live line link stick for MV lines.
- The device must be removable with a live line link stick for MV lines.

3. Testing

The bird flapper should undergo the following type tests before it is used on Eskom networks:

- Pull down test (spirally moving along the conductor) for squirrel and hare conductor.
- Testing for radio interference at 27 kV on fox conductor.
- Testing for corona at 27 kV on fox conductor.
- Salt fog test for 1000 hours.
- Wind simulation test – must pass a 500 hour test.
- Test to confirm UV stability.

Test certificates will be required for tender submissions or LAP evaluation.

4. Bird Flight Diverters to be used on Eskom Lines (Mitigating Devices)

The following two flight diverters (mitigating devices) have been successfully installed on Eskom power lines.

4.1 Flapper Type Diverter

Figure 1: Flapper Type Bird Flight Diverter

Buyers guide number DDT 3053

The flapper was first installed live line on an Eskom line in the North-West region in conjunction with EWT and proved very successful as a mitigating device over the years on MV lines.

From field experience and the testing of the flapper it was decided at the Envirotech work group meeting that this flapper can be used on conductors ranging from 6 mm to 24 mm on ACSR, AAAC conductors and shield wires.

The flapper can be attached with a link stick and a standard attachment or by hand from a bucket live line or under dead conditions. It is best suited for application on MV lines.

4.2 Swan / Spiral Flight Diverter

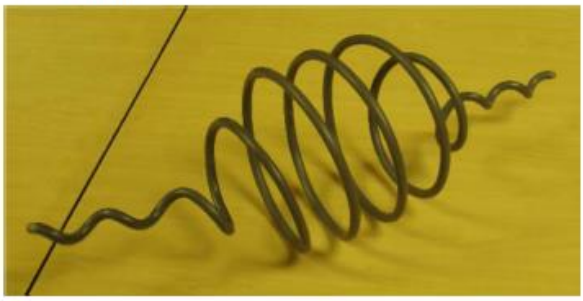


Figure 2: Swan / Spiral Bird Flight Diverter

Buyers guide number DDT 3107

The flight diverter has been used successfully in many places around the world and has been installed on a line in the North- West OU in conjunction with EWT and proved very successful as a mitigating device. The device is supplied in the colours white and grey. This device is best suited for installation on HV lines. Caution to be exercised when installed in areas of high snow loading. Other alternatives are presently being piloted to address installation of bird flight diverters in high snow loading areas.

5. Installing Bird Flight Diverters

5.1 MV Lines

- Spacing of the bird diverters are to be 5m apart alternating on each phase, for single phase lines the colours would alternate 5m apart on the two lines.
- The flight diverters are to be installed with alternating colours.

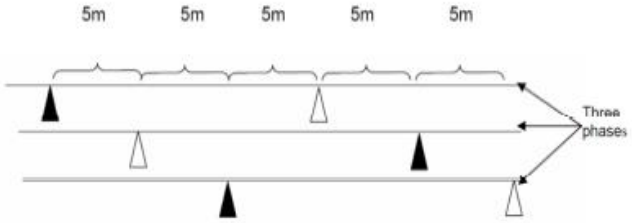


Figure 3: Spacing of Bird Flight Diverters for MV Lines

5.2 HV Lines

- To be installed on both shield wires, staggered (where applicable) or
- To be installed on single shield wire at 10 metre intervals and with alternating colours.
- To be installed only on 60% of the span and in the middle of the span. E.g. A typical 765 kV line span is 450m in length. Bird flight diverters are therefore required to be installed symmetrically from midspan for 270m (as indicated in Figure 4) or as otherwise stipulated in the environmental impact assessment.
- Bird diverters to be installed at 10 metre intervals on each shield wire and with alternating colours on each side (as per sketch below).

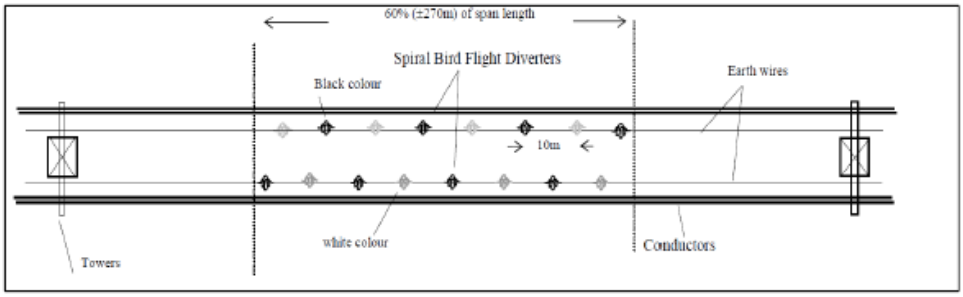
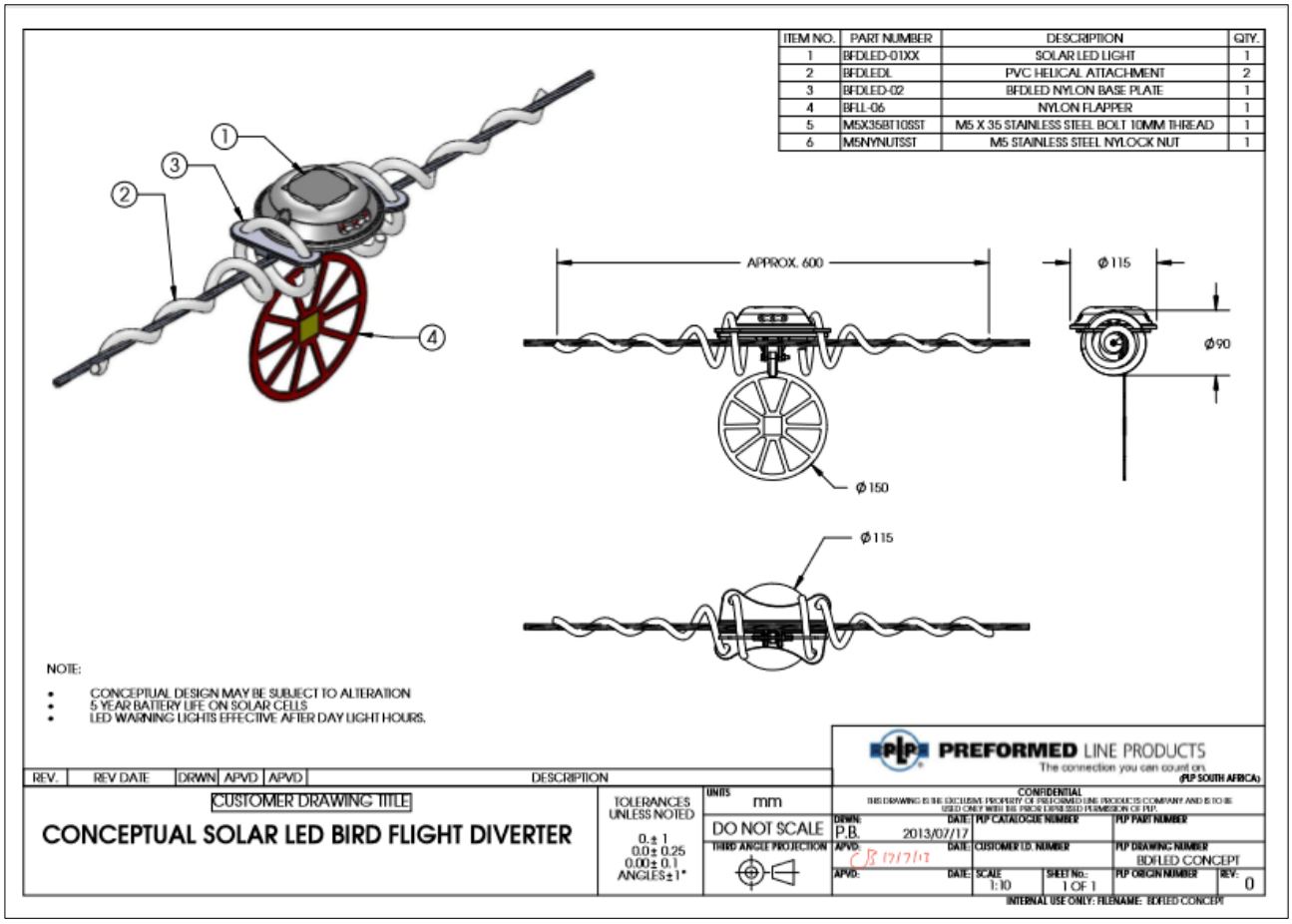


Figure 4: Spacing of Bird Flight Diverters for HV Lines


ITEM NO. | PART NUMBER | DESCRIPTION | QTY.
1 | BFDLED-01XX | SOLAR LED LIGHT | 1
2 | BFDLEDL | PVC HELICAL ATTACHMENT | 2
3 | BFDLED-02 | BFDLED NYLON BASE PLATE | 1
4 | BFLL-06 | NYLON FLAPPER | 1
5 | M5X35BT10SST | M5 X 35 STAINLESS STEEL BOLT 10MM THREAD | 1
6 | M5NYNUTSST | M5 STAINLESS STEEL NYLOCK NUT | 1
1
2
3
4
APPROX. 600
Ø 115
Ø 90
Ø 150
Ø 115
NOTE:
CONCEPTUAL DESIGN MAY BE SUBJECT TO ALTERATION
5 YEAR BATTERY LIFE ON SOLAR CELLS
LED WARNING LIGHTS EFFECTIVE AFTER DAY LIGHT HOURS.
REV. | REV DATE | DRWN | APVD | APVD | DESCRIPTION
CUSTOMER DRAWING TITLE
CONCEPTUAL SOLAR LED BIRD FLIGHT DIVERTER
TOLERANCES UNLESS NOTED
0.± 1
0.0± 0.25
0.00± 0.1
ANGLES± 1°
UNITS mm
DO NOT SCALE
THIRD ANGLE PROJECTION
PREFORMED LINE PRODUCTS
The connection you can count on.
(PLP SOUTH AFRICA)
CONFIDENTIAL
DRWN: P.B. DATE: 2013/07/17
APVD: DATE:
PLP CATALOGUE NUMBER
CUSTOMER I.D. NUMBER
APVD: DATE:
SCALE: 1:10
SHEET No.: 1 OF 1
PLP PART NUMBER
BDFLED CONCEPT
PLP DRAWING NUMBER
PLP ORIGIN NUMBER
REV: 0
INTERNAL USE ONLY: FILENAME: BDFLED CONCEPT

Annexure D3

Aquatic Ecology

Aquatic Assessment Report:

Impofu Grid Connection,

Eastern Cape Province

FOR

AURECON SOUTH AFRICA (PTY) LTD &

RED CAP IMPOFU (PTY) LTD

BY

EnviroSci (Pty) Ltd

Dr Brian Colloty

1 Rossini Rd
Pari Park
Port Elizabeth
6070

DATE

7 August 2019

REVISION 1

Executive Summary

EnviroSci (Pty) Ltd was appointed by Red Cap Impofu (Pty) Ltd to conduct an aquatic assessment, for the proposed Impofu Grid Connection that will extend from the proposed wind farms near Humansdorp via the Sans Souci Substation terminating at the Chatty Substation in the Nelson Mandela Bay Municipality in the Eastern Cape. The expected length of the transmission line (preferred alignment) is approximately 120 km in length (Figure 1). For the purposes of a catchment assessment approach and being able to provide the applicant with additional options, waterbodies 500 m outside of an alignment corridor were assessed in this report.

This was based on initial information collected during site visits in September, November and December 2017 as well as a more detailed investigation in March 2018, May 2018 and July 2019 while adhering to the assessment criteria contained in the DWAF 2005 / 2008 delineation manuals and the Wetland Classification System. Several national spatial databases and project specific wetland / waterbody spatial database layers were also used in this phase of the assessment.

Due to changes to the proposed alignment of the corridor, a site visit was also conducted in July 2019, focused on the Elandsberg section of the alignment, paying particular care to note any available habitat that could be used by several protected or listed plant/animal species known to occur in that region.

The preferred alignment corridor occurs within the following catchments within the South Eastern Coastal Belt Ecoregion located within the Mzimvubu-Tsitsikamma Water Management Area (Figure 1)

- K80F – Klipdrift River
- K90D – Krom / Diep rivers
- K90E – Geelhoutboom River
- K90F – Seekoei / Swart rivers
- K90G - Kabeljous River
- L90C – Gamtoos River (Estuary)
- O99S – van Stadens)
- M20B – Van Stadens / Maitlands rivers
- M10C - Brak River
- M10D – Swartkops / Chatty rivers

These catchments are characterised by perennial, non-perennial water courses, drainage lines and an estuary (Gamtoos) associated with these mainstem systems listed above.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of watercourses within the site have been assigned a condition score ranging from C to E/F (Nel *et al.* 2011), indicating that they are mostly moderately to largely modified but with some biological significance. This is largely due to the high degree of transformation that has taken place within the catchments of these systems through to conversion of the natural fynbos to pasture in the western portion of the study area, while residential areas dominate the eastern section of the corridor.

The only remaining riparian zones are located within the steep river valleys associated with the study area, most of which have been lost to alien tree invasion, while several wetlands remain as these areas are too wet for agricultural production or grazing. The only exceptions being the Brak, Swartkops and Chatty river reaches that were rated as E/F, i.e. no longer have any natural function. This is due to the industrial development, large scale transformation for housing and the associated illegal dumping and leaking sewers that have affected these systems.

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, and the National Wetland Inventory Data being updated by CSIR/ SANBI (currently version 5.2) indicated several wetlands could occur within the study area. These were classified as follows as shown in Figure 2a-e:

1. Valley bottom wetlands – unchannelled
2. Valley bottom wetlands – channelled
3. Endorheic pan / depressions
4. Artificial or man-made systems such as dams, reservoirs / irrigation balancing dams
5. Gamtoos Estuary

The presence of these wetlands was confirmed during this assessment, and where necessary due to changes over time, the waterbodies were either re-digitized at a finer scale or those not accounted for added (91). The final waterbody map was based on the site visit data now accounts for a total of 1316 waterbodies of which ca. 450 are natural wetland systems.

Maps indicate the typical watercourses observed within the site. Any activities within these areas or the 32 m buffer (or the 1:100 floodline, whichever is the greatest) of the rivers and drainage lines or 500 m from the boundary of the wetlands will require a Section 21 c and i Water Use License (mostly likely a General Authorisation (GA) if all other Section 21 uses are below the GA thresholds).

In this regard it is recommended that existing tracks and roads as far as possible are used to minimise any new impacts on these systems, while all towers are placed 32 m from a watercourse and 50 m from a wetland.

It is thus evident that the study area systems are largely functional but are impacted upon as a result of current land use practices. Current impacts are mostly associated with conversion of the natural landscape to grazing, livestock trampling, the large number of farm dams and alien tree infestation (*Acacia* species). Urban development has impacted upon the eastern sections of the corridor within the NMBM.

This was confirmed for each of the affected reaches located within the corridor and in particular the areas that would be crossed by the proposed line. In other words, the systems observed are modified, with either small or narrow riparian zones, or associated with Valley Bottom (Channelled or Unchannelled) wetlands.

The following direct and indirect impacts have been assessed based on the available information:

- Loss of aquatic species of special concern
- Wetland loss as natural wetlands were observed
- Loss of riparian systems and water courses
- Impact on aquatic systems through the possible increase in surface water runoff on form and function - Increase in sedimentation and erosion
- Potential impact on localised surface water quality
- Cumulative impacts
- No-Go option

However, if no towers are located within the waterbodies and watercourses it is anticipated that the overall impacts with mitigation would be low to none, based on the following assumptions:

- existing tracks, cattle pathways and roads are used as access routes as far as possible.
- Where new access roads are required, they must avoid sensitive aquatic areas and all erosion mitigation measures recommended in this report must be effectively implemented. This must be coupled to a post authorisation walkdown of the line once the final tower positions and access points are known so that new impacts don't arise and effective site-specific mitigation and recommendations can be provided.

Thus, only the following impacts are considered:

- Impact on aquatic systems through the possible increase in surface water runoff on form and function
- Increase in sedimentation and erosion
- Potential impact on localised surface water quality
- Cumulative impacts
- No-Go option

The proposed alignment corridor would seem to have a limited impact on the aquatic environment assuming that any of the proposed structures regardless of type, should avoid the delineated wetlands (with 50 m buffer applied to each), and water courses. Thus, presently no objection to the development taking place is made assuming that existing tracks or roads are used as far as possible and where new access roads are required, they must avoid sensitive aquatic areas and all erosion mitigation measures recommended in this report must be effectively implemented. This is an important consideration with regard the cumulative impact of clearing additional vegetation for roads and tracks within a new servitude that would need to cross any of the delineated waterbodies, and hence the preference for this alignment due to the high number of existing access points, servitudes roads and tracks.

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ACRONYMS

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Ecological Importance and Sensitivity
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Section where this is addressed in the Aquatic Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 9, 10 and Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 9
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 & 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5, 6
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4, 5, 6 and 12
g) an identification of any areas to be avoided, including buffers;	Section 5 and 6
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 12
k) any mitigation measures for inclusion in the EMPr;	Section 11
l) any conditions for inclusion in the environmental authorisation;	Section 11 and 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 12

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Section where this is addressed in the Aquatic Specialist Report
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Yes – This report also meets the DWS requirements in terms of GN 267 (40713) of March 2017

SPECIALIST DECLARATION

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Impofu Grid Connection

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address: Department of Environmental Affairs Attention: Chief Director: Integrated Environmental Authorisations

Private Bag X447

Pretoria

0001

Physical address:

Department of Environmental Affairs

Attention: Chief Director: Integrated Environmental Authorisations

Environment House

473 Steve Biko Road

Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:

Email: EIAAdmin@environment.gov.za

SPECIALIST INFORMATION

Specialist Company Name:	EnviroSci (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr Brian Colloty			
Specialist Qualifications:	Ph.D			
Professional affiliation/registration:	SACNASP Pr Sci Nat 400268/07 Ecological			
Physical address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal code:	6070	Cell:	0834983299	
Telephone:	0413662077	Fax:	-	
E-mail:	b.colloty@gmail.com			

DECLARATION BY THE SPECIALIST

I, _____Brian Colloty_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;

- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

EnviroSci (Pty) Ltd

Name of Company:

7 August 2019

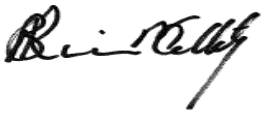
Date

SPECIALIST REPORT DETAILS

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES.

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs and or Department of Water and Sanitation.



Signed:… …… Date:…7 August 2019……

Appendix 1 of this report contains a detailed CV

1. Introduction

EnviroSci (Pty) Ltd was appointed by Red Cap Impofu (Pty) Ltd to conduct an aquatic assessment, for the proposed Impofu Grid Connection that will extend from the proposed wind farms near Humansdorp via the Sans Souci Substation terminating at the Chatty Substation in the Nelson Mandela Bay Municipality in the Eastern Cape. The expected length of the transmission line (preferred alignment) is approximately 120 km in length (Figure 1). For the purposes of a catchment assessment approach and being able to provide the applicant with additional options, waterbodies 500 m outside of an alignment corridor were assessed in this report.

This was based on information collected during site visits in September, November and December 2017 while adhering to the assessment criteria contained in the DWAF 2005 / 2008 delineation manuals and the Wetland Classification System found.

A similar and more detailed investigation of the corridor was also conducted in March and May 2018 to verify the state of several of the wetlands and to account for any changes / expansion / contraction of the proposed corridor. Due to several changes to the proposed alignment within the corridor, a site visit was also conducted in July 2019, focused on the Elandsberg section of the alignment, paying particular care to note any available habitat that could be used by several protected or listed plant/animal species known to occur in that region.

This report thus provides the delineations of the observed waterbodies to assist with the final placement of the alignment, a process that was initiated using the multi-criteria decision making (MCDM) approach to select the preferred alignment/s. This was carried out firstly to minimise the number of potential impacts through impact avoidance, but secondly to reduce the number of potential Section 21 c & i Water Use License Applications that will be required.

An analysis of the remaining potential impacts of the proposed transmission lines on the aquatic environment is also presented in this report, as well as an assessment of any cumulative impacts that may be present.

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a high level, so it is therefore important to verify the actual status of the study area during this initial phase, prior to the final development plan being produced. However, it was important to assess the proposed corridor in terms of important habitat or protected or endangered species known to occur within the region.

1.1 Aims and objectives

The aim of this report is to provide the applicant with the requisite delineation of any natural waterbodies that would then inform the final position of the proposed alignment and associated infrastructure (substations), while providing the competent authorities with the relevant information to determine legislative requirements.

Certain aspects of the development could trigger the need for Section 21, Water Use License Applications (WULAs) (or general authorisation [GA] applications) such as river crossings. These applications must be submitted to the Department of Water and Sanitation (DWS) and information contained in this report must be used in the supporting documentation. It is however evident the transmission lines could span any of the observed water courses.

Information with regard to the state and function of the observed water bodies, suitable no-go buffers and assessment of the potential impacts is also provided.

1.2 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of the aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. No base-line long-term monitoring was undertaken as part of this assessment. However, a concerted effort was made to assess as much of the potential site, as well as make use of any available literature, species distribution data and aerial photography. Furthermore, based on the previous assessments undertaken between 2010-2019 in the area and this was not foreseen as a huge limiting factor. The level of investigation undertaken is sufficient to inform this assessment.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

For the purposes of this report it is assumed that any existing roads, cattle walkways and tracks will be used as far as possible for access, while any new roads will avoid sensitive aquatic areas and the towers will span the observed waterbodies. Where new access roads are required, they must avoid sensitive aquatic areas and all erosion mitigation measures recommended in this report must be effectively implemented. This must be coupled to a post authorisation walkdown of the line once the final tower positions and access points are known so that new impacts don't arise and effective site specific mitigation and recommendations can be provided.

A further assumption is that water required for the various phases of the project will be sourced from a licensed resource and not illegally abstracted from any surrounding water courses, particularly if dust suppression is required.

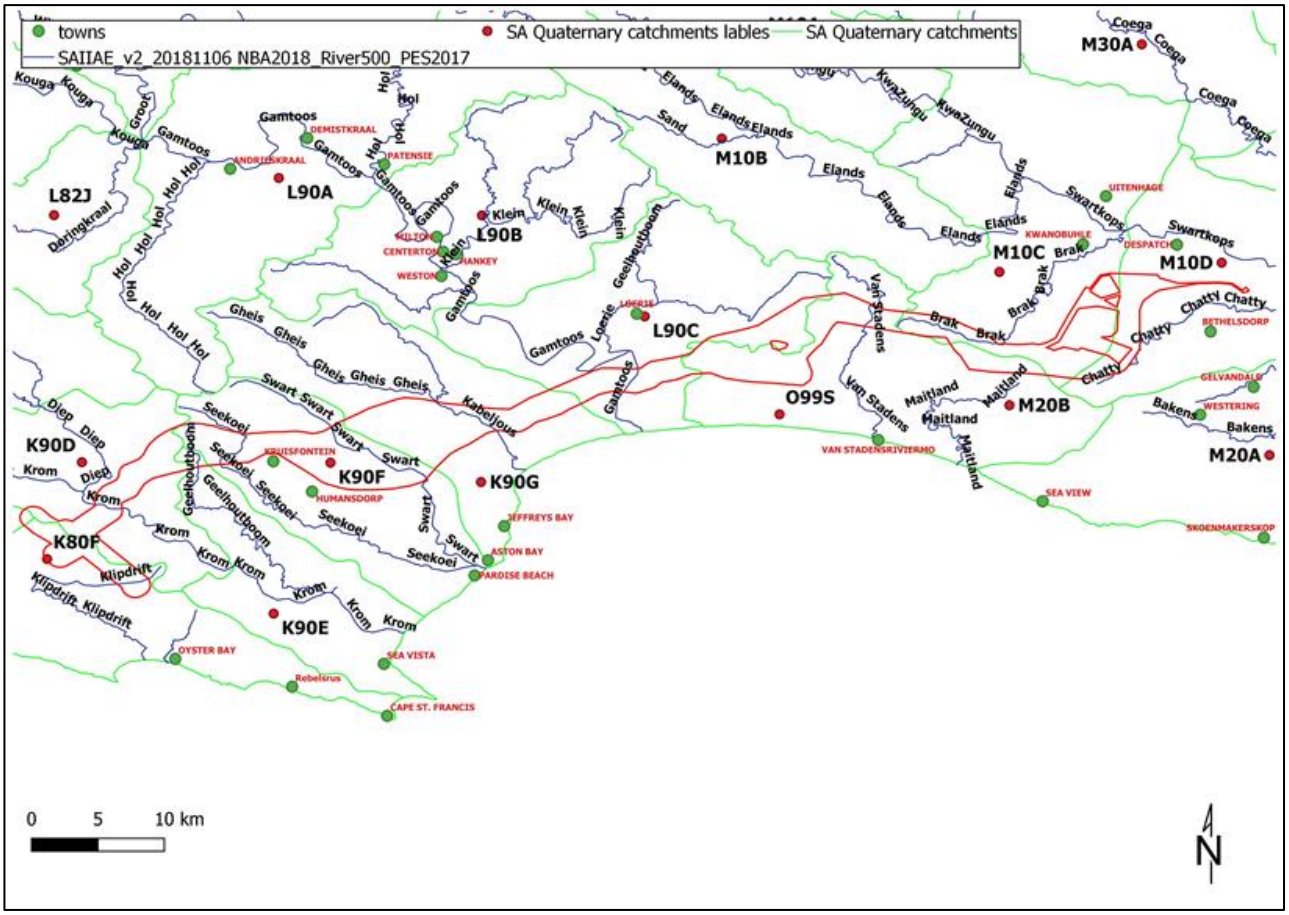


Figure 1: The transmission line corridor in relation to the mainstem rivers and quaternary catchments

2. Terms of Reference

The following was extracted from the TOR provided by Aurecon, while a detailed description of the methods used is contained in Appendix 1.

"A focussed and relevant description of all baseline characteristics and conditions of the receiving environment (e.g.: site and/or surrounding land uses including urban and agricultural areas as applicable) in relation to the Specialist's field of interest, based on all relevant available data, reports and maps, and information obtained from any field work investigations undertaken to date (to be acquired by Specialist).

A detailed evaluation of the predicted impacts of the project on the receiving environment, or of the receiving environment on the project as per the methodology to be prescribed by Aurecon, that uses the criteria of extent, duration and intensity to quantify the significance of the potential impact (refer to excel spreadsheet 'Impofu_EIA_Impact Assessment.xlsx'). The evaluation of impacts should include:

- An assessment of impacts for all phases of the life-cycle of the project, namely construction, operation, and decommissioning phases, as well as the direct and indirect impacts;
- An assessment of the probability of each impact occurring, the reversibility of each impact and the level of confidence in each potential impact;
- An assessment of the significance of each impact before and after mitigation;
- The identification of any residual risks that will remain after implementation of design and planning mitigation; and
- An assessment of the No-Go option.

Assess the grid corridor as a whole and not per section i.e. only one impact table should be supplied per predicted impact and not three.

Refer to the Aurecon standard assessment methodology (to be provided by Aurecon) as well as any discipline specific methodology that was used to inform the assessment of impacts.

Consider and evaluate the cumulative impacts in terms of the current and proposed activities in the area. Refer to Section 4.3 below for more information.

Recommendations to avoid negative impacts. Where this will not be possible then provide feasible and practical mitigation, management and/or monitoring options to reduce negative impacts and enhance positive impacts that can be included in the Environmental Management Programme.

Identify any additional measures to ensure that the project contributes towards sustainability goals or provides a positive contribution to the environment.

Where relevant, recommendations and instructions regarding any additional authorisation, permitting or licensing procedures, or any other requirements pertaining to legislation and policies relevant to the Specialist's field of interest.

An outline of recommended measures to manage residual impacts (i.e. impacts that remain after optimisation of design and planning) for the construction, operational and decommissioning phases with an indication of the following:

- Who should be responsible for implementation of mitigation;
- Details of frequency of implementation of each measure; and
- Envisaged outcome of each action.

Recommendation of a monitoring plan for the relevant aspects associated with the specialist's field of expertise, if required. In your recommendation, provide an indication of what the monitoring plan should comprise, for example:

- Aspects to be measured;
- Responsible person/body;
- Frequency of monitoring actions;
- Standards to be met; and
- Reporting requirements.

The conditions, in respect of the Specialist's field of interest, for inclusion in the Environmental Authorisation.

A reasoned opinion as to whether the proposed activity, or portions of the activity should be authorised.

Include a table upfront in the Specialist Scoping Report listing the requirements of Appendix 6 of NEMA, and where this information is detailed in the specialist report." – See Page 7-8.

3. Project Description

The proposed transmission line includes three short separate 132 kV high voltage (HV) overhead power lines that emanate from the Impofu North, Impofu West and Impofu East switching stations. The three short separate 132 kV HV lines link each of the three switching stations on the wind farms to a combined central "collector switching station" (Impofu collector switching station). The role of the collector switching station is to consolidate the three power lines from the wind farms into one, such that a single line continues from here onwards. This will also allow Eskom more control over the management of the wind farms' connections into the national grid. The whole grid connection including the wind farm switching stations, the HV line to the collector switching stations, the collector switching station and the HV line back to PE all will be transferred to Eskom once construction is complete.

From the Impofu collector switching station, a single 132 kV HV power line will continue towards PE via the Eskom Melkhout Substation. Due to the complex nature of navigating linear infrastructure, this assessment considers that a 31 m servitude will be required for the construction of the powerline but may occur within an area demarcated by a 2 km corridor. Within this corridor, a single 132 kV HV power line continues to the existing Eskom Melkhout substation, located to the north of the N2 and north of the town of Humansdorp. Thereafter, the corridor continues through or around the Jeffrey's Bay Wind Farm, across the Mondplaas area and Gamtoos River valley (roughly following the existing Eskom 132 kV lines that come down from PE to Melkhout) towards Thornhill. It then passes through the Thornhill area, across the Van Stadens River north of the railway bridge, north of the Elandsberg passing through the St Albans and Hopewell Conservation Estate areas but avoiding KwanoBuhle Residential area (current and future) before going on to the NMBM Sans Souci substation. From Sans Souci substation the line then continues to the NMBM Chatty substation where the grid connection terminates.

The reason the power line goes through the Eskom Melkhout substation and the NMBM Sans Souci substation is to improve the evacuation capacity and technical parameters of the grid connection, as well as improving the

overall stability and reliability of the Eskom and NMBM networks. This power line will be transferred to Eskom once constructed.

From west to east, the corridor will pass through the Kou-Kamma Local Municipality and the Kouga Local Municipality (both falling within the Sarah Baartman District Municipality) and will terminate in NMBM.

Each wind farm application will include an on-site substation with transformer. The transformer will transform / convert the power received from the turbines from either above ground or underground medium voltage (MV) lines (33 kV or lower) to HV (132 kV). The three on-site substations are part of the wind farm applications and are therefore not assessed in this report. Adjacent to each substation will be a switching station. The associated switching stations are part of the grid connection application.

The substation areas will include all the standard substation electrical equipment / components, such as transformers and bus bars and will also house control, operational, workshop and storage buildings / areas. Since the three on-site substations will form part of the wind farm, and the switching component will be owned by Eskom, there will be a physical barrier between the two in the form of a fence (refer to Figure 3 below for the Kouga Wind Farm as an example). The Eskom switching stations will each have a total footprint of approximately 150 x 75 m (11,250 m^2). The single collector switching station will have a total footprint of approximately 150 x 150 m (22,500 m^2).

4. Methodology

This study followed the approaches of several national guidelines with regards to wetland assessment. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study systems, applicable to the specific environment and in a clear and objective manner, assess the potential impacts associated with the proposed development site based on information collected within the relevant farm portions for a number of years for this and other proposed projects.

This methodology has also been used in the assessment of approximately 125 aquatic assessments alone by the author in the past 6 years. This includes the assessment of several of the current and proposed/future wind farms surrounding the proposed wind farm (Tsitsikamma Community Wind Farm, Gibson Bay Wind Farm, Oyster Bay Wind Farm, Jeffreys Bay Wind Farm, Banna Ba Pifhu Wind & Solar farms, Ubuntu Wind Farm), as well as all the associated transmission lines needed for these projects. This is also included acting as the wetland specialist / botanist during the construction of the following transmission lines with monitoring and rehabilitation and or submission of the Water Use License Applications to DWS:

- 132 kV Wittekleibosch – Dieprivier (Wetland assessment, monitoring and WULA)
- 132 kV Gibson Bay WF – Wittekleibosch (Wetland assessment, monitoring and WULA)
- 132 kV Melkhout – Dieprivier (Wetland assessment and rehabilitation monitoring)
- 132 kV Melkhout – Patensie (Wetland assessment)

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study. It is also important to understand wetland definition, means of assessing wetland conservation and importance as well as understanding the pertinent legislation with regards to protecting wetlands. These aspects will be discussed in greater depth in this section of the report, as they form the basis of the study approach to assessing wetland impacts.

For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: as per the National Water Act means -

  (a) a river or spring;
  (b) a natural channel in which water flows regularly or intermittently;
  (c) a wetland, lake or dam into which, or from which, water flows; and
  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

4.1 Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a wetland or river is used by DWS to assess the water resource allocations when assessing WULAs

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

Ecological Water Requirements: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

4.2 Wetland definition

Although the National Wetland Classification System (NWCS) (Ollis *et al*., 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard et al., 2005). An additional minor adaptation of the definition is the removal of the term

'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

- A high-water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the NWA and ecosystems included in DWAF's (2005) delineation manual.

Ecosystem	NWCS "wetland"	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian [3] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

4.3 National Wetland Classification System method

During this study, due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (Ollis *et al*., 2013) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.,* 2013).

The classification system used in this study is thus based on Ollis *et al*. (2013) and is summarised below:

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 2). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.

This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – nature of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other.

The HGM unit (Level 4) is the **focal point of the NWCS**, with the upper levels (Figure 3 – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

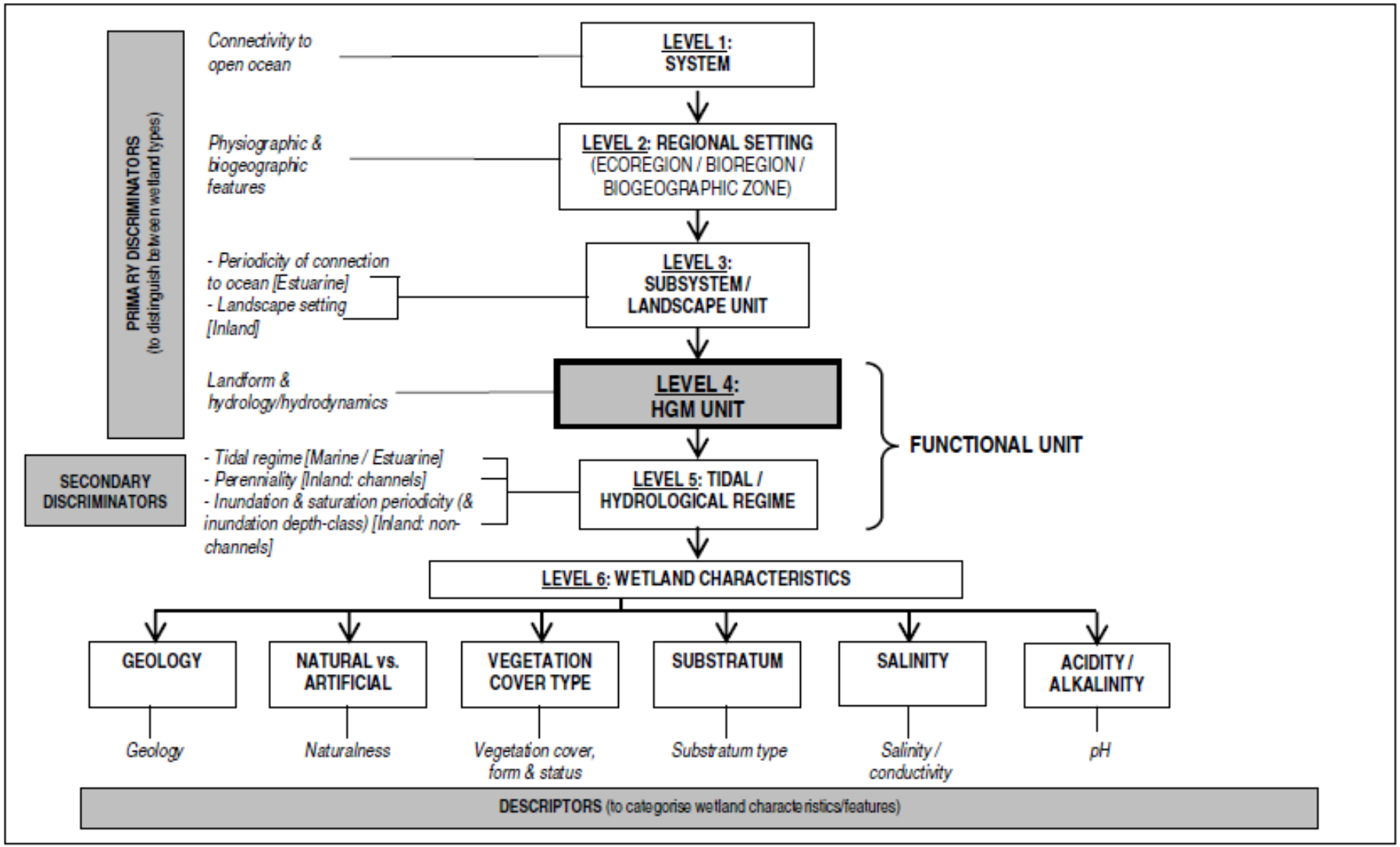


Figure 2: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From Ollis *et al.*, 2013).

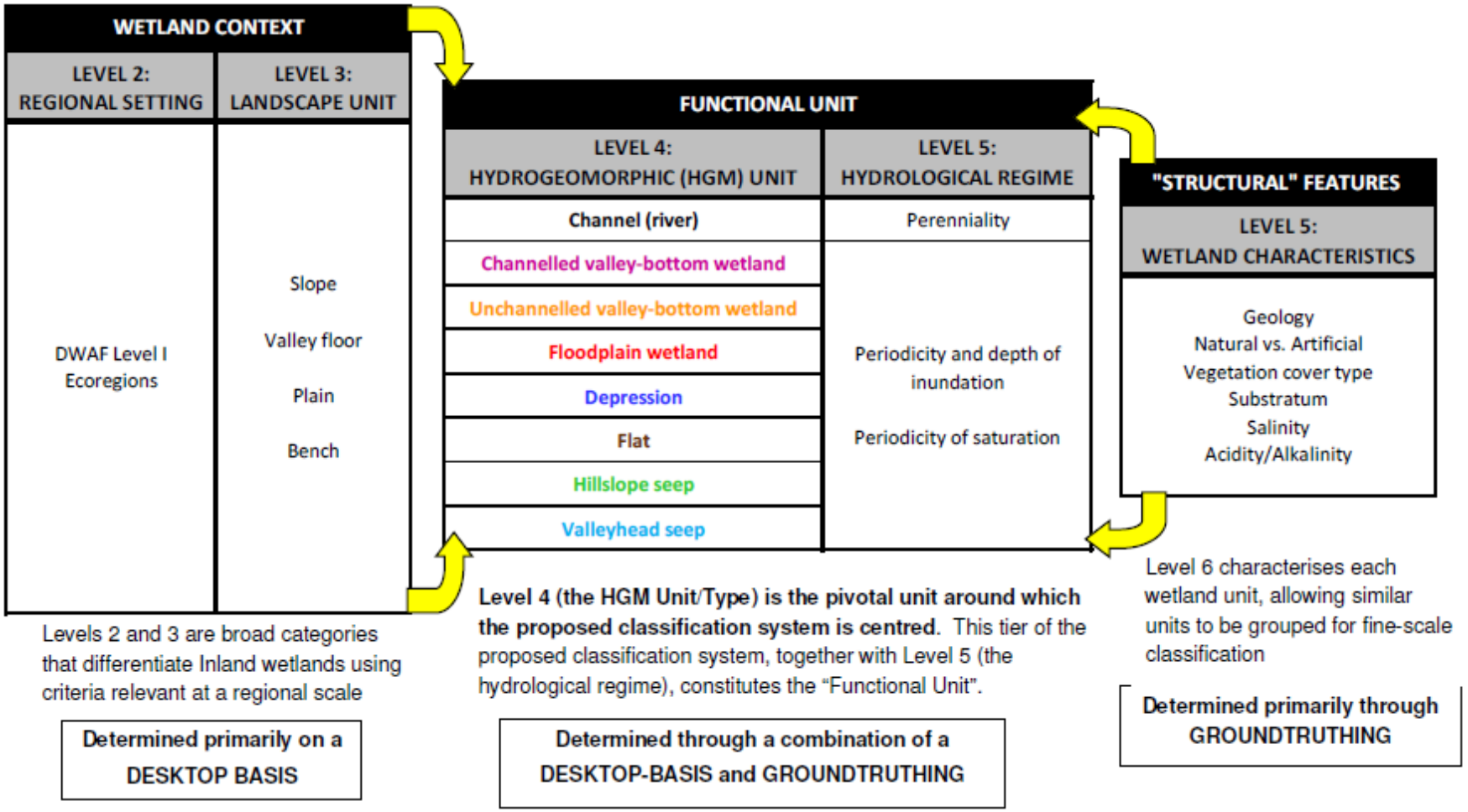


Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al.*, 2013).

4.4 Waterbody condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 2) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled with the degraded state of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 2: Description of A – F ecological categories based on Kleynhans *et al*., (2005)

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	**Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	**Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

4.5 Aquatic ecosystem importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table 3 below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 3: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al*., 2008

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits		Flood attenuation
				Stream flow regulation
			Water quality enhancement benefits	Sediment trapping
				Phosphate assimilation
				Nitrate assimilation
				Toxicant assimilation
				Erosion control
				Carbon storage
		Biodiversity maintenance		
	Direct benefits	*Provision of water for human use*		
		Provision of harvestable resources[2]		
		Provision of cultivated foods		
		Cultural significance		
		Tourism and recreation		
		Education and research		

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation or rather, continuity or intactness with regards to ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Natural wetlands or Wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological corridors.

4.6 Relevant wetland legislation and policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa, 1996;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974)
- National Forest Act, 1998 (No. 84 of 1998)
- National Heritage Resources Act, 1999 (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the land owner.

4.7 Provincial legislation and policy

Currently there are no formalised riverine or wetland buffers distances provided by the provincial authorities and as such the buffer model as described Macfarlane *et al*., 2017 wetlands, rivers and estuaries was used.

These buffer models are based on the condition of the waterbody, the state of the remainder of the site, coupled to the type of development, as wells as the proposed alteration of hydrological flows. Based then on the information known for the site the buffer model provided the following:

1. Construction period: 31 m
2. Operation period: 25 m
3. Final: 31m

However, the in previous assessments and projects related to the transmission lines in the study region, a 32m buffer for all water courses must be applied and thus in the interests of consistency, the 32m buffer is thus upheld for this assessment.

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the sites are described in the ecological assessment.
- National Freshwater Ecosystems Priority Areas (NFEPA) – (Nel *et al.,* 2011). This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

5. Description of the affected environment

The preferred alignment corridor occurs within the following catchments within the South Eastern Coastal Belt Ecoregion located within the Mzimvubu-Tsitsikamma Water Management Area (Figure 1)

- K80F – Klipdrift River
- K90D – Krom / Diep rivers
- K90E – Geelhoutboom River
- K90F – Seekoei / Swart rivers
- K90G - Kabeljous River
- L90C – Gamtoos River (Estuary)
- O99S – van Stadens)
- M20B – Van Stadens / Maitlands rivers
- M10C - Brak River
- M10D – Swartkops / Chatty rivers

These catchments are characterised by perennial, non-perennial water courses, drainage lines and an estuary (Gamtoos) associated with these mainstem systems listed above.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of watercourses within the site have been assigned a condition score ranging from C to E/F (Nel *et al.* 2011), indicating that they are mostly moderately to largely modified but with some biological significance. This is largely due to the high degree of transformation that has taken place within the catchments of these systems through to conversion of the natural fynbos to pasture in the western portion of the study area, while residential areas dominate the eastern section of the corridor. The only remaining riparian zones are located within the steep river valleys associated with the study area, most of which have been lost to alien tree invasion, while several wetlands remain as these areas are too wet for agricultural production or grazing. The only exceptions being the Brak, Swartkops and Chatty river reaches that were rated as E/F, i.e. no longer have any natural function. This is due to the industrial development, large scale transformation for housing and the associated illegal dumping and leaking sewers that have affected these systems.

Several existing overhead transmission lines have already been constructed in the region and include the following:

1. 132 kV 93 km long Grassridge to Melkhout
2. Melkhout – Dieprivier, a 27 km long 132 kV line between Humansdorp and Joubertina
3. Melkhout – Patensie, 29 km 132 kV Line

Except for the line listed in (1.) above, the remaining lines have mostly avoided the aquatic environment by integrating the findings of the aquatic reports and required buffers into the final placement of the towers. The Grassridge – Melkhout line has several towers near several wetlands along its length. However, it has been the creation of new access tracks that has the greatest impact on the rivers and wetlands within the region which has required several post construction interventions by the contractors to remedy sources of soil disturbance that have resulted in erosion and sedimentation.

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, and the National Wetland Inventory Data being updated by CSIR/ SANBI (currently version 5.2) indicated several wetlands could occur within the study area. These were classified as follows as shown in Figure 4a-d:

1. Valley bottom wetlands – unchannelled (Plate 1)
2. Valley bottom wetlands – channelled (Plate 2)
3. Endorheic pan / depressions (Plate 3)
4. Artificial or man-made systems such as dams, reservoirs / irrigation balancing dams (Plate 4)
5. Gamtoos Estuary (Plate 5)

The presence of these wetlands was confirmed during this assessment, and where necessary due to changes over time, the waterbodies were either re-digitized at a finer scale or those not accounted for added (91). The final waterbody map shown in Figure 4a-d based on the site visit data now accounts for a total of 1316 waterbodies of which ca. 450 are natural wetland systems.

Figures 5a-d indicate the typical watercourses observed within the site. Any activities within these areas or the 32 m buffer (or the 1:100 floodline, whichever is the greatest) of the rivers and drainage lines or 500 m from the boundary of the wetlands will require a Section 21 c and i Water Use License (mostly likely a General Authorisation (GA) if all other Section 21 uses are below the GA thresholds).

In this regard it is recommended that existing tracks and roads as far as possible are used to minimise any new impacts on these systems, while all towers are placed 32 m from a watercourse and 50 m from a wetland.

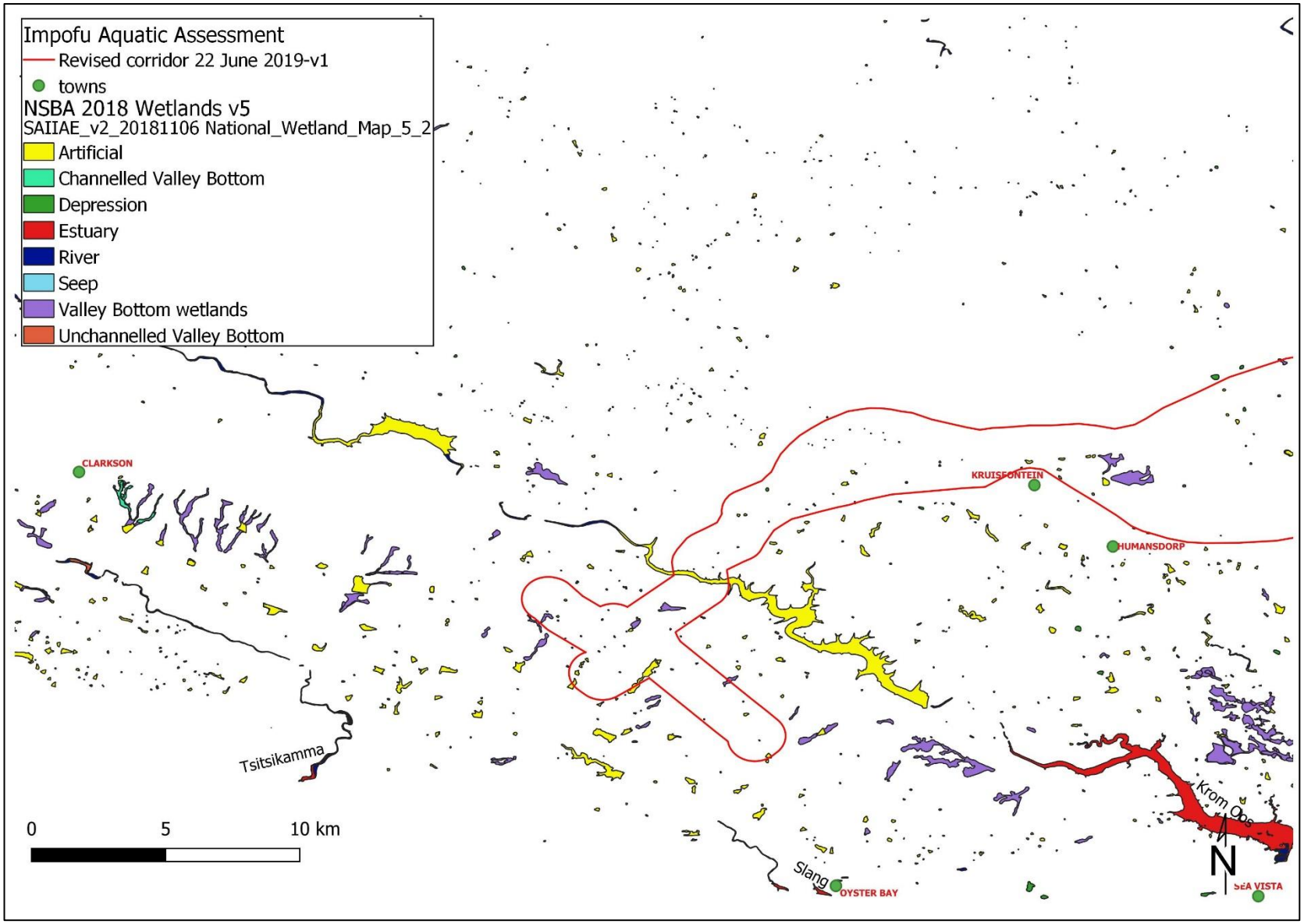


Figure 4a: Potential wetlands according to the National Wetland Inventory (SANBI, Ver 5.2) in relation to the grid corridor

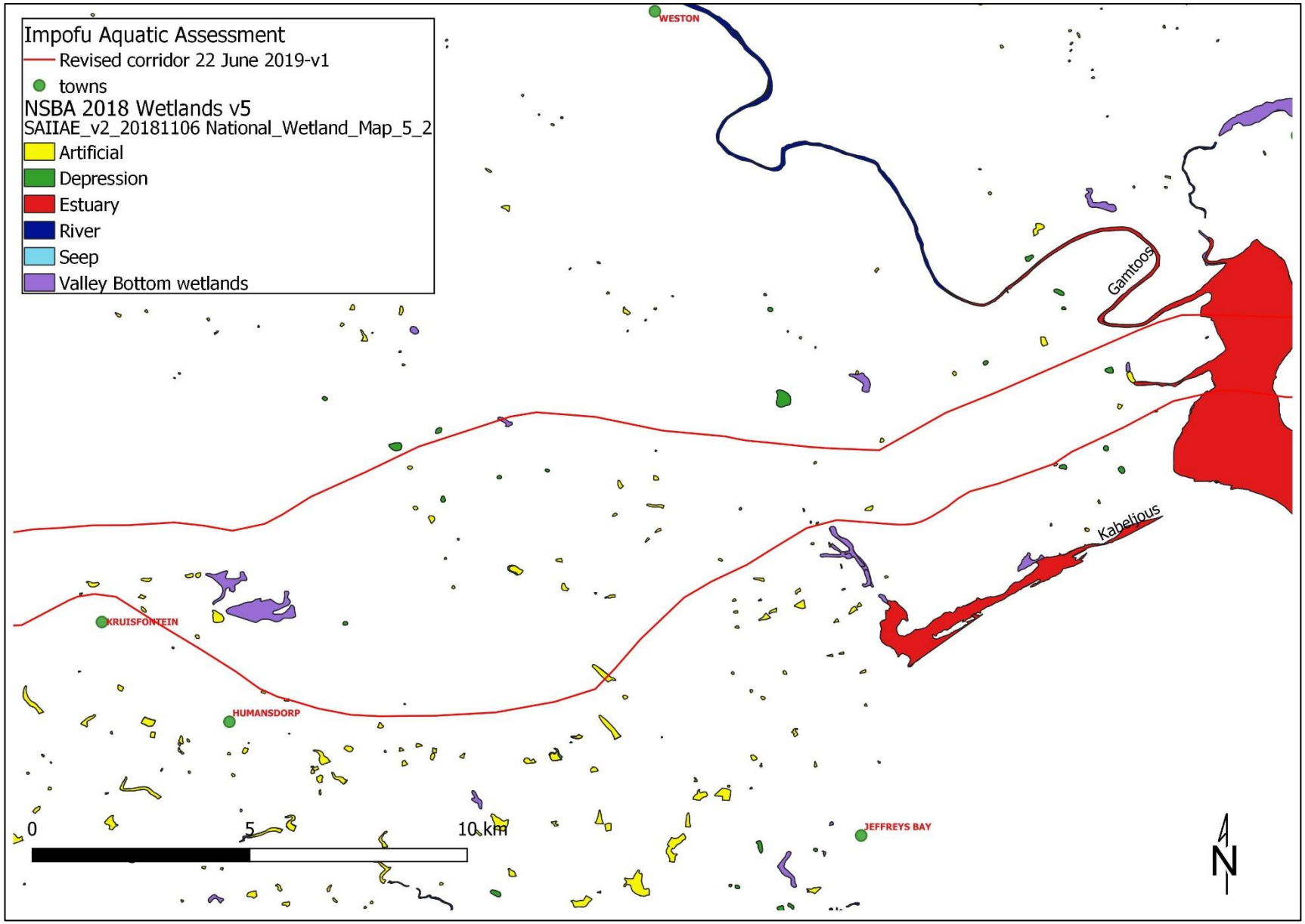


Figure 4b: Potential wetlands according to the National Wetland Inventory (SANBI, Ver 5.2) in relation to the grid corridor

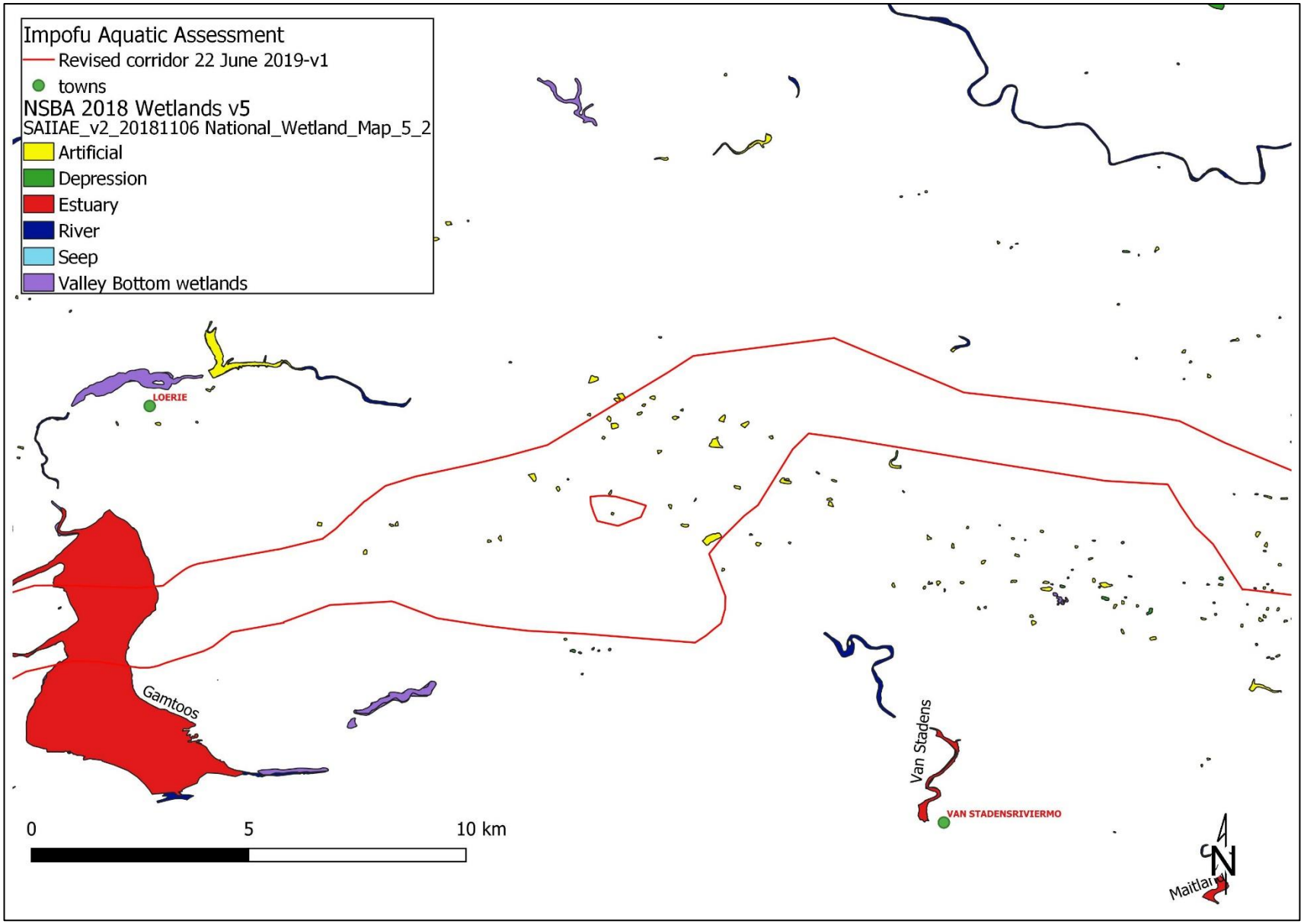


Figure 4c Potential wetlands according to the National Wetland Inventory (SANBI, Ver 5.2) in relation to the grid corridor

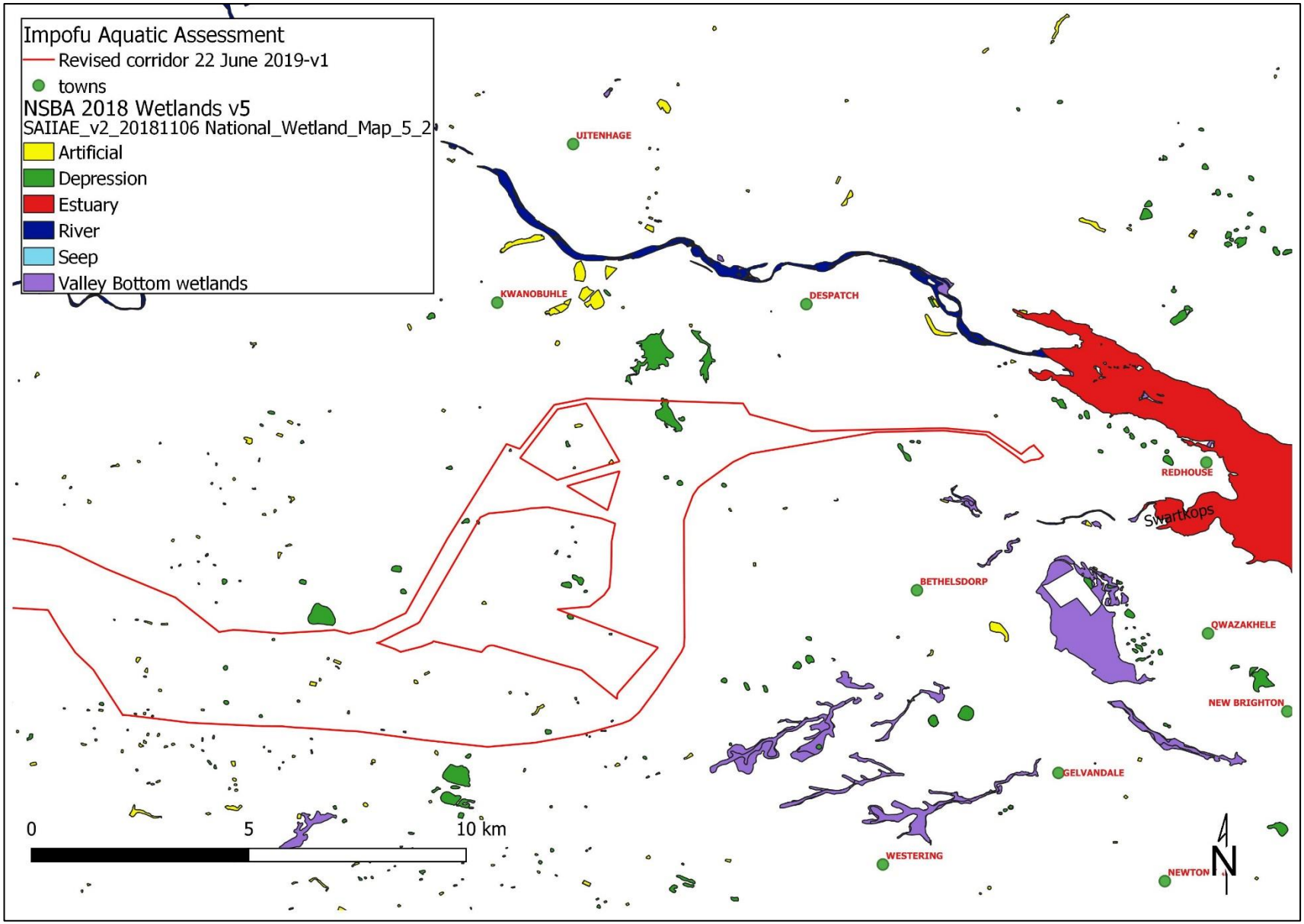


Figure 4d: Potential wetlands according to the National Wetland Inventory (SANBI, Ver 5.2) in relation to the grid corridor

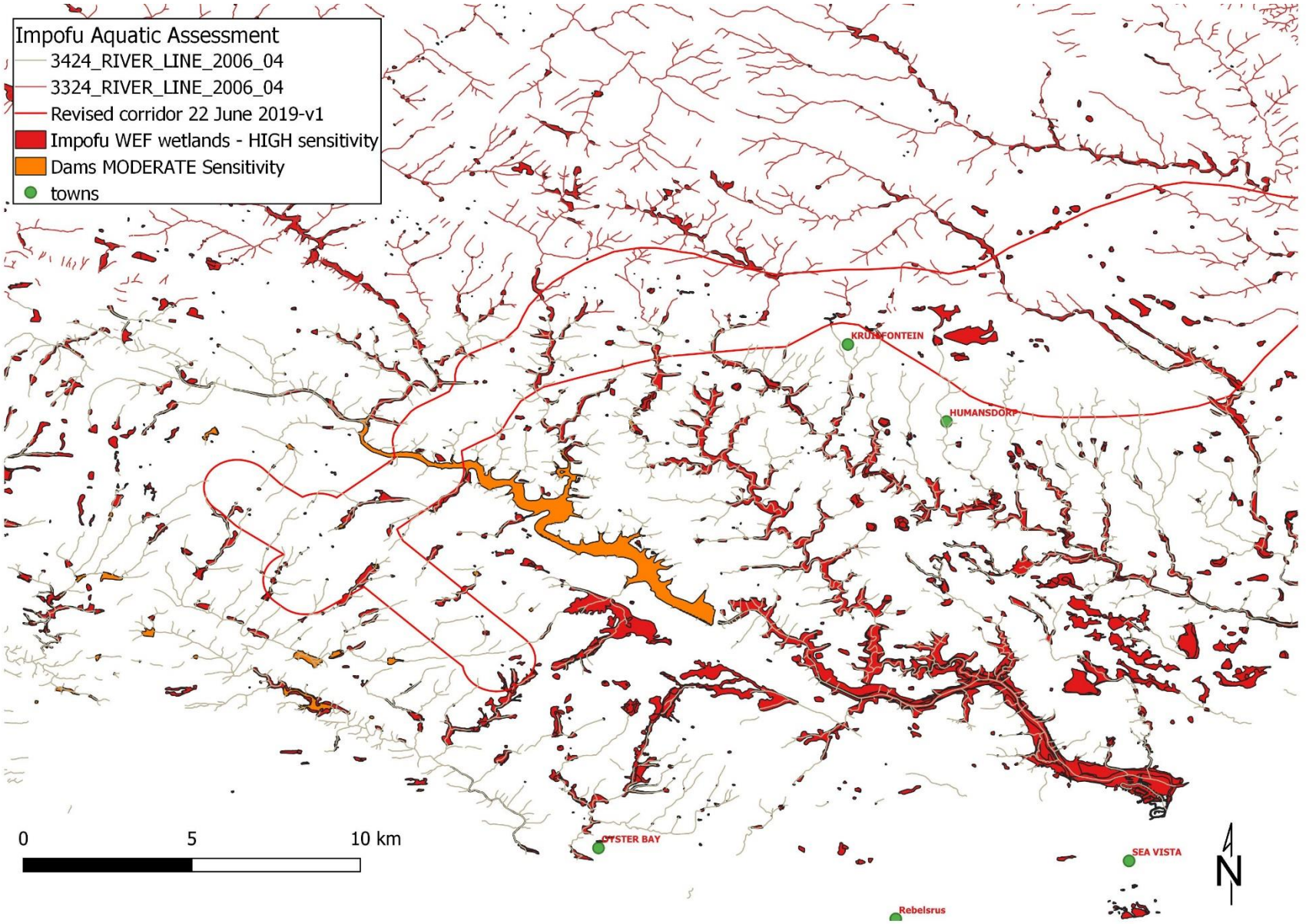


Figure 5a: Confirmed aquatic waterbodies observed during the assessment

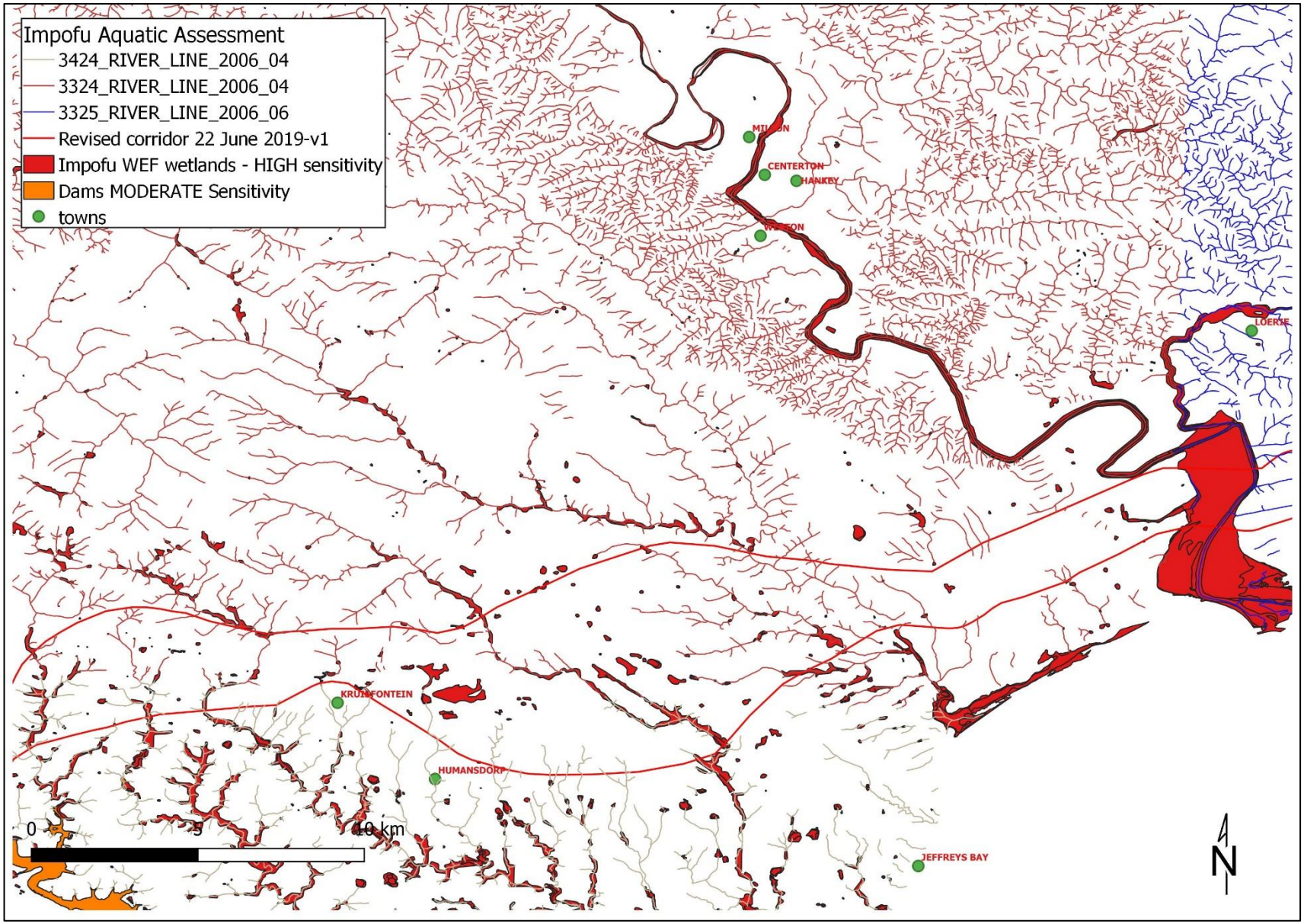


Figure 5b: Confirmed aquatic waterbodies observed during the assessment

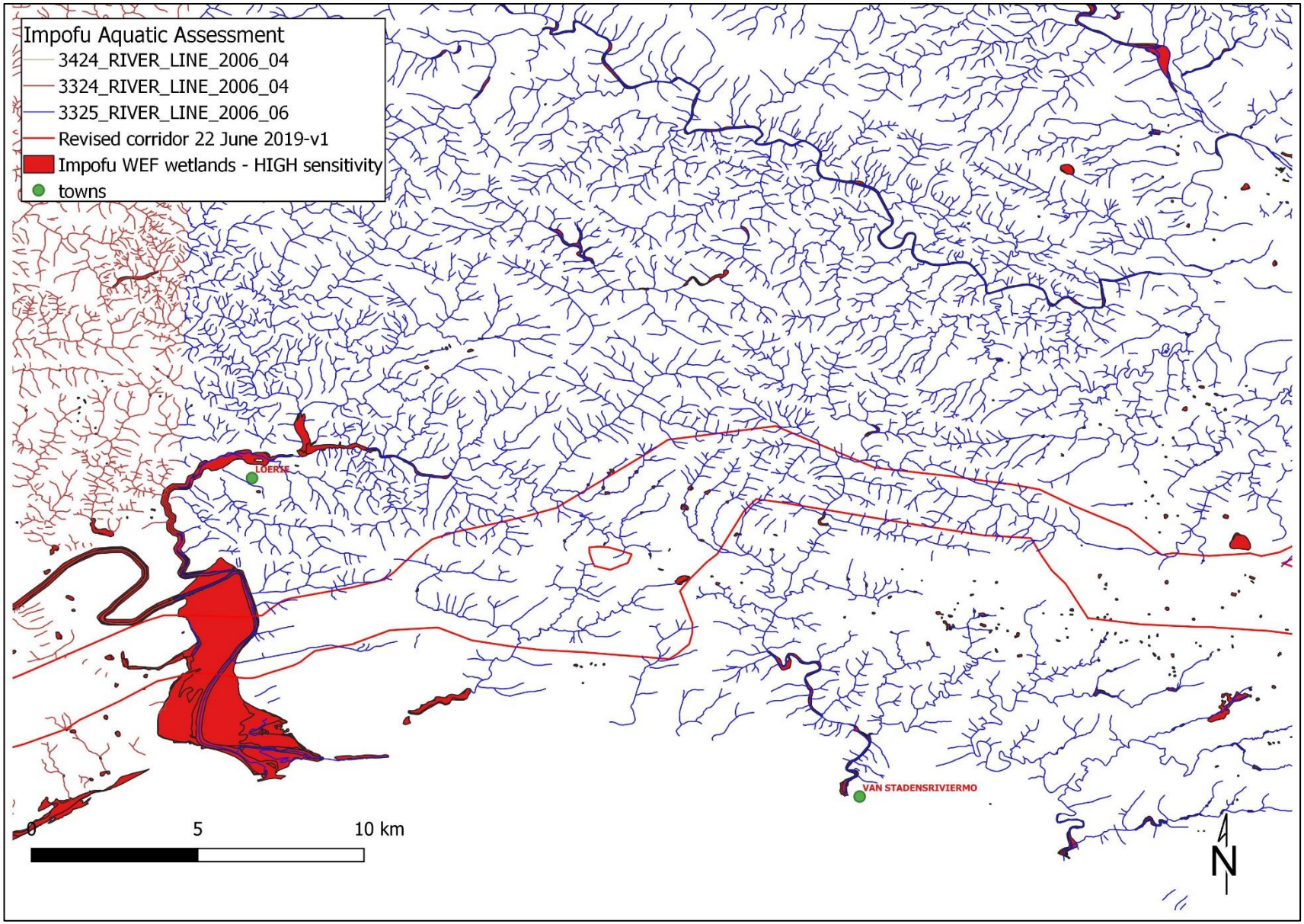


Figure 5c: Confirmed aquatic waterbodies observed during the assessment

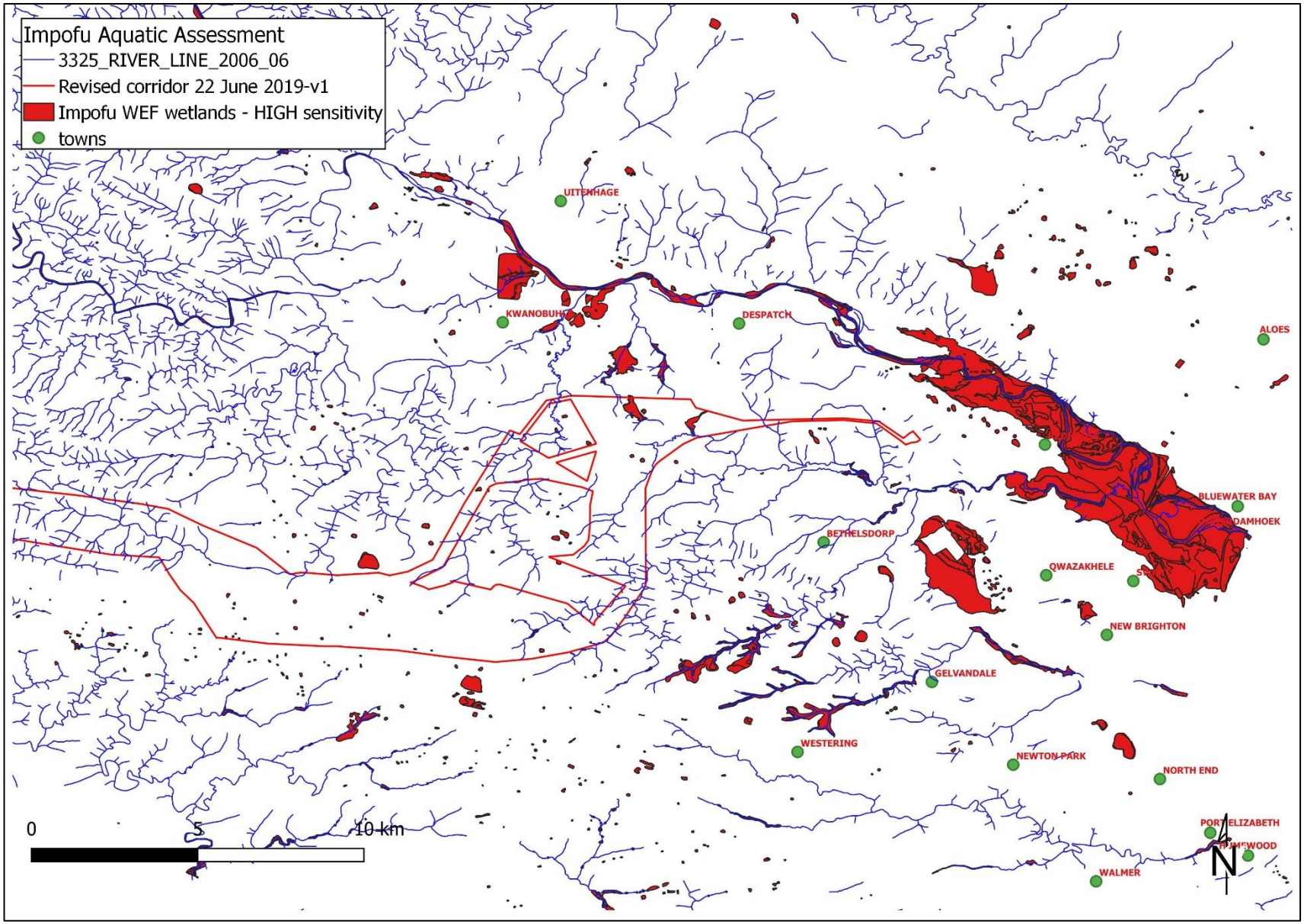


Figure 5d: Confirmed aquatic waterbodies observed during the assessment

Plate 1: A view of an unchanneled Valley Bottom wetland located near the Impofu East Wind Farm collector switching station that should be avoided (i.e. towers should not be located within wetland including 50 m buffer)

Plate 2: A view of a channelled Valley Bottom wetland located within Impofu West Wind Farm near WTG 16.

Plate 3: A small pan / endorheic depression found near the convergence of the three collector transmission lines

Plate 4: A view of the Mpofu Dam near the proposed point where the transmission line will span this system

Plate 5: A view the Gamtoos Estuary and floodplain with an existing 132 kV line in the background

Plate 6: Aerial view of the Bulk River post fire, within the proposed corridor which will be spanned

Plate 7: A view of the remaining extent of the water courses in the Kwadezi / Bethelsdorp section of the corridor, showing a high degree of encroachment and degradation

6. Present Ecological State and conservation importance

The Present Ecological State of a river or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance, as well as direct and indirect impacts that have been included (DWS, 2014). The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. Although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters is assessed or then overall PES is rated between a C or D.

The Present Ecological State scores (PES) for the drainage lines and the rivers in the Impofu Wind Farm study area were rated as follows (DWS, 2014 – where B= Largely Natural D = Largely Modified & C = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
9201	D	Moderate	High
9127	D	Moderate	Moderate
9130	B	Moderate	High
9147	D	Moderate	High
9132	D	Moderate	High
9116	C	Moderate	High
9056	C	Moderate	High
9096	C	Moderate	High
Gamtoos Estuary	D	Moderate	High
9008	C	Moderate	High
9078	D	Moderate	High
9011	D	Moderate	Moderate
8989	D	Moderate	Moderate
8929	D	Moderate	Moderate

It is thus evident that the study area systems are largely functional but are impacted upon as a result of current land use practices. Current impacts are mostly associated with conversion of the natural landscape to grazing, livestock trampling, the large number of farm dams (See Figure 4a-d) and alien tree infestation (*Acacia* species – Plate 6). Urban development has impacted upon the eastern sections of the corridor within the NMBM.

This was confirmed for each of the affected reaches located within the corridor and in particular the areas that would be crossed by the proposed line shown in Figure 5a-e. In other words, the systems observed are modified, with either small or narrow riparian zones, or associated with Valley Bottom (Channelled or Unchannelled) wetlands.

The Moderate and High EI and ES scores were related to areas that contained important or intact aquatic habitat. In this assessment attention was also paid to the presence of important fish and or amphibians known to occur within the region, particularly in the Elandsberg section in proximity to and within the corridor. For example, the Endangered Hewitts Ghost Frog (*Heleophryne hewitti)* has been recorded to the west of the corridor in this area and the Eastern Cape Redfin

(*Pseudobarbus afer*) within it. Several catchments within the study area were thus highlighted as critical biodiversity areas (Figure 8) in the Eastern Cape Biodiversity Conservation Plan (Berliner & Desmet, 2007) and the NMBM Bioregional Conservation Plan (SRK, 2014) (Figure 8).

Based on past records and searching for available habitat, it is unlikely that these species wold be impacted upon by the transmission line, i.e. species habitat not found and or lines can span the aquatic systems.

Typical aquatic plant species included:

PNCO = Provincial Nature Conservation Ordinance

Species	**Protection Status**
Miscanthus capensis	-
Disa chrysostachya	Protected PNCO - Orchid
Phragmites australis	-
Cyperus textilis	-
Isolepis spp	-
Eleocharis limosa	-
Ficinia nodose	-
Juncus lomatophyllus	-
Leersia hexandra.	-
Paspallum distichum,	-
Pycreus polystachyos	-
Typha capensis	-
Setaria spacellata	-
Stenotaphrum secundatum	-
Cynodon dactylon	-
Centella asiatica	-
Conyza scabrida	-
Elegia tectorum	-

Alien invasive species in the riparian / instream areas included:

- *Lantana camara*
- *Acacia longifolia*
- *Pinus spp*
- *Eucalyptus spp*
- *Populus X canescens*
- *Cortaderia selloana*
- *Pennisetum clandestinum*.

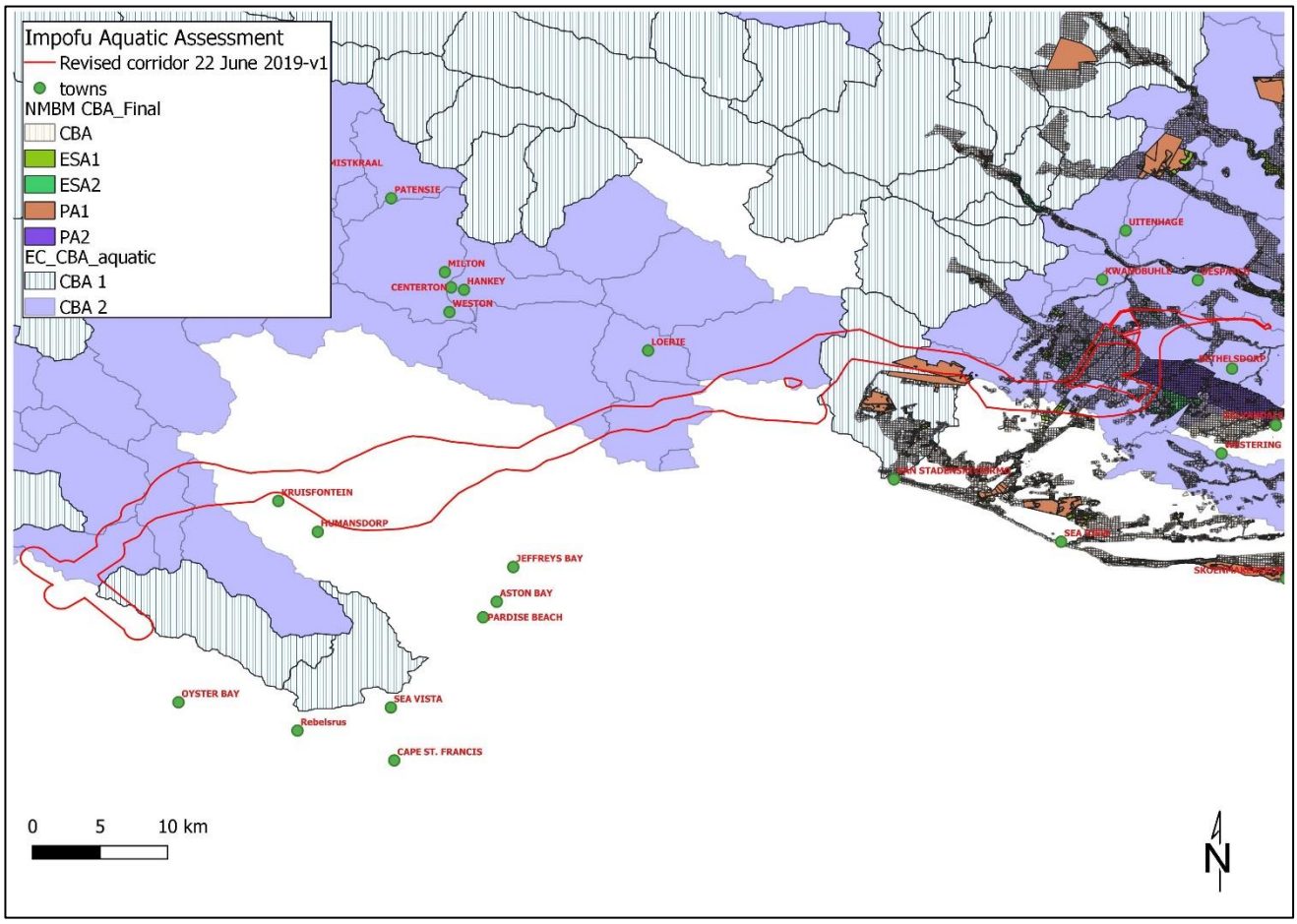


Figure 6: Critical Biodiversity Areas as per the ECBCP and NMBM NCAP

7. Permit requirements

Based on an assessment of the proposed activities and past engagement with DWS, the following GA's could be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) will determine if a GA or full WULA will be required during the pre-application process (Phase 1):

- **DWS Notice 538 of 2016, 2 September in GG 40243**– Section 21 a & b, Abstraction and Storage of water.
- **Government Notice 509 in GG 40229 of 26 August 2016 –** Section 21 c & i, Impeding or diverting the flow of water in a watercourse and or altering the bed, banks, course or characteristics of a watercourse.
- **Government Notice 665, 6 September 2013 in GG 36820** (Has expired as GA is only valid for 5 years thus a full WULA will be required) – Section 21g Disposing of waste in a manner that may detrimentally impact on a water source which includes temporary storage of domestic waste water i.e. conservancy tanks under Section 37 of the notice.

	Water Use Activity	**Applicable to this development proposal**
S21(a)	Taking water from a water resource	Yes, as water might be abstracted from local rivers when available and/ or boreholes.
S21(b)	Storing water	If the total volume stored is greater than 40 000 m^3 then a full Water Use License will be required. This is however unlikely that onsite water storage for the purpose of the project would never exceed this threshold.
S21(c)	Impeding or diverting the flow of water in a watercourse	If any structures (tx line towers) are located within any watercourses a GA process can potentially be followed.
S21(d)	Engaging in a stream flow reduction activity	Not applicable
S21(e)	Engaging in a controlled activity	Not applicable
S21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit	Not applicable
S21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Typically, the conservancy tanks at construction camps and then O/M buildings require a license (GA if volumes are below 5000 m^3 noting that GA (Government Notice 665, 6 September 2013 in GG 36820) has expired 30.8.2018.
S21(h)	Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process	Not applicable