

APPENDIX

F-2 *BIODIVERSITY*

BASIC ASSESSMENT FOR THE PROPOSED
ESTABLISHMENT OF POWER LINES AND
ELECTRICAL INFRASTRUCTURE TO SUPPORT
THE IMPUMELELO WIND ENERGY FACILITY
LOCATED
NEAR SECUNDA, MPUMALANGA

TERRESTRIAL BIODIVERSITY AND SPECIES:
SPECIALIST ASSESSMENT



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EXECUTIVE SUMMARY

Background

Impumelelo Wind (Pty) Ltd proposes to develop the Impumelelo Wind Energy Facility (up to 200 MW) and its associated infrastructure near Greylingstad in Mpumalanga.

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted *'Procedures for the assessment and minimum criteria for reporting on identified environmental themes'* (Government Gazette 43110, No. 320, 20 March 2020 and Government Gazette 43855, No. 1150, 30 October 2020) (NEMA 2020a, 2020b). Note that these protocols replace the requirements of Appendix 6 of the 2014 NEMA EIA Regulations. The approach, methodology and regulatory framework is explained in Chapters 2 and 3 of the report.

Location, topography, climate, geology and soils

The area falls within the Gert Sibande District Municipality and the Dipaleseng Local Municipality as well as the Govan Mbeki Local Municipality in the Mpumalanga province, with the Impumelelo on-site substation located at 26° 39' 05.8" S; 28° 52' 53.4" E. The gridline covers a distance of approximately 34 km from the onsite substation to the stepdown substation at Zandfontein. The power gridline follows the Impumelelo mine conveyor belt eastwards up to the R547 then goes northwards to link up with the R50. The route then turns northeast on the R547 before turning east towards the Zandfontein substation. The site is characterised by grassland on the gentle undulating plains. Altitude ranges from about 1560 m to 1660 m above sea level. The site is drained from north to south by the Wolwespruit, Kaalspruit and Watervalrivier and their tributaries.

The site is underlain by dolerite (Jd) and sandstone, shale and coal beds of the Vryheid Formation, Ecca Group (Pv). Some alluvium occurs along the drainage lines. The Ea Land Type covers the entire site and occurs on undifferentiated soils and consists of one or more vertic, melanic, red structured diagnostic horizons.

The mean annual rainfall as measured at Secunda is 693 mm with the rainy season predominantly from October to March when about 86% of the annual rainfall occurs. The mean annual temperature at Secunda is 15.8°C with the extreme maximum and minimum temperatures 33.0°C and -4.3°C respectively.

Vegetation and flora

The Impumelelo site falls in the Grassland Biome and more specifically in the Mesic Highveld Grassland Bioregion. It is located in the Soweto Highveld Grassland (Gm8) national vegetation type which has a "Vulnerable" conservation status because almost half of it has been transformed mostly by cultivation, plantations, mining and urbanisation. Based on species composition, six habitats (plant communities) were distinguished, described and mapped for the Impumelelo WEF site of which five habitats were distinguished along the gridline routes (Habitats 1, 4, 5, 6 & 7). A further four units were also distinguished, i.e. croplands, infrastructure, disturbed areas and dams. The site does not fall within any Centre of Endemism.

During the field surveys, 290 plant species were recorded on the three Enertrag sites (Vhuvhili, Mukondeleli and Impumelelo). Combined, the checklist generated by the NewPosa database for the region, the red-list for Mpumalanga (Lötter 2015) and the list for the current field study yielded 396 species for the region of which 30 are protected species according to the MNCA (1998).

Twelve of the 30 Mpumalanga protected plant species (Schedule 11) were recorded during the site surveys. Another five species are on the Mpumalanga Red list (Lötter 2015) although not included in the MNCA (1998) list for Mpumalanga. The geophyte *Gladiolus robertsoniae* was the only one of seven SCCs (*sensu* SANBI SCC definition) listed for the region that was noted at the Impumelelo WEF site. No threatened or protected species (ToPS listed) under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) is listed for the Impumelelo site and none were found at the site. Thirteen (13) CITES Appendix II species are listed for the region including mostly (10) species of the Orchidaceae. However only two CITES species were recorded on the Impumelelo site, *viz.* *Aloe transvaalensis* and *Euphorbia clavarioides*. No nationally protected tree species is listed for the site and none were recorded during the site visit. No endemic species are listed for the Soweto Highveld Grassland Vegetation Type.

Forty-seven alien plant species were recorded on the three Enertrag sites of which 12 are currently declared alien invasive species and 35 naturalised alien species (Appendix B). Another four naturalised alien species are listed by NewPosa for the region.

Fauna

The site falls within the distribution range of 52 terrestrial mammal species. Three IUCN Threatened and seven Near Threatened mammal species were listed for the environs of the Impumelelo site. Mammals that have been sighted (own observations and landowner reported) include the Near Threatened Serval *Leptailurus serval*, Southern African hedgehog *Atelerix frontalis* and the Southern African vlei rat *Otomys auratus*. The steenbok *Raphicerus campestris* and hedgehog *Atelerix frontalis* are Schedule 2 mammal species recorded on the Impumelelo site (MNCA 1998), while the serval *Leptailurus serval* was the only CITES listed mammal species recorded in the vicinity. The Screening Tool highlighted the possible presence of the endangered oribi *Ourebia ourebi*, however the landowners did not confirm its presence.

Thirty-two (32) reptile species are listed for the region. *Smaug giganteus*, the giant girdled lizard, has a Vulnerable IUCN status and is classified as Endangered in the NEMBA (2007c) ToPS list, but was not highlighted by the screening tool for the site nor listed on the MTPA database for the participating farms. Provincially protected reptile species include 15 Schedule 2 Protected reptiles and 17 Schedule 5 reptiles. The two CITES listed reptile species that were recorded for the larger region were the giant girdled lizard (ouvolk), *Smaug giganteus*, and the common girdled lizard, *Cordylus vittifer*. The only reptile that the landowners reported for the Impumelelo site, is the Rinkhals *Hemachatus haemachatus*.

The species that were highlighted by the Screening Tool, included *Crocidura maquassiensis*, *Hydrichtis maculicollis*, *Ourebia ourebi ourebi* and *Lepidochrysops procera*. None of these species were listed in the MTPA database for the farms participating in the proposed Impumelelo WEF development and none were encountered during the site visit. The spotted-necked otter (*Hydrichtis maculicollis*) is not listed on the ADU database for the region while the Maquassie musk shrew (*Crocidura maquassiensis*) and *Lepidochrysops procera* are not listed on the ADU database for the region or the MNCA (1998) lists for the Mpumalanga province. The Impumelelo site falls marginally within the distribution range of *Ourebia ourebi ourebi*. None of the animal species listed by the Screening Tool were recorded on site during the survey. *Lepidochrysops procera* was not recorded on site and is unlikely to occur there because its host plant (*Ocimum obovatum*) was only recorded once in one locality. The habitat of the spotted-necked otter (Habitat 7) was rated as being highly sensitive and will be avoided by the development.

Conservation

The Impumelelo site is not located in a protected area and does not form part of the NPAES (2010). It is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA).

The presence of Critical Biodiversity Areas (CBA optimal or CBA2) are indicated across a large section of the Impumelelo gridline, mostly in Habitats 4 & 5 (natural and disturbed grassland) although these habitats were classified as having a low sensitivity rating in the current survey, with only the watercourses having a high sensitivity.

There are some ESA Local corridors demarcated within the Impumelelo alternative gridline site but these areas also had a low sensitivity rating in the current assessment and the gridline should not further degrade the landscape functionality. Gridlines are permissible in ONAs and their presence would not impact negatively on the ONAs.

Large portions of the site are demarcated as either 'Heavily modified' or 'Moderately modified – old lands'. These MBSP categories do not have equivalent categories in the SANBI CBA classification system and must be assumed to be degraded to such an extent that they cannot qualify as ESAs or ONAs.

The site does not fall in a Strategic Water Source Area (SWSA). Although the Screening Tool did not mention river of wetland FEPAs the entire Impumelelo site is contained in an Upstream Management Area river FEPA. In the current assessment, the area mapped as river FEPA did not emerge as being highly sensitive and the sensitivity model that was applied, classified only the drainage lines on site as being of high sensitivity with most of the area classified as low sensitivity and a few spots of medium sensitivity. Several Highveld Wetland categories are present along the Impumelelo gridline, with most of the seeps and channelled valley-bottom wetlands captured in the CBA delineation.

Sensitivity

A sensitivity model was applied to the data for each of the six habitats (plant communities) on site. Overall, the wetlands were classified as having a high sensitivity (Habitat 7), the rocky sheet grasslands (Habitat 1) were of medium sensitivity and the remainder classified as low sensitivity. According to the current gridline layout, substation 1 (SS1) is located within the medium sensitive habitat (Habitat 1). Along the watercourses, buffers are applicable to the development. A buffer zone of 32 m is usually applied to drainage lines, but the aquatic specialists may apply wider buffer zones along these habitats. **We recommend that the buffer specifications of the aquatic specialist are followed for all drainage lines/channelled valley bottom wetlands and seeps.**

Screening Tool

The Site Sensitivity Verification Report is given in Appendix D.

Plant Species Theme

The Screening Tool rated the sensitivity of the Plant Species Theme as Medium and four species were highlighted as being of concern. None of the SCC highlighted by the screening tool were recorded on site and our background study indicated that most of site had a **low** sensitivity.

Animal Species Theme

The Screening Tool rated the sensitivity of the Animal Species Theme as high. Animal species (excluding avifauna) highlighted by the screening tool for the region included *Crocidura maquassiensis*, *Hydriectis maculicollis*, *Ourebia ourebi ourebi* and *Lepidochrysops procera*. None of these species were listed in the MTPA database for the farms participating in the proposed Impumelelo development. *Crocidura maquassiensis* was also not listed in the ADU mammal species list or the MNCA (1998) lists for the Mpumalanga province. The Screening Tool also listed *Lepidochrysops procera* (Lepidoptera) as a SCC for the site. However, it was not listed in the ADU database, the MNCA (1998) provincial species lists or the NEMBA (2007c) ToPS lists. *Lepidochrysops procera* was not recorded on site and is unlikely to occur there because its host plant (*Ocimum obovatum*) was only recorded once in one locality. The Impumelelo site falls marginally within the distribution range of the 'endangered' *Ourebia ourebi ourebi*. The 'vulnerable' *Hydriectis maculicollis* would make use of Habitat 7, if present, and this habitat will be avoided by the development.

The giant girdled lizard (*Smaug giganteus*), classified as Endangered in the NEMBA (2007c) ToPS list, is listed for the larger region on the ADU database, but was not highlighted by the Screening Tool nor listed in the MTPA database for the farms in the immediate vicinity of the Impumelelo site. Furthermore, according to Bates *et al.* (2014), the distribution of the giant girdled lizard does not include the Impumelelo site. No individuals were recorded on site. Overall, the sensitivity of the animal species theme (avifaunal and bat component excluded) is rated as **medium**. If the suggested mitigation measures are followed the animal SCC should not be negatively affected by the development.

Relative Terrestrial Biodiversity Theme

The Screening Tool rated the sensitivity of the Relative Terrestrial Biodiversity Theme as Very High based on the presence of a Vulnerable ecosystem; CBAs; ESAs; and Protected Area Expansion Strategy (PAES). River or wetland FEPAs were not flagged by the screening tool as reasons for the very high sensitivity. Our background study confirmed that the Soweto Highveld Grassland vegetation type on site is listed as Vulnerable. However, we could not find support that the study area is located in an area earmarked for NPAES (2010). It is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA). Our background study confirmed the presence of CBAs on site. However, our sensitivity analysis rated large areas delineated as CBA as being of low sensitivity. Nevertheless, the gridline should preferably not be located within the areas demarcated as CBAs.

If the same 4-tiered scale were to be applied to the Terrestrial Biodiversity Theme, as in the case of the other themes, we would downgrade it to **medium**.

Environmental Impact Assessment

The direct, indirect and cumulative impacts of the proposed development on the Terrestrial Biodiversity and Species were assessed based on the knowledge gained during the site visit and literature review. Each of the impacts is briefly described in Chapter 13 in terms of the nature; proposed mitigation measures; and the significance of the impact without and with the mitigation measures applied. The methodology follows the guidelines provided by the CSIR.

The key issues are that the site falls within a “Vulnerable” national vegetation type and that large parts of the site have been delineated as CBAs. Infrastructure positioning should preferably avoid the CBAs.

Potential impacts identified during construction, operational and decommissioning phases

- The clearing of natural vegetation
- The loss of threatened, protected, CITES listed and/or endemic plants/animals
- Loss of faunal habitat
- Direct faunal mortalities due to construction and increased traffic
- Increased dust deposition
- Increased human activity, noise and light levels
- Establishment of alien vegetation
- Increased water run-off and erosion
- Changes in animal behaviour

Cumulative impacts

- Vegetation loss and habitat destruction
- Compromising integrity of CBAs, ESAs and NPAES
- Reduced ability to meet conservation obligations and targets
- Loss of landscape connectivity and disruption of broad-scale ecological processes

The impacts, mitigation measures, management objectives and actions as well as monitoring are discussed in Chapters 12 & 13 and also in the Environmental Management Programme (see Chapter 15).

Legislative and permit requirements

The most important permit requirement is the permit that needs to be obtained for the removal of plant species protected in Mpumalanga (MTPA). Legislative requirements also relate to the combatting of alien invasive species. Other aspects are summarised in Chapter 14, e.g. NEMBA (ToPS listed species) and CITES listed species.

A brief summary of the most important considerations is provided below:

Vegetation and flora:

- **Vegetation types:** The Soweto Highveld Grassland vegetation type is listed as “Vulnerable” and consequently the layout of the gridline infrastructure should give preference to the habitats on site where past disturbance has occurred e.g. disturbed areas, cultivated cropland or abandoned cropland. The threat status of the vegetation type will not be affected if the development occurs in areas of past disturbance.
- **Screening Tool:** None of the plant species highlighted by the Screening Tool were encountered on site.
- **Threatened plant species:** No IUCN threatened or red-listed plant species were encountered during the field survey.
- **Near Threatened Species:** *Gladiolus robertsoniae* was recorded in Habitat 1. Substation 1 (SS1) falls in Habitat 1 (medium sensitivity) and should preferably be repositioned.
- **Protected plant species:** No ToPS plant species or nationally protected tree species were recorded on site. A number of Mpumalanga protected species were recorded on site, but none with a threatened IUCN status.
- **CITES:** Two CITES listed species occur on site, i.e. *Aloe transvaalensis* and *Euphorbia clavarioides*.
- **Habitats:** Two of the four habitats on site had a low sensitivity rating with one habitat rated as of medium sensitivity, i.e. Habitat 1 (rocky sheets). The wetland habitat (Habitat 7) had a high sensitivity.
- **Overall sensitivity of plant theme based on the status of the habitats (plant communities):** Rated as **low** – provided some infrastructure is repositioned to habitats of low sensitivity and to avoid all CBAs and highly sensitive habitats. The Soweto Highveld Grassland has a ‘Vulnerable’ threat status and to minimise the impact on the vegetation a ground cover should be maintained in the servitude along the gridline.

Fauna (avifaunal and bat component excluded):

- **Screening Tool:** The species that were highlighted by the Screening tool, included *Crocidura maquassiensis*, *Hydrictis maculicollis*, *Ourebia ourebi ourebi* and *Lepidochrysois procera*. None of these species were listed in the MTPA database for the farms participating in the proposed Impumelelo development and none were encountered during the site visit. The spotted-necked otter *Hydrictis maculicollis*, Maquassie musk shrew *Crocidura maquassiensis* and *Lepidochrysois procera* are also not listed on the ADU database for the region. The Impumelelo gridline falls marginally within the distribution range of *Ourebia ourebi ourebi*, however it was not encountered during the site visit and also not reported as present by the landowners.
- **Threatened animal species:** The giant girdled lizard (*Smaug giganteus*), a reptile with a Vulnerable IUCN status occurs in the broader region. This species was however not highlighted by the Screening Tool and is not listed in the MTPA database for the region. Furthermore, according to Bates *et al.* (2014), the distribution of the giant girdled lizard does not include the Impumelo site.
- **Near Threatened species:** Three Near Threatened mammal species are reported for the site according to the land owners, i.e. the serval *Leptailurus serval*; Southern African hedgehog *Atelerix frontalis* and the Southern African vlei rat *Otomys auratus*). None of these species were however highlighted by the Screening Tool as SCC.
- **Overall sensitivity of animal theme (avifaunal and bat components excluded):** This is rated as **medium**. If the suggested mitigation measures are followed the animal SCC should not be negatively affected.

Conservation:

- **Protected Areas:** The study area is not located in a protected area.
- **National Protected Areas Expansion Strategy (NPAES):** The development will not interfere with the protected areas expansion strategy according to the NPAES spatial data of 2010 and it is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA).
- **Critical Biodiversity Areas (CBAs):** Both the on-site substations are located partially or fully in CBAs and should be repositioned even though the habitat of substation 1 (SS1) had a medium sensitivity and substation 2 (SS2) had a low sensitivity in our current assessment (Figure 14). Large sections of the power line route have been delineated as CBAs. Pylon positions can largely be selected to avoid drainage lines. It should however be noted that the mapping of CBAs in the region is not always secure. For example, almost the entire Impumelelo mine has been mapped as part of a CBA1 (irreplaceable). Such gross inaccuracies leaves a question mark over the entire CBA mapping effort.
- **Ecological Support Areas (ESAs):** The gridline option 1 does not cross any ESAs but the alternative route traverses ESAs. However, these areas had a low sensitivity rating in the current assessment and the gridline should not further degrade the landscape functionality.
- **Freshwater Ecosystem Priority Area (FEPA):** Although the entire site is classified as an upstream management area, the site assessment of the vegetation and the application of a sensitivity model rated most of the river FEPA area as being of low to medium sensitivity, with only the drainage lines having a high sensitivity.
- **Mpumalanga Highveld wetlands:** Channelled valley-bottom wetlands, floodplain wetlands, seeps and dams were distinguished on site. These wetlands were largely incorporated into the delineation of the CBAs (refer to aquatic specialist report for wetlands).

Ecological processes, function and drivers:

- Overall, it is highly unlikely that the development will contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions.
- The disturbance caused by the construction of the infrastructure will inevitably create conditions favourable for invasion by alien species and thus a programme for the early detection as well as control of alien invasive plant species must be implemented.
- Fire is an important driver of vegetation dynamics in the Grassland Biome and can occur when the fuel load is high. To avoid damage to the infrastructure, fire will have to be suppressed. If the grass layer is regularly mowed/brush cut, it should prevent grasses from becoming moribund in the absence of fire, although regular mowing could affect seed set.

Significance of environmental impacts:

Overall the significance of the environmental impacts was rated as low to moderate. In summary:

- Since the development footprint is expected to be relatively small, the loss of habitat within the Soweto Highveld Grassland vegetation type will be fairly small. However, our impact assessment was based on the assumptions (i) only a service track would be cleared and a vegetative groundlayer would be retained beneath the rest of the servitude; and (ii) where the vegetation was destroyed at the pylon sites during construction, that it will be rehabilitated and allowed to recover. Beyond the permanent infrastructure footprint, environmental functions and processes should however, not be altered.
- **From an ecological point of view,** large portions of the site have been heavily modified (compare CBA map, Figure 12) and not prime examples of the Soweto Highveld Grassland. If the development is thus contained within the heavily or moderately modified areas it would not affect the status of the vegetation type since these modified area were already considered as lost for the allocation of a vulnerable status of the vegetation type.

- Habitat 7 was rated as highly sensitive and Habitat 1 was rated as of medium sensitivity in the current assessment. Optional substation 1 (SS1) is located in a medium sensitive habitat (Figure 14).
- Most of the habitats covered by the proposed infrastructure were rated as having a low sensitivity in the current assessment.
- None of the species highlighted by the screening tool were encountered on site, thus the impact on populations of threatened or protected species will be negligible if all mitigation measures are applied.
- Depending on the type of fencing to be erected at some of the infrastructure, the gridline will contribute minimally to obstruction of animal movement.

Key environmental mitigation and management actions proposed

- Ensure that the placing of infrastructure takes the sensitivity mapping of the ecological assessment into account to avoid and reduce impacts on species and habitats of conservation concern.
- Infrastructure should be micro-sited prior to approval of final layout to ensure that any sensitive areas are avoided.
- Demarcate all infrastructure sites clearly to avoid unnecessary clearance of the vegetation.
- Avoid or minimise impacts that could potentially affect animal behaviour.
- Trenches should not be left open for long periods of time. Trenches should be inspected regularly for the presence of trapped animals.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns.
- Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site.
- Speed limits should be strictly adhered to.
- Dust control measures should be implemented.
- Permits have to be obtained for the removal of Mpumalanga protected species.
- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species.

Preferred infrastructure locations

Gridline:

There is no preferred option regarding the gridline route. Large sections of the power line route have been delineated as CBAs.

Impumelelo on-site substation:

Both the on-site substations are located partially or fully in CBAs and should be repositioned even though the habitat of substation 1 (SS1) had a medium sensitivity and substation 2 (SS2) had a low sensitivity in our current assessment (Figure 14).

Final specialist statement and authorisation recommendation

Our findings related to the Terrestrial Ecology and Species are the following:

Provided the positioning of gridline infrastructure takes sensitive habitats, CBAs and Highveld Wetlands into consideration, the resulting low sensitivity rating and low impact significance for many of the habitats means the project could go ahead, provided all mitigation measures and management actions proposed to conserve protected fauna and flora on the site, are complied with. **We thus recommend authorisation of the project provided all mitigation measures are implemented.**

SPECIALIST DECLARATION

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted '*Procedures for the assessment and minimum criteria for reporting on identified environmental themes*' (Government Gazette 43110, No. 320, 20 March 2020 and Government Gazette 43855, No. 1150, 30 October 2020) (NEMA 2020a, 2020b). Note that these protocols replace the requirements of Appendix 6 of the 2014 NEMA EIA Regulations.

Appointment of specialist

Ekotrust cc was appointed by ENERTRAG to provide an assessment on the terrestrial biodiversity and species of the Impumelelo Wind Energy Facility, located to the south of Secunda in the Mpumalanga province.

Company profile:

Name of Company: Ekotrust cc
(Registration number: CK90/05465/23)
Sole Member: Dr Noel van Rooyen
Founding date: 1990

Ekotrust cc specialises in habitat evaluation, vegetation classification and mapping, floristic diversity assessments, rare species assessments, alien plant assessments and management, wildlife management, wildlife production and economic assessments, veld condition assessment, bush encroachment, fire management, carrying capacity, wildlife numbers and ratios.

Specialist declaration

We, Noel van Rooyen and Gretel van Rooyen, as the appointed independent specialists, hereby declare that we:

- act as independent specialists in this application;
- 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 our specialist input/study, to be objective, true and correct within the framework of assumptions and limitations;
- do not have and will not have any business, financial, personal or other 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 amendments 2017; *Procedures for the assessment and minimum requirements for reporting on identified environmental themes* in terms of Sections 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation, and any specific environmental management act (NEMA 2020);
- declare that there are no circumstances that may compromise our objectivity in performing such work;
- 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;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- undertake to disclose to the applicant and the competent authority all material information in our possession that reasonably has or may have the potential to influence any decision to be taken with respect to the

application by the competent authority; or the objectivity of any report, plan or document to be prepared by us for submission to the competent authority;

- all the particulars furnished by us in this form are true and correct; and
- realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Indemnity and conditions relating to this report:

The observations, findings, recommendations and conclusions provided in the current report are based on the compilers' best scientific and professional knowledge and other available information. If new information should become available Ekotrust cc reserves the right to modify aspects of the report. This report (hard copy and/or electronic) must not be amended or extended without the prior written consent of the author. Furthermore, any recommendations, statements or conclusions drawn from or based on this report must make reference to the report. If these recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety (as an Appendix).

Although Ekotrust cc has exercised due care in preparing this report, it accepts no liability, and by receiving this document, the client indemnifies Ekotrust cc against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.



Signature of specialists:



Name of specialists: Dr N van Rooyen

Prof. MW van Rooyen

Date: 30 January 2023

30 January 2023

Note: This specialist assessment was commissioned prior to the gazetting of the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species' and the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant Species' (GG 43855 / GN R1150, 30 October 2020). Nevertheless, the Protocols for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant and Animal Species were considered and the findings are contained in the Site Verification Report. Where appropriate a compliance statement has been appended to the Site Verification Report.

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ACRONYMS

AIS	Alien Invasive species
BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CBD	Convention on Biodiversity
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CSIR	Council for Scientific and Industrial Research
DFFE	Department of Forestry, Fisheries and the Environment
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAr	Environmental Impact Assessment Report
EMPr	Environmental Management Plan Report
ESA	Ecological Support Area
IUCN	International Union for the Conservation of Nature
I&APs	Interested and Affected Parties
GIS	Geographical Information System
MBSP	Mpumalanga Biodiversity Sector Plan
MNCA	Mpumalanga Nature Conservation Act
MPHG	Mpumalanga Highveld Grassland
MTPA	Mpumalanga Tourism & Parks Agency
GIS	Geographical Information System
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NPAES	National Protected Area Expansion Strategy
ONA	Other Natural Areas
PA	Protected Area
PAES	Protected Area Expansion Strategy
SEA	Strategic Environmental Assessment
SANBI	South African National Biodiversity Institute
ToPS	Threatened and Protected Species
ToR	Terms of Reference
SEF	Solar Energy Facility
WEF	Wind Energy Facility

GLOSSARY

Alien invasive species	Any species whose establishment and spread outside of its natural distribution range (i) threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats or other species; and (ii) may result in economic or environmental harm or harm to human health.
Alternative	A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following, but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.
Alluvium	Unconsolidated material deposited by flowing water
Biodiversity	The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. It includes diversity within species, between species and of ecosystems.
Category 1a Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as a species that must be combatted or eradicated. Landowners are obliged to take immediate steps to control Category 1a species in compliance with sections 75(1), (2) and (3) of the Act. If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must combat or eradicate the listed invasive species in accordance with such a programme.
Category 1b Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as species that must be controlled. If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such a programme.
Category 2 Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the Act as species that require a permit to carry out a restricted activity specified in the Notice or an area specified in the permit, as the case may be. Permit-holders must ensure that specimens of the species do not spread outside the area specified in the Notice or permit.
Category 3 Listed Invasive Species	A species listed by notice in terms of section 70(1)(a) of the act, as species that are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the Act, as specified in the Notice. However, a Category 3 Listed Invasive Species that occurs in riparian areas must be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3.
Critical Biodiversity Areas	Areas required to meet biodiversity targets for ecosystems, species or ecological processes. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species.
Critically Endangered species	Indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
Development	The building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity.
Development footprint	Any evidence of physical alteration as a result of the undertaking of any activity.
Ecological Support Areas	These are not essential for meeting biodiversity targets, but play an important role in supporting the functioning of Protected Areas or CBAs and are often vital for delivering ecosystem services. ESAs must be maintained in at least a functional and often natural state, but some limited habitat loss may be acceptable.
Endangered species	Indigenous species facing a high risk of extinction in the wild in the near future, although they are not yet Critically Endangered species.
Habitat	A place where a species or ecological community occurs naturally.
Indigenous vegetation	Vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Indigenous	A species that occurs, or has historically occurred, naturally in a free state in nature within the borders of the Republic, but excludes a species that has been introduced in the Republic as a result of human activity.
Introduced	In relation to a species, means the introduction by humans, whether deliberately or accidentally, of a species to a place outside the natural range or natural dispersal potential of that species;
Linear activity	An activity that is arranged in or extending along one or more properties and which affects the environment or any aspect of the environment along the course of the activity, and includes railways, roads, canals, channels, funiculars, pipelines, conveyor belts, cableways, power lines, fences, runways, aircraft landing strips, firebreaks and telecommunication lines.
Mitigate	The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.
"No-Go" option	The "no-go" development alternative option assumes the site remains in its current state, i.e. there is no development in the proposed project area.
Schedules 1 – 4: Specially protected game, Protected game, Ordinary game and protected wild animals	Any species of wild animal specified in Schedule 1, 2, 3 & 4 of the Act (MNCA 1998).
Schedule 5: Wild animals	Provisions of Section 33 apply (MNCA 1998): No person shall import into the province, keep, possess, sell, purchase, donate or receive as a donation or convey a Schedule 5 live wild animal without a permit.
Schedule 6: Exotic animals	Provisions of Section 34 apply (MNCA 1998): No person shall keep, possess, sell, donate or receive as a donation or convey a Schedule 6 live exotic animal without a permit.
Schedule 7: Invertebrates	Provisions of Section 35(1) apply (MNCA 1998): No person shall collect, catch, kill, keep, purchase, sell, donate or receive as a donation, convey, import or export a Schedule 7 invertebrate without a permit.
Schedule 8: Problem Animal	An animal declared to be a problem animal listed in Schedule 8 of the Act (MNCA 1998).

Schedules 11 & 12: Protected plants and specially protected plants	Any species of flora specified in Schedules 11 and 12 of the Act (MNCA 1998).
Schedule 13: Invader weeds and plants	Any species of flora specified in Schedule 13 of the Act (MNCA 1998). No person shall possess, sell, purchase, donate or receive as a donation, convey, import or cultivate a Schedule 13 declared invader weed or plant without a permit.
Vulnerable species	Indigenous species facing a high risk of extinction in the wild in the medium-term future, although they are not Critically Endangered species or an Endangered species.
Watercourse	Includes (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, pan, lake or dam into which, or from which, water flows; and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland	Land that 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 typically adapted to life in saturated soil.

GENERAL INFORMATION

Study site: Impumelelo Wind Energy Facility: Farms or farm portions of Platkop 543 IR, Hartbeesfontein 522 IR and Mahemsfontein 644 IR.

Client: ENERTRAG South Africa (Pty) Ltd

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Terrestrial Biodiversity and Species Assessment by:

This specialist assessment was undertaken by Dr Noel van Rooyen and Prof. Gretel van Rooyen of Ekotrust cc. The *curriculum vitae* of the specialists are included in Appendix G of this assessment.

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TERMS OF REFERENCE

The Scope of Work for the terrestrial biodiversity and ecology specialist study includes the following tasks:

- Compilation of a specialist study in adherence to:
 - o the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted *'Procedures for the assessment and minimum criteria for reporting on identified environmental themes'* (Government Gazette 43110, No. 320, 20 March 2020 and Government Gazette 43855, No. 1150, 30 October 2020) (NEMA 2020a, 2020b). Note that these protocols replace the requirements of Appendix 6 of the 2014 NEMA EIA Regulations.

Compilation of a specialist study in adherence to:

- o the gazetted *'Protocol for the Specialist Assessment and Minimum Report Content Requirements of Environmental Impacts on Terrestrial Biodiversity'* (GG 43110 / GN R320, 20 March 2020). Note that this protocol replaces the requirements of Appendix 6 of the 2014 NEMA EIA Regulations, as amended;
- o any additional relevant legislation and guidelines that may be deemed necessary.
- The assessment should be based on existing information, national and provincial databases, SANBI mapping, professional experience and field work conducted.
- Undertake a site inspection to identify the site sensitivities, and verify them in terms of the National Web-Based Screening Tool (<https://screening.environment.gov.za/>).
- If needed, liaise with the South African National Biodiversity Institute (SANBI) to obtain information on sensitive species flagged in the National Web-Based Screening Tool (where species names are obscured / only numbered).
- Describe the terrestrial ecological features of the project area, with focus on features that are potentially impacted by the proposed project. The description should include the major habitat forms within the study site, giving due consideration to terrestrial ecology (flora and fauna), Species of Conservation Concern (SCC) or Protected Species.
- If applicable, specify development set-backs/buffers, and provide clear reasons for these recommendations.
- Map the sensitive ecological features within the proposed project area, showing any “no-go” areas (i.e. “very high” sensitivity).
- Provide input on the preferred infrastructure locations following the sensitivity analysis.
- Provide sensitive features spatial data in a useable GIS format (.kmz /.shp).
- Provide an assessment of direct, indirect and cumulative impacts associated with the proposed WEF, with and without mitigation.
- Address relevant concerns/comments raised by Interested and Affected Parties and Stakeholders, including the Competent Authority, during Public Participation Processes.
- Identify relevant legislative requirements and permits that may be required.
- Recommend mitigation measures, best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts to be included in the Environmental Management Programme (EMPr).
- Update the draft specialist study report after Environmental Assessment Practitioner (EAP) and client review (before public release) and after public review for submission to the Competent Authority for decision-making.
- Address any queries from the Competent Authority during the decision-making phase.

STATEMENTS, LIMITATIONS, ASSUMPTIONS AND UNCERTAINTIES

The following assumptions, limitations or uncertainties are listed regarding the evaluation of the impacts of the proposed Impumelelo project on the terrestrial biodiversity and ecology:

- The area has been moderately collected in the past and the list of plant species that could potentially occur on site as obtained from the NewPosa database, is thus considered to provide a fair representation of the flora on site.
- Rare and threatened plant and animal species are generally uncommon and/or localised and the once-off survey may fail to locate such species. Information on rare and threatened plant and animal species was supplemented by data provided by MTPA (M. Lötter) on localities of such species at farm level.
- Rare plant species usually occur in specialised and localised habitats, thus special attention was given to these habitats.
- The site visit was undertaken in December 2021 after the region had received good rains, thus the botanical assessment was conducted under favourable conditions.
- No aerial census, road census or trapping (either camera trapping or by way of Sherman traps) was conducted for fauna, since these methods generally provide an underrepresentation of the full faunal diversity within the limited timeframe available. Faunal lists were sourced from literature and the website of the Animal Demography Unit of the University of Cape Town.

1. INTRODUCTION

Impumelelo Wind (Pty) Ltd (Registration number 2022/601923/07) proposes to develop the Impumelelo Wind Energy Facility (up to 200 MW) and its associated infrastructure near Secunda in Mpumalanga. This report covers the proposed grid infrastructure which includes an on-site substation at the Impumelelo WEF, a 132kV gridline and the step-down substation at Zandfontein.

The proposed Impumelelo Wind Energy Facility (WEF) and associated infrastructure include the following components:

- Two substations to facilitate grid connection.
- The on-site substation will feed electricity generated by the proposed Impumelelo WEF into the step-down substation at the Zandfontein facility.
- Overhead 132 kV powerlines of approximately 34 km to connect the on-site Impumelelo WEF and Zandfontein substations.
- A 32 m per 132kV powerline servitude.
- Powerline pylon height of maximum 40 m.

Gridline corridors with a width of approximately 500 m are assessed to allow flexibility when determining the final route alignment. The proposed gridline however only requires a 32 m wide servitude and as such, this servitude would be positioned within the corridor as required.

A Basic Assessment process is required for the proposed development of the Impumelelo gridline project and associated infrastructure. As required in Part A of the Government Gazette 43110, GN 320 (20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area.

This report presents the Specialist Terrestrial Biodiversity and Species Impact Assessment Report of the proposed Impumelelo project. The scope, purpose and objectives of the report have essentially been summarised in the ToR.

2. APPROACH AND METHODOLOGY

2.1 Approach

The study commenced as a desktop study, followed by field-based surveys in December 2021. October to March is the main rainy season when about 86% of the annual rainfall occurs, thus the site visit was undertaken at a favourable time.

The focus of the site visit was:

- to undertake a site sensitivity verification in order to confirm the current land use and environmental sensitivity as identified in the screening tool; and
- to conduct surveys (fauna and flora) of the Impumelelo site to identify sensitive habitats, to classify the vegetation into habitats (or plant communities), compile species lists and to search for Species of Conservation Concern (SCC). According to SANBI's (SANBI 2020) definition of SCC, these are species that have a high conservation importance in terms of preserving South Africa's high floristic and faunal diversity and include not only threatened species, but also those classified as Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining, Data Deficient - Insufficient Information (DDD) and Data Deficient – Taxonomic (DDT) (www.redlist.SANBI.org).

Hard copy and digital information from spatial databases, such as BGIS of the South African Biodiversity Institute (SANBI) for maps of Critical Biodiversity Areas, Protected Areas, Nationally Protected Area Expansion Strategy (NPAES), Freshwater Ecosystem Priority Areas (FEPA); the geological survey maps (2628 East Rand); land type maps (2628 East Rand); topocadastral maps (2629CA SECUNDA, 2629CB BAANBREKER, 2628DB WILLEMSDAL 1:50 000 maps); vegetation types of SANBI (2006 – 2018); NewPosa database of SANBI; and databases of the Animal Demography Unit, University of Cape Town, as well as literature were sourced to provide information on the environment and biodiversity of the study area.

Satellite images (Google Earth) were used to stratify the area into relatively homogeneous terrain/vegetation units. The vegetation survey consisted of visiting the mapped units and systematically recording plant species on site, and estimating their canopy cover. A total of 20 sample plots were surveyed on the Impumelelo site. However, a further 60 sample plots were surveyed on the Vhuvhili and Mukondeleli sites in the nearby region and the total of 80 sample plots were used to compile a differential table (Appendix A) to identify the habitats (or plant communities) for the region. Physical habitat features were also noted. During the site visit, digital photographs were taken and representative photographs of the different habitats are included in the report. The site was also surveyed for rare, threatened and/or endemic plant species during the site visit.

The animal site survey was limited to day-time visual assessments on site. Animal species presence on site was mainly attained by means of direct or indirect sighting methods (animals, spoor, burrows, scats, sounds), whilst traversing the site by vehicle or on foot. Red-listed species are generally uncommon and/or localised and the survey may have been insufficient to record their presence at or near the proposed development. Furthermore, the owners of the participating farms were consulted regarding sightings of especially mammal species on the properties. Please note the avifauna and bats were assessed in the avifaunal and bat specialist assessments and are not part of the current report.

2.2 Vegetation and flora

The plant species data were summarised in a phytosociological table (Appendix A) and seven habitats (or plant communities) and a further four habitats were identified, described and mapped for the region.

The term species is used here in a general sense to denote species, subspecies and varieties. The checklist of plant species in Appendix B was compiled from the NewPosa database of the South African National Biodiversity Institute (newposa.sanbi.org) and supplemented by lists of rare species of the Mpumalanga Tourism & Parks Agency and own observations during the vegetation surveys. The IUCN status, conservation and protected status of all plant species provided in Appendix B were determined from available literature and Acts, e.g. NewPosa database (newposa.sanbi.org), and Red list database (redlist.sanbi.org) of the South African National Biodiversity Institute; NEM:BA (2007c) (ToPS list); NFA (2021), CITES (2021) and the MNCA (1998).

2.3 Fauna

Species lists (the term species is used here in a general sense to denote species, subspecies and varieties) of the faunal component were sourced from the Animal Demography Unit, University of Cape Town website (www.adu.uct.ac.za) and consulting of other available databases and/or relevant literature, e.g. Leeming (2003), Skinner and Chimimba (2005), Alexander and Marais (2007), Mecenero *et al.* (2013), Bates *et al.* (2014), Child *et al.* (2016), MNCA (1998) lists and DEA (2016a) to determine the diversity, conservation status and distribution of relevant faunal species (Appendix C). These species lists were supplemented by own observations and observations from the landowners.

2.4 Sensitivity assessment

Based on the environmental features and the species encountered in the on-site survey, a sensitivity assessment of each habitat was done (Chapter 10). Sensitive features are presented spatially in GIS format (provided as a separate .kmz file).

2.5 Sources of information

Vegetation:

- Vegetation types occurring in the area were obtained from Mucina & Rutherford (2006) and the revised national vegetation map produced by SANBI in 2018 (SANBI 2006-2018).
- Conservation status of the vegetation types was obtained from Mucina & Rutherford (2006) and the National List of Threatened Ecosystems (NEMA 2011, Skowno *et al.* 2018).
- Information on species endemic to a national vegetation type was obtained from Mucina & Rutherford (2006);
- The Impumelelo gridline does not occur in any Centre of Plant Endemism (Van Wyk & Smith 2001).
- A plant species checklist of the immediate region around the site (2628DB, 2629CA & 2629CB grids) was obtained from the NewPosa database of the South African National Biodiversity Institute (SANBI) (Appendix B) (website accessed November 2021).
- The IUCN Red List Categories of the plant species were extracted from the Threatened Species Programme (Red List of South African plants; website accessed November 2021) as well as the NewPosa database of the South African National Biodiversity Institute (SANBI) (website accessed November 2021).
- The MNCA (1998) and Mpumalanga Biodiversity Sector Plan (MBSP) were consulted to establish provincially specially protected and protected status of plant species including the rare plant species at the Impumelelo site (data provided by M. Lötter, MTPA).

- The National Protected tree list (NFA 2021) was consulted.
- **The wetland component is reported on separately (see aquatic specialist report).**

Fauna

- Lists of mammals, reptiles, frogs, butterflies (Lepidoptera), spiders and scorpions were extracted from the Animal Demography Unit, University of Cape Town website (<http://vmus.adu.org.za>; accessed November 2020) and supplemented by information gathered in Skinner and Chimimba (2005) for mammals; Bates *et al.* (2014) for reptiles; and Mecenero *et al.* (2013) for butterflies (Appendix C).
- Lists extracted from the MTPA database for the farms participating in the proposed Impumelelo WEF development (M. Lötter, MTPA).
- The IUCN Red List Categories for the animal species were extracted from Child *et al.* (2016) for mammals; Bates *et al.* (2014) for reptiles; and Mecenero *et al.* (2013) for butterflies. No IUCN Categories are however available for spiders and scorpions.
- Data provided by M. Lötter, MTPA were consulted to establish provincially specially protected and protected status of animal species.
- **The avifauna and bat component is reported on separately (see avifaunal and bat specialist reports).**

Other

- The Mpumalanga Biodiversity Sector Plan (MBSP) was consulted for maps indicating CBAs and ESAs in the region of the Impumelelo site.
- The National Protected Areas Expansion Strategy (NPAES 2010) was consulted for possible inclusion of the site into a protected area in future (biodiversityadvisor.sanbi.org; accessed October 2021) as well as the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA).
- NFEPA database (2011) was consulted for inclusion of the site in a Freshwater Ecosystem Priority Area and MPHG Wetlands database (2014) was consulted for wetlands on site (biodiversityadvisor.sanbi.org; accessed October 2021).

Regulatory framework

- This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted Environmental Assessment Protocols of the NEMA EIA Regulations (2014, as amended), where applicable (Government Gazette 43110, No. 320, 20 March 2020 and Government Gazette 43855, No. 1150, 30 October 2020) (NEMA 2020a, 2020b).

3. REGULATORY FRAMEWORK

3.1 Introduction

The White Paper on the conservation and sustainable use of South Africa's biodiversity and the National Environmental Management Act (Act No. 107 of 1998) specifies that due care must be taken to conserve and avoid negative impacts on biodiversity and that the sustainable, equitable and efficient use of biological resources must be promoted. Various acts provide control over natural resources in terms of their conservation, the use of biological resources and avoidance of negative impacts on biodiversity. Some international conventions are also relevant to sustainable development.

3.2 Natural resources

Terrestrial and other ecosystems and their associated species are widely used for commercial, semi-commercial and subsistence purposes through both formal and informal markets. While some of this use is well managed and/or sustainable, much is thought to be unsustainable. "Use" in this case refers to direct use, such as collecting, harvesting, hunting and fishing for human consumption and production, as well as more indirect use such as ecotourism and wildlife ranching.

3.3 Convention on Biodiversity (CBD)

South Africa is a signatory to the United Nations Convention on Biological Diversity (CBD), which was ratified in 1995. The CBD requires signatory states to implement the objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources; and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

3.4 National Environmental Management Act (Act No. 107 of 1998) (NEMA)

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or well-being. It is administered by the Department of Forestry, Fisheries and the Environment (DFFE), but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for cooperative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws.

The EIA Regulations Listing Notices of 2010 were repealed in 2014 and amended regulations and listings were published in 2014 and 2017 under the National Environmental Management Act (NEMA 2014, 2017). Listing Notice 1 (GRN No. 327), Listing Notice 2 (GRN No 325) and Listing Notice 3 (GRN No 324) of the 2017 Regulations list activities that may require Environmental Authorisation prior to commencement of an activity and identify competent authorities in terms of sections 24(2) and 24D of the Act.

Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA 1998, when applying for Environmental Authorisation were published in the Government Gazette 43110, No 320, 20 March 2020 and Government Gazette 43855, No. 1150, 30 October 2020).

3.5 National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA)

As the principal national act regulating biodiversity protection, NEM:BA, which is administered by DFFE, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term 'biodiversity', according to the Convention on Biodiversity (CBD), refers to the variability among living organisms from all sources including, *inter alia* terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

Threatened ecosystems

Section 53 of NEM:BA lists the threatened status of ecosystems, i.e. Critically Endangered ecosystems, Endangered ecosystems, and Vulnerable ecosystems. The list of threatened ecosystems was published in 2011 (NEM:BA 2011). The recent 2018 National Biodiversity Assessment (Skowno *et al.* 2018) includes the updated extent and status of threatened ecosystems, although not yet formally adopted under the NEM:BA.

Threatened or Protected Species (ToPS) Regulations

Section 56 of NEM:BA makes provision for the declaration of species which are of such high conservation value, national importance or are considered threatened that they need protection, i.e. Critically Endangered species, Endangered species and Vulnerable species. Lists of species that are threatened or protected, and associated activities that are prohibited and/or exempted from restriction were published in 2007 (NEMBA 2007c). Any proposed development involving one or more threatened or protected species and/or prohibited/restricted activities will require a permit in term of these Threatened or Protected Species (ToPS) Regulations.

Alien and Invasive Species (AIS) Regulations

Chapter 5 of NEM:BA provides for the protection of biodiversity from alien and invasive species. The act defines alien species and provides lists of invasive species in regulations. The Alien and Invasive Species (AIS) lists were published in Government Gazette No. 43726 of 18 September 2020 (NEM:BA 2020a). The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEM:BA, was subsequently published in Government Gazette No. 43735 of 25 September 2020 (NEM:BA 2020b).

In terms of the aforementioned legislation, the following categories of declared alien and invasive plants are recognised in South Africa (see Glossary for explanations):

1. Category 1a Listed Invasive Species
2. Category 1b Listed Invasive Species
3. Category 2 Listed Invasive Species
4. Category 3 Listed Invasive Species

3.6 The National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA)

NEM:PAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

3.7 National Forests Act (Act No. 84 of 1998) (NFA)

The National Forest Act makes provision for the declaration of for example specially protected areas, forest nature reserves, forest wilderness areas and protected woodlands. The latest list of declared protected tree species in terms of the NFA was published in 2021 (NFA 2021). In terms of section 15(1) of this act, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. The competent authority responsible for considering and issuing the license will be the national Department of Forestry, Fisheries and the Environment (DFFE).

3.8 Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)

The objectives of the Conservation of Agricultural Resources Act are to provide for the conservation of the natural agricultural resources by the maintenance of the production potential of the land; by combating and preventing erosion and weakening or destruction of the water resources; and by protecting natural vegetation and combating weeds and invader plants. In order to achieve the objectives, certain control measures are prescribed to which land users must comply. The activities mentioned relate to:

- the cultivation of virgin soil;
- the irrigation of land;
- the prevention or control of waterlogging or salinisation of land;
- the utilisation and protection of vleis, marshes and watercourses;
- the regulation of the flow pattern of run-off water;
- the utilisation and protection of vegetation; and
- the restoration or reclamation of eroded land.

3.9 Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is an international agreement to which countries adhere voluntarily. The aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES are listed in three appendices reflecting the degree of protection that the species needs. Appendix I includes species that are threatened with extinction and trade in these species is permitted only in exceptional circumstances. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. Appendix III lists species that are protected in at least one country that has asked other CITES parties for assistance in controlling the trade (Website: www.cites.org, accessed October 2020).

4. STUDY AREA

4.1 Location

The Impumelelo gridline covers a distance of approximately 34 km to the Zandfontein substation in the northeast (Figures 1 & 2). The power gridline follows the Impumelelo mine conveyor belt eastwards up to the R547 then goes northwards to link up with the R50. The route then turn northeast on the R547 before turning east towards the Zandfontein substation. The area falls within the Gert Sibande District Municipality and the Dipaleseng Local Municipality as well as the Govan Mbeki Local Municipality in the Mpumalanga province, with the Impumelelo on-site substation located at 26° 39' 05.8" S; 28° 52' 53.4" E.

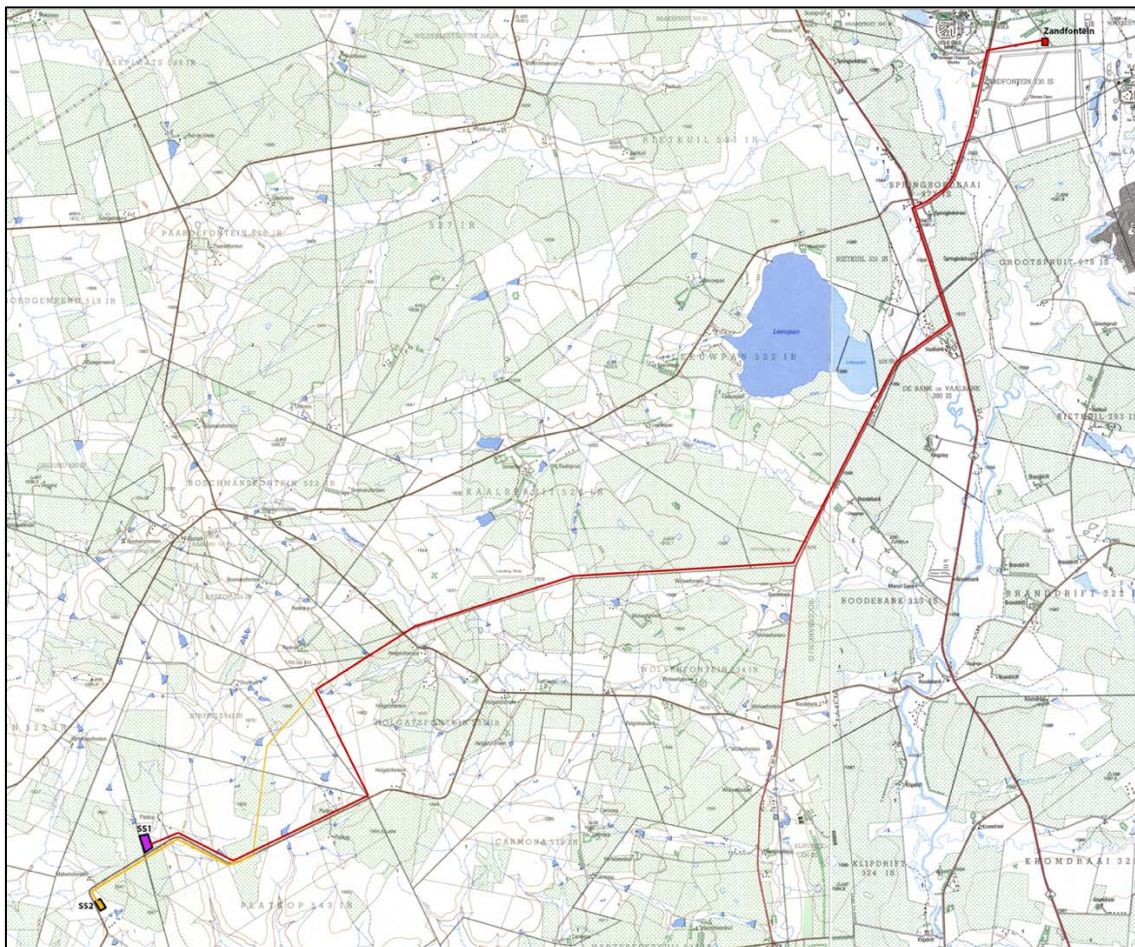


Figure 1: Topocadastral map of the Impumelelo gridline site (2628DB Willemsdal 1996; 2629CA Secunda 1996). Gridline option 1 = red line starting at SS1 (purple square); gridline option 2 starts at SS2 (orange square and orange line).

4.2 Terrain morphology and drainage

The site is characterised by grassland on gently undulating plains. Altitude ranges from about 1560 m to 1660 m above sea level (Figure 1). The site is drained from north to south by the Wolwespruit, Kaalspruit and Watervalrivier and their tributaries.



Figure 2: Google image of the Impumelelo gridline site. SS1 & SS2 = substations 1 & 2 at Impumelelo. Orange gridline starts at SS1 and the red gridline at SS2.

4.3 Climate

4.3.1 Regional climate (Mucina & Rutherford 2006)

The site falls in a strongly seasonal summer-rainfall, cool-temperate region, with very dry winters. The mean annual precipitation of the Soweto Highveld Grassland is 662 mm with a peak in rainfall from November to January. The annual precipitation coefficient of variation is 27%. Mean annual potential evaporation is 2060 mm, while the mean annual soil moisture stress is 75%. Mean annual temperature is 14.8°C and frost is frequent in winter with a mean of 41 days per annum.

4.3.2 Rainfall

The mean annual rainfall in the region ranges from 667 mm at the farm Zandfontein to 738 mm at the farm Driefontein, both close to Secunda (Table 1). The mean annual rainfall as measured at Secunda is 693 mm (Table 2, Figure 3). The total annual rainfall at Secunda during dry and wet years respectively may range from 558 mm to 965 mm, indicating a moderate variation in the annual rainfall. The rainy season at Secunda is predominantly from October to March when about 86% of the annual rainfall occurs. December and January are the wettest months and the driest period is from May to August, when less than 15 mm of rain per month is recorded. Maximum rainfall

measured over a 24-hour period at Secunda was 82 mm, recorded in November. The highest monthly rainfall recorded was 241 mm, also measured in November.

Table 1: Rainfall at some weather stations in the general environs of the Impumelelo gridline (Weather Bureau 1998)

Month	Mean Annual Rainfall (mm)				
	Secunda	Zandfontein	Driefontein	Bethal	Standerton
Jan	114	125	121	146	122
Feb	93	97	100	75	87
Mar	64	84	80	61	66
Apr	35	34	44	48	44
May	8	24	21	14	12
June	14	6	7	7	9
July	2	12	9	6	7
Aug	8	5	10	13	12
Sep	33	24	27	28	29
Oct	82	62	71	78	86
Nov	104	100	116	129	117
Dec	136	116	118	106	104
Year	693	667	738	711	695

Table 2: Maximum rainfall (mm) in 24 hours, highest maximum and lowest monthly minimum rainfall at Secunda: 26° 30' S; 29° 11' E; 1628 m (Weather Bureau 1998)

Month	Rainfall (mm)			
	Mean (month)	24 h max	Max per month	Min per month
Jan	114	66	168	50
Feb	93	69	142	41
Mar	64	55	121	31
Apr	35	56	119	2
May	8	12	18	0
June	14	41	75	0
July	2	6	13	0
Aug	8	24	24	0
Sep	33	26	107	0
Oct	82	59	146	0
Nov	104	82	241	0
Dec	136	76	200	89
Year	693	82	965	558

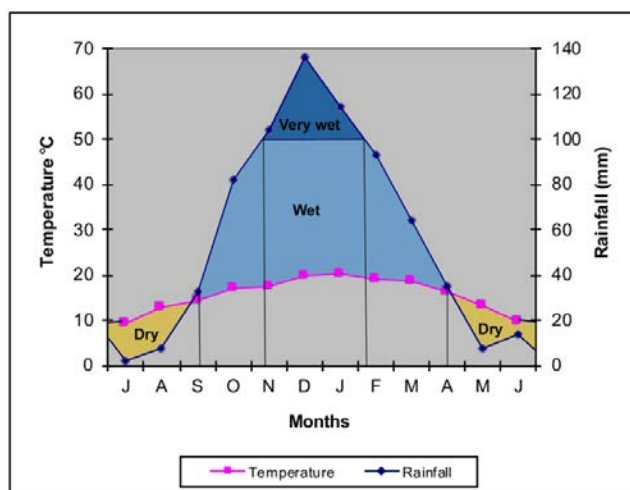


Figure 3: Climate diagram for the Secunda region. Months on X-axis are from July to June. When the rainfall curve is below the temperature curve, it indicates a dry period and when the monthly rainfall is higher than 100 mm, it indicates a very wet period.

4.3.3 Temperature

The mean annual temperature for Secunda is 15.8°C (Table 3) with the extreme maximum and minimum temperatures 33.0°C and -4.3°C respectively. The mean daily maximum for January is 27.2°C and for July it is 18.1°C, whereas the mean daily minimum for January is 13.5°C and for July it is 0.9°C. Frost may occur anytime from April to October.

Table 3: Temperature data (°C) for the Secunda region: 26° 30' S; 29° 11' E; 1628 m (Weather Bureau 1998)

	Temperature (°C)												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Max	27.2	25.9	25.2	23.0	20.8	17.3	18.1	21.5	22.3	24.3	23.8	26.0	27.2
*Ext. Max	33.0	32.5	30.0	30.6	25.5	25.3	25.3	27.0	31.0	32.0	31.0	31.5	33.0
Min	13.5	12.9	12.0	9.8	5.9	2.3	0.9	4.1	6.9	10.0	11.1	13.6	0.9
*Ext. Min	10.1	10.5	7.1	4.2	2.0	-2.6	-4.3	-1.5	1.1	4.3	6.3	8.8	-4.3
Mean	20.4	19.3	18.6	16.3	13.4	9.8	9.5	12.8	14.6	17.1	17.5	19.9	15.8

Max = mean daily maximum temperature for the month

*Ext. Max = extreme maximum temperature recorded per month

Min = mean daily minimum temperature for the month

*Ext. Min = extreme minimum temperature recorded per month

Mean = mean monthly temperature for each month and for the year

4.3.4 Cloudiness and relative air humidity

At Bethal weather station, located about 25 km east of Secunda, the cloud cover at 14:00 is the highest from November to January (5.1 – 5.3 eights) and the lowest in June, July and August (1.5 – 1.9 eights) (Table 4). The highest mean relative air humidity (%) at 08:00 occurs during the late summer and autumn months (February to April; 83 – 84%) and the lowest relative air humidity at 14:00 (31%) occurs in early spring (August) (Weather Bureau 1998).

Table 4: Cloud cover at 14:00 and percentage relative air humidity at 08:00 and 14:00 at Bethal: 26° 27' S; 29° 29' E; 1663 m (Weather Bureau 1998)

	Cloud (0-8)	Relative air humidity %	
	14:00	08:00	14:00
Jan	5.2	80	51
Feb	4.9	83	48
Mar	4.9	83	44
Apr	4.1	84	41
May	2.4	80	34
June	1.6	81	34
July	1.5	79	33
Aug	1.9	75	31
Sept	3.1	74	33
Oct	4.6	75	41
Nov	5.3	77	49
Dec	5.1	77	48
Year	3.7	80	41

4.4 Geology

The geology of the site is depicted in the 1:250 000 geological map 2626 East Rand (1986) (Figure 4). Most of the site is underlain by sandstone, shale and coal beds of the Vryheid Formation, Ecca Group with some areas in the west and north covered by dolerite. Alluvium occurs along the drainage lines.

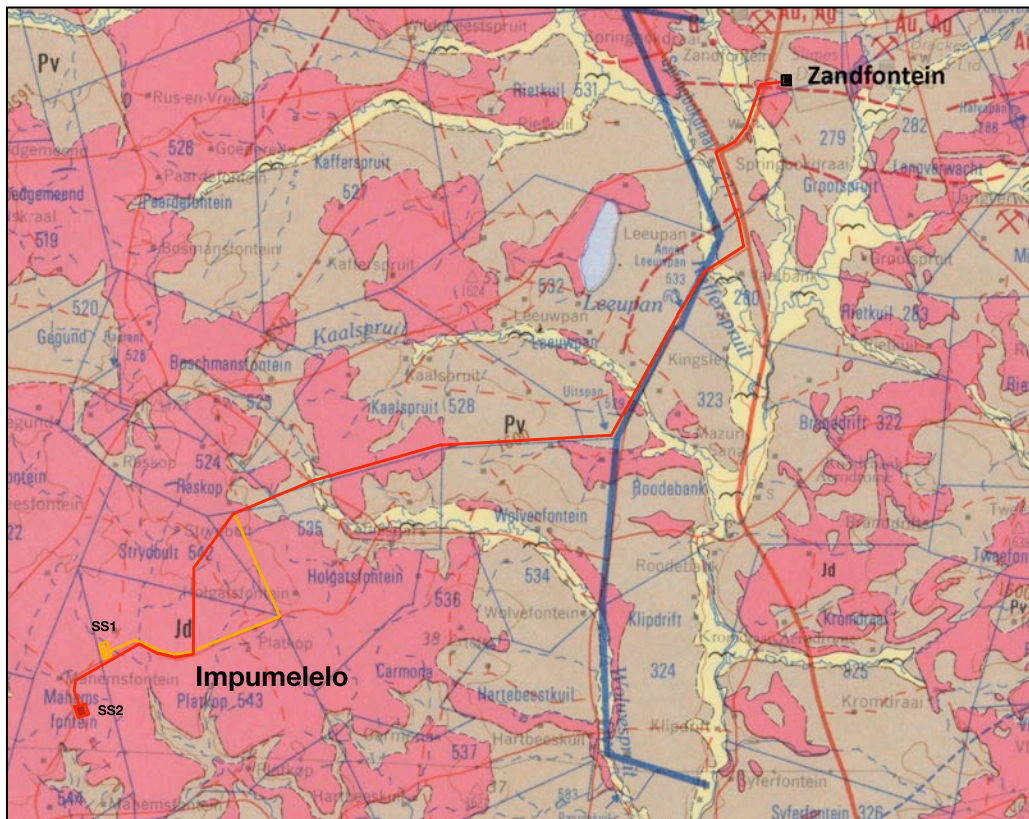


Figure 4. Geology of the Impumelelo site (2628 East Rand Geological Survey 1986). SS1 & SS2 = Substations 1 & 2 at Impumelelo.

Legend:

- Jd = Dolerite
- Pv = Sandstone, shale and coal beds (Vryheid Formation, Ecca Group)
- Yellow = Alluvium

4.5 Land types

Land types denote areas that display a marked degree of uniformity with respect to terrain form, soil pattern and climate. A terrain unit within a land type is any part of the land surface with homogeneous form and slope. The site is covered by the Ea 20b Land Type (2628 East Rand Land Type Series 1979) which occurs on undifferentiated soil and consists of one or more vertic, melanic or red structured diagnostic horizons.

5. VEGETATION

5.1 Introduction

The site falls in the Grassland Biome and more specifically in the Mesic Highveld Grassland Bioregion. The site does not fall within any Centre of Plant Endemism according to Van Wyk and Smith (2001).

5.2 Broad-scale vegetation type

Soweto Highveld Grassland (Gm 8)

The Impumelelo gridline is located within the Soweto Highveld Grassland (Gm8) vegetation type (SANBI 2006-2018). This vegetation type covers 14 513 km² of Mpumalanga and Gauteng (and to a very small extent also in the neighbouring Free State and North-West provinces) and occurs at an altitude ranging from 1420 m to 1760 m above sea level (Mucina & Rutherford 2006).

The landscape is gently to moderately undulating on the Highveld plateau, supporting dense tufted grassland dominated by *Themeda triandra*. Other grass species include *Elionurus muticus*, *Eragrostis racemosa*, *Heteropogon contortus* and *Tristachya leucothrix*. In undisturbed places scattered wetlands, narrow stream alluvia, pans and occasional ridges interrupt the grassland cover. Frost and frequent grass fires during winter play an important role in limiting the occurrence of trees and shrubs in the region.

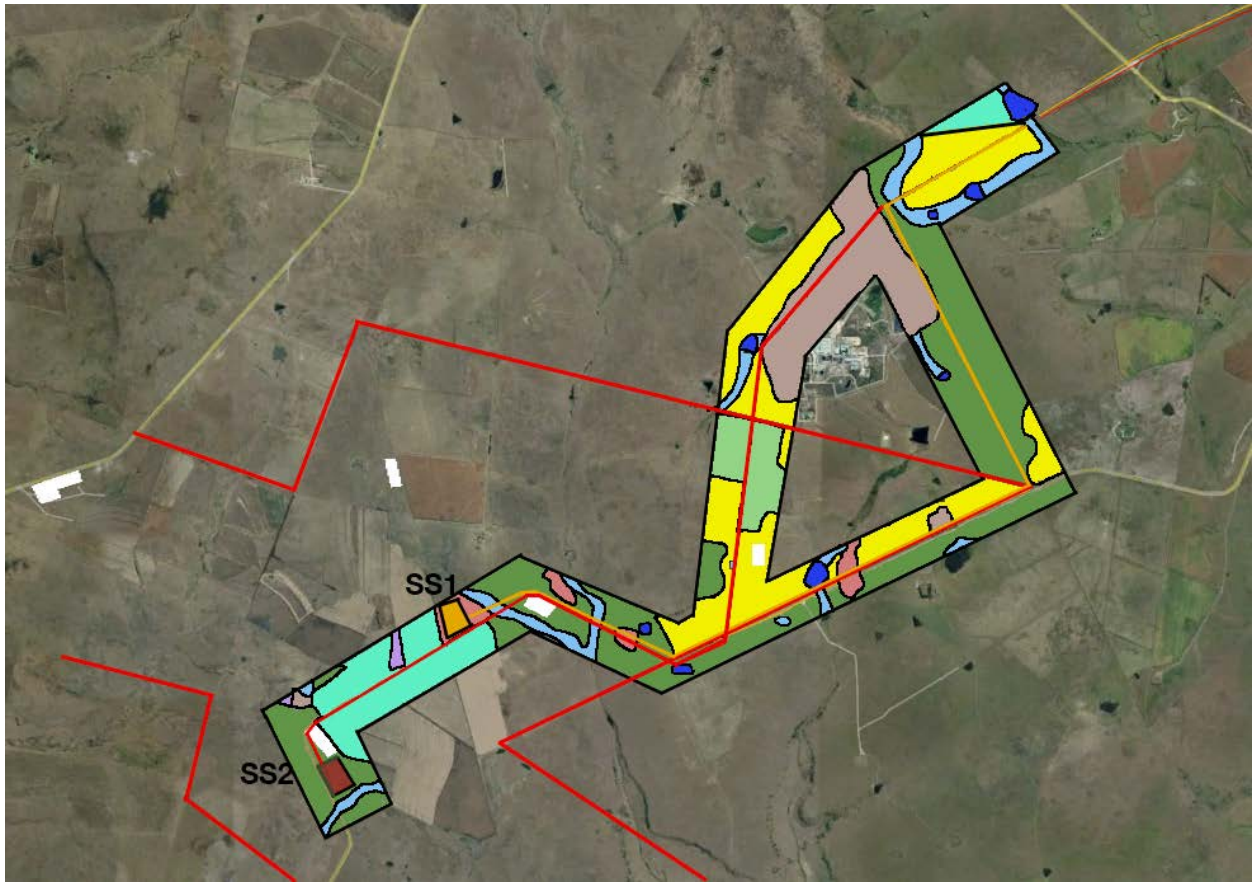
The most prominent grass species include *Andropogon appendiculatus*, *Brachiaria serrata*, *Cymbopogon pospischilii*, *Cynodon dactylon*, *Elionurus muticus*, *Eragrostis capensis*, *Eragrostis chloromelas*, *Eragrostis curvula*, *Eragrostis plana*, *Heteropogon contortus*, *Setaria sphacelata*, *Themeda triandra* and *Tristachya leucothrix*. The forb layer is characterised by *Hermannia depressa*, *Acalypha angustata*, *Berkheya setifera*, *Dicoma anomala*, *Haplocarpha scaposa*, *Helichrysum nudifolium*, *Helichrysum rugulosum*, *Justicia anagalloides*, *Selago densiflora*, *Senecio coronatus*, *Hilliardiella elaeagnoides* and *Wahlenbergia undulata*.

Although the conservation status of this vegetation type was listed as “Endangered” by Mucina & Rutherford (2006) it is listed as “Vulnerable” by NEMA (2011) and the National Biodiversity Assessment (Skowno *et al.* 2018). Very few statutorily conserved areas occur in this vegetation type and almost half of it has been transformed mostly by cultivation, plantations, mining and urbanisation.

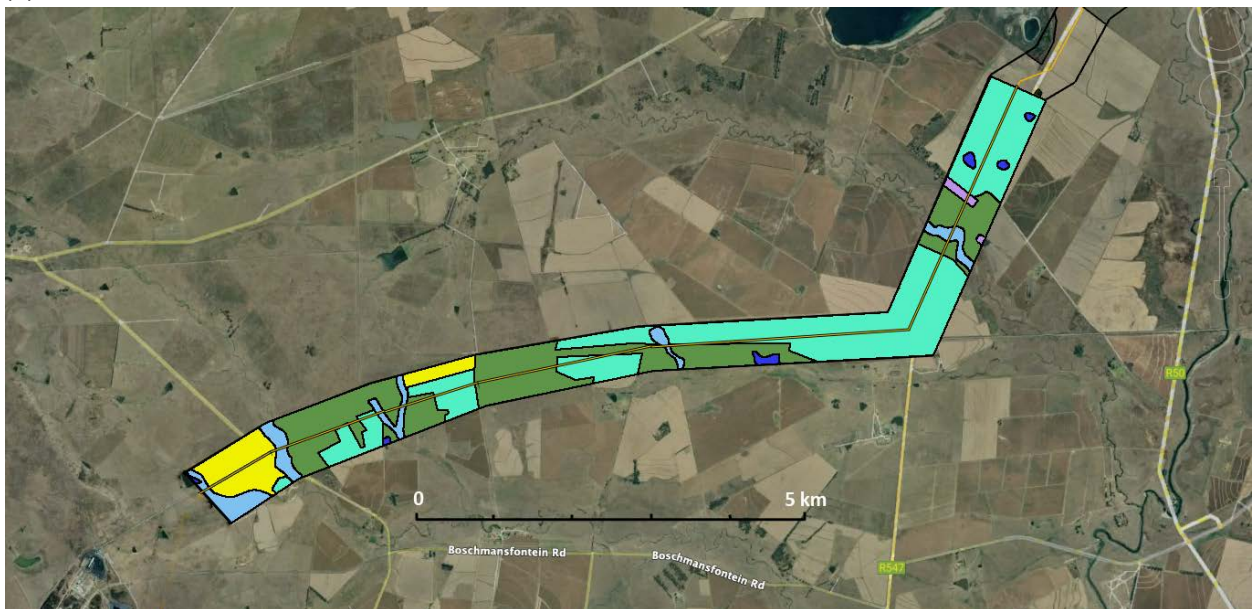
5.3 Description of habitats (plant communities)

During the field survey, 20 sampling sites were surveyed at the proposed Impumelelo WEF. However, a further 60 sample plots were surveyed on the Vhuvhili and Mukondeleli sites in the nearby region and the total of 80 sample plots were used to improve the identification and description of habitat types in the area. Based on species composition, seven habitats (plant communities) were distinguished, described and mapped on the Impumelelo WEF site (Figure 5), however Habitats 2 and 3 were not found along the gridline route. A further four units were also distinguished, i.e. croplands, infrastructure, disturbed areas and dams.

(a)



(b)



(c)

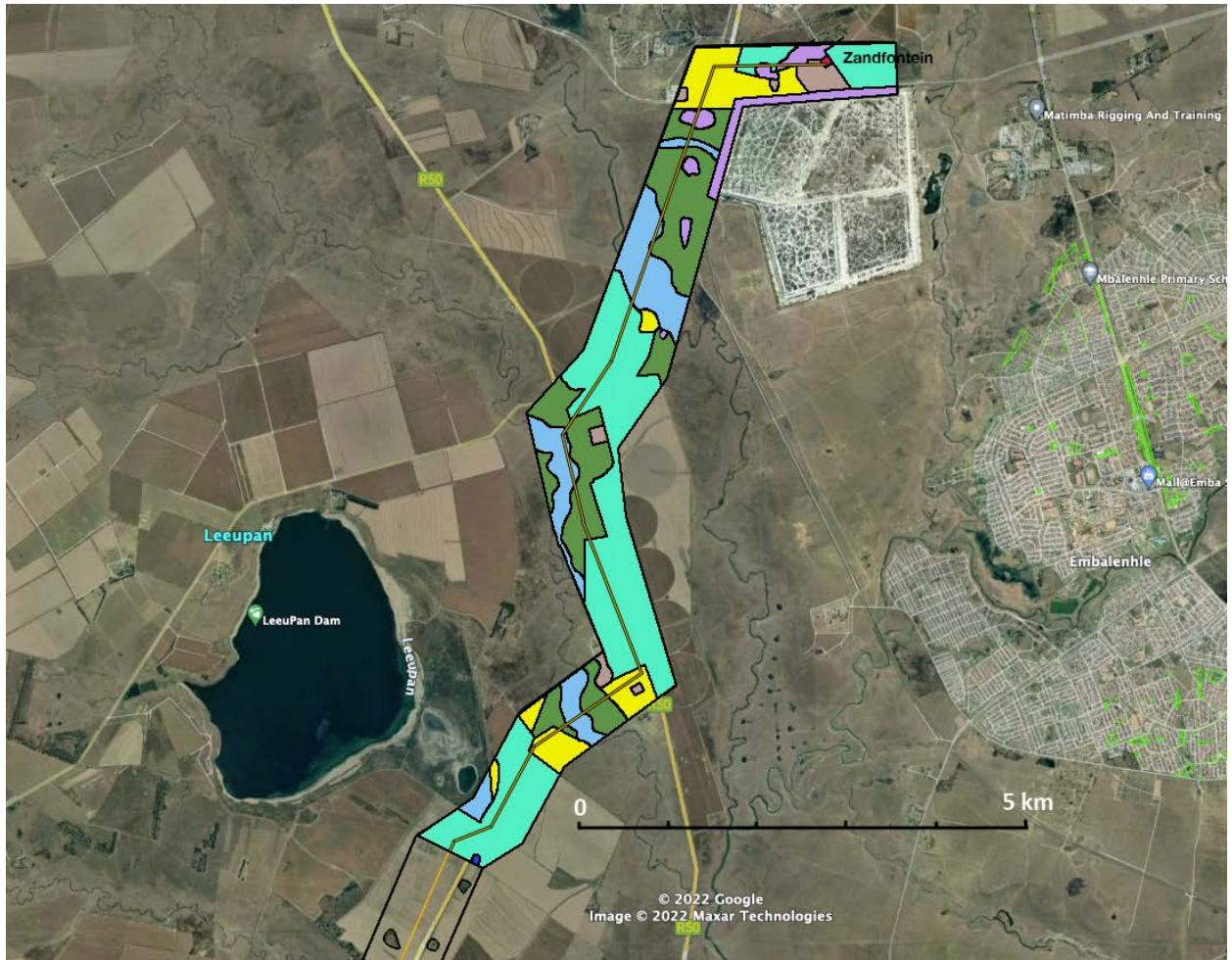













Figure 5 a, b & c. Vegetation map of the Impumelelo site. Figure 5a shows the Impumelelo site with substations 1 & 2 (SS1 & SS2). Figure 5b continues to the north of Figure 5a and Figure 5c represents the northern section ending at the Zandfontein substation.

Legend:

- | | | |
|----|---|---|
| 1 |  | <i>Euryops laxus</i> - <i>Microchloa caffra</i> grassland on shallow soils |
| 2 |  | <i>Elionurus muticus</i> - <i>Aristida diffusa</i> rocky grassland |
| 3 |  | <i>Diospyros lycioides</i> - <i>Tristachya biseriata</i> - <i>Ajuga ophrydis</i> rocky grassland |
| 4 |  | <i>Themeda triandra</i> - <i>Eragrostis chloromelas</i> - <i>Helichrysum pilosellum</i> natural grassland |
| 5 |  | <i>Eragrostis curvula</i> - <i>Hyparrhenia hirta</i> disturbed grassland |
| 6 |  | <i>Digitaria eriantha</i> / <i>Eragrostis curvula</i> planted pasture |
| 7 |  | <i>Trisetopsis imberbis</i> - <i>Crinum bulbispermum</i> wetlands |
| 8 |  | Croplands |
| 9 |  | Infrastructure |
| 10 |  | Disturbed areas |
| 11 |  | Dams |

List of plant communities and other units identified in the region (Habitats 2 & 3 were not distinguished on site):

1. *Euryops laxus* - *Microchloa caffra* grassland on shallow soils
2. *Elionurus muticus* - *Aristida diffusa* rocky grassland
3. *Diospyros lycioides* - *Tristachya biseriata* - *Ajuga ophrydis* rocky grassland
4. *Themeda triandra* - *Eragrostis chloromelas* - *Helichrysum pilosellum* natural grassland
5. *Eragrostis curvula* - *Hyparrhenia hirta* disturbed grassland
6. *Digitaria eriantha*/*Eragrostis curvula* planted pasture
7. *Trisetopsis imberbis* - *Crinum bulbispermum* wetlands
 - 7a. *Trisetopsis imberbis* - *Leersia hexandra* wetlands
 - 7b. *Andropogon appendiculatus* - *Cyperus longus* wetlands
 - 7c. *Typha capensis* - *Phragmites australis* wetlands
8. Cropland
9. Infrastructure
10. Disturbed areas
11. Dams

Habitat 1. *Euryops laxus* - *Microchloa caffra* grassland on shallow soils

This rocky grassland occurs on the plains in the south along the Impumelelo gridline route (Figures 5 & 6). It occurs on shallow soils on rocky sheets. Surface rocks and gravel cover up to 50% of the area. The shallow, dark-brown to black, clayey soils are derived from dolerite.



Figure 6: Community 1: *Euryops laxus* - *Microchloa caffra* grassland on shallow soils.

The diagnostic species of this habitat (community) include *Euryops laxus*, *Microchloa caffra*, *Dipcadi ciliare*, *Panicum repens*, *Jamesbrittenia stricta*, *Colchicum striatum*, *Huernia hystrix* and *Oropetium capense* (species group 1, Appendix A).

- The grass layer is well-developed and covers approximately 78% of the area. The dominant grass species include *Eragrostis plana*, *Eragrostis chloromelas*, *Themeda triandra* and *Eragrostis curvula*. Other grass

species include *Microchloa caffra*, *Panicum repens*, *Tragus berteronianus*, *Oropetium capense*, *Aristida diffusa* and *Setaria incrassata*.

- Herbaceous species have a mean canopy cover of approximately 15%. The most common species include *Euryops laxus*, *Jamesbrittenia stricta*, *Hermannia* cf. *coccocarpa*, *Tulbaghia acutiloba*, *Geigeria burkei*, *Monsonia angustifolia*, *Hibiscus trionum* and the sedges *Cyperus rupestris*, *Cyperus semitrifidus* and *Cyperus capensis*.
- The prominent succulent species include *Euphorbia clavarioides*, *Huernia hystrix* and *Crassula* cf. *setulosa*.
- The most common geophytes include *Crinum bulbispermum*, *Dipcadi ciliare*, *Colchicum striatum*, *Gladiolus robertsoniae* and *Ledebouria* cf. *minima*.
- The following alien invasive plant species was recorded in this community: *Solanum elaeagnifolium*.

Threatened (red listed) and/or protected species recorded in plant community 1:

IUCN list:	<i>Gladiolus robertsoniae</i>
NEM:BA (ToPS):	None
NFA:	None
MNCA:	<i>Gladiolus robertsoniae</i> , <i>Crinum bulbispermum</i> , <i>Huernia hystrix</i>
CITES:	<i>Euphorbia clavarioides</i>
Endemic species:	None

Habitat 2. *Elionurus muticus* - *Aristida diffusa* rocky grassland

Not represented on the Impumelelo gridline site.

Habitat 3. *Diospyros lycioides* - *Tristachya biseriata* - *Ajuga ophrydis* rocky grassland

Not represented on the Impumelelo gridline site.

Habitat 4. *Themeda triandra* - *Eragrostis chloromelas* - *Helichrysum pilosellum* natural grassland

This natural grassland occurs on plains and gentle footslopes and covers large sections of both Impumelelo gridline routes (Figures 5 & 7). Surface rocks and gravel are mostly absent but may cover more than 10% of the area in places. The deep, dark-brown to black, clayey soils are derived from dolerite.



Figure 7: Community 4 – *Themeda triandra* - *Eragrostis chloromelas* - *Helichrysum pilosellum* natural grassland.

There is no diagnostic species group that differentiates this community. However, the presence of species groups 6, 7 & 8 and the absence of species groups 1 – 5 distinguish this community (Appendix A).

- The grass layer is well developed and covers approximately 88% of the area. The dominant grass species include *Themeda triandra*, *Eragrostis chloromelas*, *Setaria incrassata*, *Elionurus muticus* and *Brachiaria serrata*. Other common grass species include *Eragrostis curvula*, *Eragrostis planiculmis*, *Hyparrhenia hirta*, *Setaria nigrirostris*, *Eragrostis plana*, *Lolium perenne* and *Cynodon dactylon*.
- Herbaceous species have a mean canopy cover of approximately 8%. The most common species include *Helichrysum pilosellum*, *Gazania krebsiana*, *Scabiosa columbaria*, *Indigofera hedyantha*, *Berkheya radula*, *Berkheya setifera*, *Helichrysum rugulosum*, *Ipomoea crassipes*, *Asclepias stellifera*, *Jamesbrittenia aurantiaca*, *Oenothera rosea*, *Oenothera tetraptera*, *Senecio inaequidens*, *Conyza podocephala*, *Senecio erubescens*, *Hermannia erodioides*, *Pseudognaphalium luteo-album* and *Convolvulus saggitatus*.
- The succulent species recorded in this habitat included *Aloe ecklonis*, *Aloe transvaalensis* and *Euphorbia clavarioides*.
- The most common geophytes include *Hypoxis rigidula*, *Hypoxis acuminata*, *Hypoxis hemerocallidea*, *Gladiolus dalenii*, *Pelargonium minimum* and *Ledebouria* cf. *revoluta*.
- Sedges include *Bulbostylis humilis*, *Cyperus esculentus*, *Kyllinga erecta* and *Abildgaardia ovata*.
- The following alien invasive plant species were recorded in this community: *Cirsium vulgare*, *Verbena bonariensis*, *Verbena brasiliensis*, *Solanum elaeagnifolium*, *Cuscuta campestris* and *Datura ferox*.

Threatened (red listed) and/or protected species recorded in plant community 4:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
MNCA:	<i>Aloe ecklonis</i> *, <i>Aloe transvaalensis</i> , <i>Gladiolus dalenii</i> , <i>Boophone disticha</i>
Mpumalanga Rare species list:	<i>Hypoxis hemerocallidea</i>
CITES:	<i>Euphorbia clavarioides</i> , <i>Aloe transvaalensis</i> , <i>Aloe ecklonis</i> *
Endemic species:	None

*In community 4 but not recorded on Impumelelo

Habitat 5. *Eragrostis curvula* - *Hyparrhenia hirta* disturbed grassland

This mixture of degraded natural grassland and old abandoned croplands occurs in small patches along the Impumelelo gridline. It is found on the plains of the undulating countryside (Figures 5 & 8). Surface rocks and gravel are absent and the deep, dark-brown, clayey soils are derived from dolerite.

There is no diagnostic species group that differentiates this community. However, the presence of species groups 9, 10 & 11 and the absence of species groups 1 – 8 distinguish this community (Appendix A).

- Dwarf shrubs cover less than 1% of the habitat and include *Seriphium plumosum*.
- The grass layer is well developed and covers approximately 83% of the area. The dominant grass species include *Eragrostis curvula*, *Hyparrhenia hirta*, *Themeda triandra*, *Setaria incrassata*, *Eragrostis plana*, *Eragrostis chloromelas* and *Paspalum dilatatum*. Other common grass species include *Setaria nigrirostris*, *Setaria sphacelata*, *Cynodon dactylon*, *Hyparrhenia tamba*, *Elionurus muticus*, *Brachiaria serrata*, *Aristida bipartita* and *Eragrostis planiculmis*.
- Herbaceous species have a mean canopy cover of approximately 14%. The most common species are *Senecio erubescens*, *Oenothera tetraptera*, *Hermannia erodioides*, *Solanum elaeagnifolium*, *Pseudognaphalium*

luteo-album, *Schkuhria pinnata*, *Ranunculus multifidus*, *Senecio inaequidens*, *Oenothera rosea*, *Asclepias stellifera*, *Asclepias cf. gibba*, *Berkheya setifera*, *Berkheya radula*, *Helichrysum rugulosum*, *Helichrysum aureo-nitens*, *Leobordea divaricata* and *Scabiosa columbaria*.

- The only succulent species recorded in Habitat 5 was *Aloe transvaalensis*.
- Geophytes include *Crinum bulbispermum*, *Gladiolus crassifolius*, *Cyrtanthus stenanthus*, *Hypoxis rigidula*, *Hypoxis argentea*, *Ledebouria cf. revoluta*, *Haemanthus humilis*, *Pelargonium luridum* and *Boophone disticha*.
- Sedges include *Abildgaardia ovata*, *Kyllinga erecta* and *Cyperus esculentus*.
- The following alien invasive plant species were recorded in this community: *Cirsium vulgare*, *Verbena bonariensis*, *Verbena brasiliensis*, *Solanum elaeagnifolium* and *Cuscuta campestris*.



Figure 8: Community 5 – *Eragrostis curvula* - *Hyparrhenia hirta* disturbed grassland.

Threatened (red listed) and/or protected species recorded in plant community 5:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
MNCA:	<i>Aloe transvaalensis</i> , <i>Crinum bulbispermum</i> , <i>Cyrtanthus stenanthus</i> , <i>Gladiolus crassifolius</i>
Mpumalanga Rare species list:	<i>Hypoxis hemerocallidea</i>
CITES:	<i>Euphorbia clavarioides</i> , <i>Aloe transvaalensis</i>
Endemic species:	None

Habitat 6. *Digitaria eriantha*/*Eragrostis curvula* planted pasture

These planted pastures are found in the northern parts the site consisting mostly of *Digitaria eriantha* pasture (Figures 5 & 9). Surface rocks and gravel are absent and the deep, dark-brown, clayey soils are derived from dolerite.



Figure 9: Community 6 – *Digitaria eriantha*/*Eragrostis curvula* planted pasture.

There is no diagnostic species group that differentiates this community. However, the presence of species groups 11 and the absence of species groups 1 – 10 differentiate this community (Appendix A).

- The grass layer is dominated by either *Digitaria eriantha* or *Eragrostis curvula* and covers more than 90% of the community. Other grass species include *Eragrostis chloromelas*, *Hypparrhenia hirta*, *Setaria sphacelata* and *Paspalum dilatatum*.
- Herbaceous species have a mean canopy cover of approximately 3%. The most common species include *Senecio erubescens*, *Pseudognaphalium luteo-album*, *Hibiscus trionum*, *Cosmos bipinnatus* and *Rorippa nasturtium-aquaticum*.
- The following alien invasive plant species were recorded in this community: *Solanum elaeagnifolium* and *Cuscuta campestris*.

Threatened (red listed) and/or protected species recorded in plant community 6:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
MNCA:	None
CITES:	None
Endemic species:	None

Habitat 7. *Trisetopsis imberbis* - *Crinum bulbispermum* wetlands

These streams, wetlands, vleis and floodplains are associated mostly with the Wolwespruit, Kaalspruit and Watervalrivier and their tributaries and cross the Impumelelo gridline routes at various places (Figures 5 & 10). Surface rocks are present in some places along the streams. The alluvial soils are mostly deep, dark-brown to black, clayey soils.



Figure 10: Community 7 – *Trisetopsis imberbis* - *Crinum bulbispermum* wetlands.

The diagnostic species of this habitat (community) include *Ischaemum fasciculatum*, *Andropogon appendiculatus*, *Fingerhuthia sesleriiformis* and *Galium capense* (species group 12, Appendix A).

- The grass layer is well developed and covers approximately 90% of the area. The dominant grass species include *Trisetopsis imberbis*, *Leersia hexandra*, *Paspalum dilatatum*, *Setaria nigrirostris*, *Ischaemum fasciculatum* and *Andropogon appendiculatus*. Other grass species include *Eragrostis plana*, *Fingerhuthia sesleriiformis*, *Bromus catharticus*, *Themeda triandra*, *Eragrostis curvula*, *Harpechloa falx* and *Pennisetum clandestinum*.
- Herbaceous species have a mean canopy cover of approximately 10%. The most common species are *Galium capense*, *Plantago lanceolata*, *Oenothera rosea*, *Oenothera tetraptera*, *Berkheya radula*, *Haplocarpha scaposa*, *Ranunculus multifidus*, *Gomphocarpus fruticosus*, *Cosmos bipinnatus* and *Lepidium africanum*.
- The most common geophytes include *Crinum bulbispermum*, *Haemanthus humilis*, *Ledebouria* cf. *revoluta* and *Hypoxis argentea*.
- Sedges include, amongst others, *Cyperus longus*, *Cyperus esculentus* and *Schoenoplectus* cf. *muricinux*.
- The following alien invasive plant species were recorded in this community: *Cirsium vulgare*, *Verbena bonariensis*, *Verbena brasiliensis*, *Solanum elaeagnifolium* and *Datura ferox*.

Threatened (red listed) and/or protected species recorded in plant community 7:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
MNCA:	<i>Crinum bulbispermum</i> , <i>Haemanthus humilis</i>
CITES:	None
Endemic species:	None

Mapping unit 8. Cropland

These croplands are currently utilised mainly for maize production and cover large sections of the gridline route.

Mapping unit 9. Infrastructure

This unit includes farm houses and associated infrastructure.

Mapping unit 10. Disturbed areas

These sites include woodlots (*Eucalyptus* and *Populus* spp.), tailings dams, areas that are used for diggings and areas disturbed by farming activities.

Mapping unit 11. Dams

6. ALIEN INVASIVE PLANT SPECIES

6.1 Introduction

An “invasive species” is any species whose establishment and spread outside of its natural distribution range (i) threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats or other species; and (ii) may result in economic or environmental harm or harm to human health. Invasive alien plant species are globally considered as one of the greatest threats to biodiversity and ecosystems integrity.

The Alien and Invasive Species (AIS) Regulations and the Alien and Invasive Species (AIS) list were published in 2020 (NEM:BA 2020a & b).

Forty-seven alien plant species were recorded on the three Enertrag sites of which 12 are currently declared alien invasive species and 35 naturalised alien species (Appendix B). Another four naturalised alien species were listed by NewPosa for the region.

The following categories of declared weeds and invader plants are recognised in South Africa:

Category 1a Listed Invasive Species refers to species that must be combatted or eradicated. Landowners are obliged to take immediate steps to combat or eradicate Category 1a species.

Category 1b Listed Invasive Species refer to species that must be controlled. If an Invasive Species Management Programme has been developed, landowners are obliged to control the species in accordance with such programme. The following species were recorded in the area:

<i>Arundo donax</i>	<i>Solanum elaeagnifolium</i>
<i>Cereus jamacaru</i>	<i>Tamarix cf. ramosissima</i>
<i>Cirsium vulgare</i>	<i>Verbena bonariensis</i>
<i>Cuscuta campestris</i>	<i>Verbena brasiliensis</i>
<i>Datura ferox</i>	<i>Xanthium spinosum</i>
<i>Opuntia ficus-indica</i>	

Category 2 Listed Invasive Species refer to species that require a permit to carry out a restricted activity e.g. cultivation, within an area specified in the Notice or an area specified in the permit, as the case may be. Category 2 includes plant species that have economic, recreational, aesthetic or other valued properties, notwithstanding their invasiveness. It is important to note that a Category 2 species that falls outside the demarcated area specified in the permit, becomes a Category 1b invasive species. Permit-holders must take all the necessary steps to prevent the escape and spread of the species outside of the land or the area specified in the Notice or permit.

*Acacia mearnsii**
*Eucalyptus camaldulensis**
Populus x canescens

*These species are exempted for existing plantations.

Category 3 Listed Invasive Species refer to species that are subject to exemptions and prohibitions as specified in the Notice. Category 3 species are less-transforming invasive species that are regulated by activity. The principal focus with these species is to ensure that they are not introduced, sold or transported. However, a Category 3 plant species becomes a Category 1b species within riparian areas.

6.2 Prevention and control of alien invasive plant species

There are a number of strategies that can be employed to prevent the introduction of new invasive plant species:

- Limiting their introductions by humans;
- Creating a buffer zone of alien-free vegetation around the site;
- Integrated catchment management with the surrounding neighbours because areas around and upstream of the site provide an unlimited source of seed which invade downstream areas; and
- Maintaining a healthy grass cover by sound veld management and judicious burning of the grass sward.

Alien invaders should be controlled by mechanical and/or chemical means. Mechanical means include ringbarking (girdling), uprooting, chopping, slashing and felling. An axe, chain saw or brush cutter can be used. Stumps or ringbarked stems should be treated immediately with a chemical weed killer. Follow-up treatment is usually needed.

7. FLORA: CHECKLISTS AND RED-LISTED AND/OR PROTECTED SPECIES

A list of plant species (the term species is used here in a general sense to denote species, subspecies and varieties) that could be found in the region (quarter degree grids: 2628 DB; 2629 CA; 2629 CB) was downloaded from the South African Biodiversity Institute's website (SANBI: newposa.sanbi.org – accessed November 2021) (Appendix B). The NewPosa data search yielded 147 plant species. During the field surveys, 290 plant species were recorded on the Enertrag sites (Appendix A) and additionally eight species were listed for the region (data supplied by M. Lötter, MTPA). Combined, these sources yielded 396 species for the region of which 30 are protected species according to the MNCA (1998).

The South African Threatened Species Programme website (redlist.sanbi.org) of SANBI; the National Forests Act (Act No. 84 of 1998) (NFA 2021); the National Environmental Management: Biodiversity Act (NEMBA 2007c) (ToPS list); CITES (2021) appendices and the lists of red-listed or protected plant species of MNCA (1998) were consulted to classify the species in the study area into the relevant IUCN or protected categories (Appendix B).

7.1 Species listed by the Screening Tool

None of the four plant species listed by the Screening Tool were encountered on site. The following species were highlighted by the Screening Tool:

Sensitivity	Feature(s)
Medium	Sensitive species 1252
Medium	Sensitive species 691
Medium	<i>Khadia beswickii</i>
Medium	<i>Pachycarpus suaveolens</i>

7.2 IUCN Red-listed species

For the IUCN Categories, the following definitions were applied (see Figure 11). **The colours in Figure 10 were applied to the checklist of plants and animals in this section as well as in Appendices B and C.**

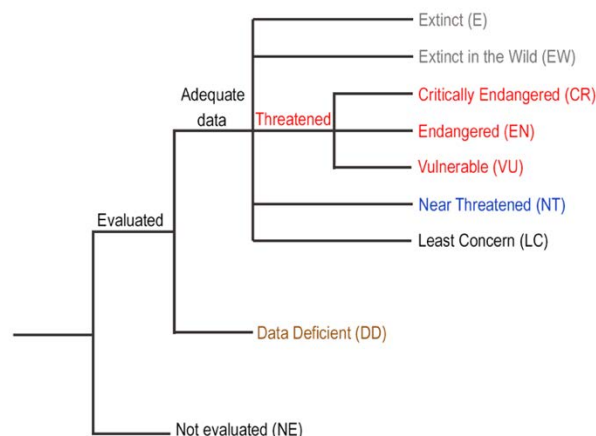


Figure 11: Schematic representation of the relationship between the various IUCN Red List Categories.

Extinct Categories:

- **Extinct (E):** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW):** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalised population (or populations) well outside the past range.

Threatened Categories:

- **Critically Endangered (CR):** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN):** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that it is facing a very high risk of extinction.
- **Vulnerable (VU):** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that it is facing a high risk of extinction.

Not Threatened Categories but regarded as SCC by SANBI:

- **Near Threatened (NT):** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.
- **Data Deficient (DD):** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. In this case the species would be classified as DDD. If however, taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible, the species is classified as DDT. The latter category cannot be considered as SCC.
- **Additional categories recognised by SANBI:** Although not threatened categories, SANBI have added the species classified as Critically Rare, Rare and Declining to their SCC.

Not Threatened Categories and not considered as SCC by SANBI

- **Least Concern (LC):** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
- **Not Evaluated (NE):** A taxon is Not Evaluated when it is has not yet been evaluated against the five IUCN criteria. This category often applies to alien species.

Khadia beswickii and *Nerine gracilis* are the only IUCN threatened species occurring in the region according to Appendix B. Neither of the two species were encountered on site. Near Threatened (NT), Data Deficient (DDD) and Data Deficient (Taxonomically) (DDT) species are not classified as threatened according to the IUCN classification.

7.3 SANBI: Species of Conservation Concern

According to the South African National Biodiversity Institute (SANBI 2020), SCCs include all species that have been assessed according the IUCN Threatened or Red-List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD), as well as range-restricted species which are not declining and are nationally listed as Rare or Critically Rare. The DD category is split into those that are taxonomically unresolved (DDT) and those where insufficient data (DDD) are available to make a judgement on endangered status. The Taxonomically Data Deficient (DDT) species were excluded as SCC since taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of extinction risk is not possible.

The SCC species listed for the region are:

<i>Argyrobium campicola</i>	NT
<i>Gladiolus robertsoniae</i>	NT
<i>Habenaria barbertoni</i>	NT
<i>Khadia beswickii</i>	VU (data supplied by M. Lötter, MTPA)
<i>Kniphofia typhoides</i>	NT (data supplied by M. Lötter, MTPA)
<i>Nerine gracilis</i>	VU (data supplied by M. Lötter, MTPA)

Stenostelma umbelluliferum NT

The geophyte *Gladiolus robertsoniae* was noted on the Impumelelo WEF site in Habitat 1.

7.4 Protected species

7.4.1 Mpumalanga Nature Conservation Act (No. 10 of 1998) (MNCA 1998)

A total of thirty (30) plant species are listed as Schedule 11 Protected plant species in the region according to the MNCA (1998) (Appendix B). Most of these species are members of the Amaryllidaceae and Orchidaceae. Twelve Protected plant species (Schedule 11) were recorded during the survey of the three Enertrag sites in December 2021.

The 12 species recorded on all three Enertrag sites:

<i>Aloe ecklonis</i>	<i>Gladiolus crassifolius</i>
<i>Aloe transvaalensis</i>	<i>Gladiolus dalenii</i>
<i>Boophone disticha</i>	<i>Gladiolus robertsoniae</i>
<i>Crinum bulbispermum</i>	<i>Haemanthus humilis</i>
<i>Cyrtanthus stenanthus</i>	<i>Haemanthus sp.</i>
<i>Eucomis autumnalis</i>	<i>Huernia hystrix</i>

Another five species are on the Mpumalanga Red list (Lötter 2015) although not included in the MNCA (1998) list for Mpumalanga:

<i>Drimia angustifolia</i>	LC
<i>Hypoxis hemerocallidea</i>	LC*
<i>Khadia beswickii</i>	VU (data supplied by M. Lötter, MTPA)
<i>Nerine gracilis</i>	VU (data supplied by M. Lötter, MTPA)
<i>Trachyandra erythrorrhiza</i>	NT

*species recorded on the Impumelelo site

Some provisions are given in terms of Schedule 11 Protected plants and Schedule 12 Specially Protected plants (Chapter 6, MNCA 1998):

- No person shall pick a Protected plant without a permit.
- No person shall pick an indigenous plant in a nature reserve without a permit.
- No person shall pick an indigenous plant on a public road, land next to a public road within a distance of 100 meters from the centre of the road without a permit.
- No person shall pick an indigenous plant which is not a Protected plant or Specially Protected plant on land which he or she is not the owner or occupier.
- No person shall donate, sell or export or remove from the province a Protected plant without a permit.
- No person shall possess, pick, sell, purchase, donate or receive as a donation, import or export or remove from the Province a Specially Protected plant without a permit.

7.5 ToPS list (NEM:BA 2007c)

No species classified as protected within the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA 2007c) is listed for the study area and none were found at the Impumelelo site.

7.6 CITES appendices

Appendix II of CITES lists species that are not necessarily now threatened with extinction, but that may become so unless trade is closely controlled. Thirteen (13) Appendix II species are listed for the region including mostly (10) species of the Orchidaceae. *Aloe transvaalensis* and *Euphorbia clavarioides* were recorded on the Impumelelo site.

7.7 Protected Tree Species - National Forests Act (Act No. 84 of 1998)

No nationally protected tree species is listed for the site (NFA 2021) and none were recorded during the site visit.

7.8 Endemic species

No endemic species are listed for either the Soweto Highveld Grassland or the Tsakane Clay Grassland Vegetation Types (Mucina & Rutherford 2006).

8. FAUNA: CHECKLISTS AND RED-LISTED AND/OR PROTECTED SPECIES

Species lists (the term species is used here in a general sense to denote species, subspecies and varieties) of the faunal component were sourced for the study area from the Animal Demography Unit, University of Cape Town website (<http://vmus.adu.org.za>), and species listed for the farms in close proximity to the site (data supplied by M. Lötter, MTPA) and supplemented by relevant literature to determine the conservation status. The faunal species listed by the Screening Tool are given below (Section 8.1).

8.1 Mammals

The site falls within the distribution range of 52 mammal species (<http://vmus.adu.org.za>) (Appendix C).

8.1.1 Screening Tool

The screening tool rated the sensitivity of the Animal Species Theme as High. The following species were highlighted by the Screening Tool:

Sensitivity	Feature(s)
High	Aves- <i>Circus ranivorus</i>
High	Aves- <i>Hydroprogne caspia</i>
High	Aves- <i>Eupodotis senegalensis</i>
High	Aves- <i>Sagittarius serpentarius</i>
Medium	Aves- <i>Sagittarius serpentarius</i>
Medium	Aves- <i>Eupodotis senegalensis</i>
Medium	Aves- <i>Tyto capensis</i>
Medium	Aves- <i>Circus ranivorus</i>
Medium	Aves- <i>Hydroprogne caspia</i>
Medium	Insecta- <i>Lepidochrysops procera</i>
Medium	Mammalia- <i>Crocidura maquassiensis</i>
Medium	Mammalia- <i>Hydricotis maculicollis</i>
Medium	Mammalia- <i>Ourebia ourebi ourebi</i>

The avifaunal and bat component will be addressed by the avifaunal and bat specialists and are therefore excluded from the following discussion. The species that were highlighted by the Screening tool, included the mammals *Crocidura maquassiensis*, *Hydricotis maculicollis*, *Ourebia ourebi ourebi* and the Invertebrate *Lepidochrysops procera*. None of these species were listed in the MTPA database for the farms participating in the proposed Impumelelo WEF development and none were encountered during the site visit. The spotted-necked otter (*Hydricotis maculicollis*) is not listed on the ADU database for the region while the Maquassie musk shrew (*Crocidura maquassiensis*) and *Lepidochrysops procera* are not listed on the ADU database for the region or the MNCA (1998) lists for the Mpumalanga province. The Impumelelo site falls marginally within the distribution range of *Ourebia ourebi ourebi*. None of the animal species listed by the Screening Tool were recorded on site during the survey.

The Maquassie Musk Shrew *Crocidura maquassiensis*: is classified as Vulnerable (Taylor *et al.* 2016). It depends on wetlands as suitable habitat in savanna and grasslands. Although it has a wide inferred extent of occurrence, it appears to be patchily distributed. *Crocidura maquassiensis* has not been reported from Gauteng, North West Province or Mpumalanga post-1999 and thus there is a very low probability for it to occur on site.

Marginally suitable habitat for the spotted-necked otter (Vulnerable IUCN status) is available on site. It occurs widespread, but it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base.

According to the distribution map of *Ourebia ourebi ourebi* provided in Child *et al.* (2016) the Impumelelo site falls within a gap in its distribution although it does occur in the broader region.

Although *Lepidochrysops procera* has a IUCN status of Least Concern, it is a habitat specialist and is rated as Rare. It is not regarded as sensitive in the National Sensitive Species List of SANBI and is not exploited, collected, traded or utilised in a targeted manner (<http://nssl.sanbi.org.za/species/lepidochrysops-procera> accessed October 2021). Its habitat is rocky areas in grassland (and grassy areas in savanna), where its larval host plant, *Ocimum obovatum*, occurs. *Lepidochrysops procera* is unlikely to occur on site because its host plant was only recorded once on site.

8.1.2 IUCN threatened mammal species

Three IUCN threatened mammal species were listed for the environs of the Impumelelo gridline on the website of the Animal Demography Unit, University of Cape Town:

<i>Ourebia ourebi</i>	Oribi	EN
<i>Panthera pardus</i>	Leopard	VU
<i>Felis nigripes</i>	Black-footed cat	VU

Seven mammal species were listed for the environs of the Impumelelo gridline as Near Threatened (a category that is not a threatened category in the IUCN classification, but qualifies as SCC):

<i>Amblysomus septentrionalis</i>	Highveld Golden mole	NT
<i>Atelerix frontalis</i>	Southern African hedgehog*	NT
<i>Leptailurus serval</i>	Serval*	NT
<i>Otomys auratus</i>	Southern African vlei rat*	NT
<i>Aonyx capensis</i>	African Clawless otter	NT
<i>Poecilogale albinucha</i>	African Striped weasel	NT
<i>Crocidura mariquensis</i>	Swamp musk shrew	NT

*Mammals that were either sighted or confirmed by the landowners (Appendix C)

8.1.3 Mpumalanga: provincially protected mammal species (MNCA 1998)

Six of the 52 mammal species listed in Appendix C are Schedule 2: Protected Game in Mpumalanga. The following protected mammal species were recorded on the Impumelelo site and could potentially be present along the gridline:

<i>Raphicerus campestris</i>	Steenbok
<i>Atelerix frontalis</i>	Southern African hedgehog

8.1.4 Nationally Threatened or Protected Species: ToPS (NEMBA 2007c)

According to ToPS legislation (NEMBA 2007c), one mammal species is listed as Endangered, one mammal species is listed as Vulnerable and six species are Protected (Appendix C). *Atelerix frontalis* and *Leptailurus serval* were noted by the land owners on the Impumelanga WEF site.

Endangered: Indigenous species facing a high risk of extinction in the wild in the medium-term future, although they are not critically endangered:

Ourebia ourebi Oribi (En) (see note above)

Vulnerable: Indigenous species facing a high risk of extinction in the wild in the medium-term future, although they are not critically endangered or endangered:

Panthera pardus Leopard (Vu)

Protected species: Indigenous species of high conservation value or national importance that require national protection:

Aonyx capensis African clawless otter
Atelerix frontalis Southern African hedgehog*
Felis nigripes Black-footed cat
Leptailurus serval Serval*
Vulpes chama Cape fox

*Mammals that were either sighted or confirmed by the landowners.

8.1.5 CITES

The following mammal species occurring in the region are CITES listed with the serval *Leptailurus serval* recorded on the Impumelelo site:

<i>Aonyx capensis</i>	African Clawless Otter	Appendix II
<i>Caracal caracal</i>	Caracal	Appendix II
<i>Leptailurus serval</i>	Serval*	Appendix II
<i>Panthera pardus</i>	Leopard	Appendix I

*Mammals that were either sighted or confirmed by the landowners.

8.2 Reptiles

Thirty-two (32) reptile species are listed for the larger region (Appendix C). The list includes one IUCN threatened (Vulnerable) species, i.e. the giant girdled lizard (*Smaug giganteus*) and one Near-threatened species, i.e. *Chamaesaura aenea* (coppery grass lizard).

Provincially protected reptile species include 15 Schedule 2 Protected reptiles and 17 Schedule 5 reptiles. The giant girdled lizard (*Smaug giganteus*) is listed as Endangered according to the ToPS list (NEMBA 2007c). Only the rinkhals *Hemachatus haemachatus* has been recorded on the Impumelelo site.

Two CITES listed species were recorded for the region surveyed:

Giant girdled lizard (ouvolk)	<i>Smaug giganteus</i>
Common girdled lizard	<i>Cordylus vittifer</i>

8.3 Frogs

Fourteen species were listed for the region and all have an IUCN status of Least Concern. None of the frog species listed for the region has a MNCA or ToPS protected status (MNCA 1998, NEMBA 2007c).

8.4 Lepidoptera

Only one of the 62 species of the Lepidoptera listed for the region is IUCN listed as Endangered, i.e. *Chrysoritis aureus* (Golden opal).

The Screening Tool listed *Lepidochrysops procera* as a sensitive species for the site. However, it was not listed in the ADU website (<http://vmus.adu.org.za>), the MNCA (1998) provincial species lists or the NEMBA (2007c) ToPS lists. It has a IUCN status of Least Concern, but is a habitat specialist and rated as Rare. It is not regarded as sensitive in the National Sensitive Species List of SANBI and is not exploited, collected, traded or utilised in a targeted manner (<http://nssl.sanbi.org.za/species/lepidochrysops-procera> accessed October 2021).

8.5 Scorpions

One scorpion species *Uroplectes triangulifer* is listed for the 2629C and 2628D locus.

8.6 Spiders

All baboon spiders are provincially Schedule 7 protected (Appendix C). The listed baboon spider *Harpactira hamiltoni* is a ToPS protected species (NEMBA 2007c).

Note: Bird and bat checklists will be provided and discussed in the avifaunal and bat specialist assessments.

9. CONSERVATION

9.1 National Environmental Management: Protected Areas Act (Act No. 10 of 2003)

The study site is not located in a protected area.

9.2 National Protected Areas Expansion Strategy (NPAES)

The study site does not form part of the NPAES (NPAES 2010) and it is also not earmarked in the 5-year plan of the Mpumalanga PAES for the expansion of protected areas (data supplied by M. Lötter, MTPA).

9.3 National list of ecosystems that are threatened and in need of protection

The site is located in the Soweto Highveld Grassland vegetation type (Mucina & Rutherford 2006, SANBI 2006-2018), which is classified as 'Vulnerable' (NEMA 2011, Skowno *et al.* 2018).

9.4 Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs)

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species or ecological processes. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species. The definitions for CBAs are (SANBI 2018):

- CBA 1: Areas that are irreplaceable for meeting biodiversity targets. There are no other options for conserving the ecosystems, species or ecological processes in these areas (SANBI 2018).
- CBA 2: Areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses.

It is assumed that the terms 'CBA irreplaceable' in the MBSP is equivalent of a CBA1 and a 'CBA optimal' refers to a CBA2. The main reasons provided for the mapping of the CBAs were (data provided by M. Lötter, MTPA):

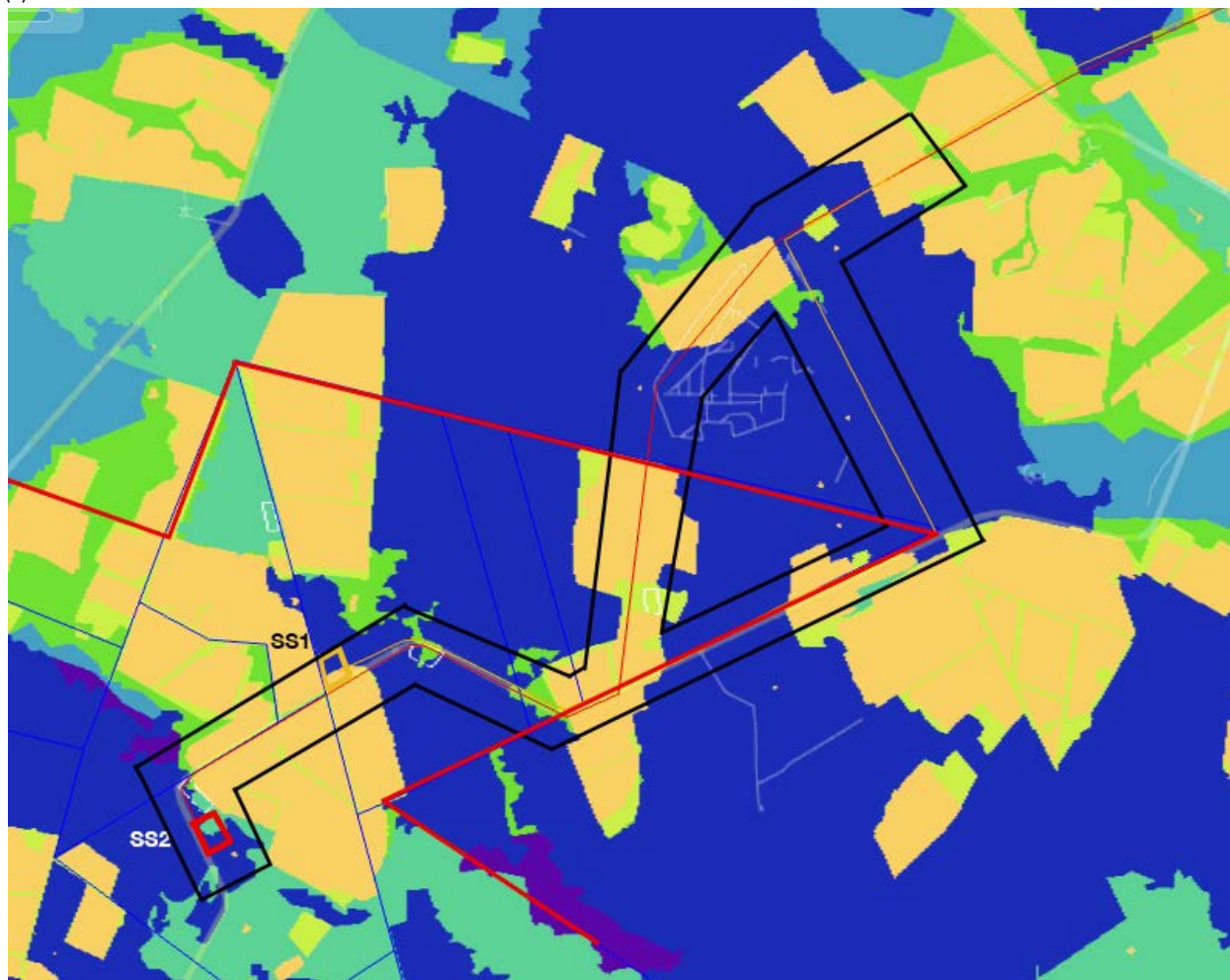
- Soweto Highveld Grassland
- Mesic Highveld Grassland (wetlands) – Group 1
- Intact grassland patches
- *Gladiolus robertsoniae*
- *Kniphofia typhoides*
- African bullfrog *Pyxicephalus adspersus*
- African Grass Owl *Tyto capensis*
- Blue korhaan *Eupodotis caerulescens*
- Barrows korhaan *Eupodotis senegalensis*
- Secretarybird *Sagittarius serpentarius*
- Climate change land facets
- Critical linkages
- Core and supporting corridors

It should be noted that these reasons are applicable to the entire Mpumalanga planning units wherein the Impumelelo site is located and not necessarily applicable to the site.

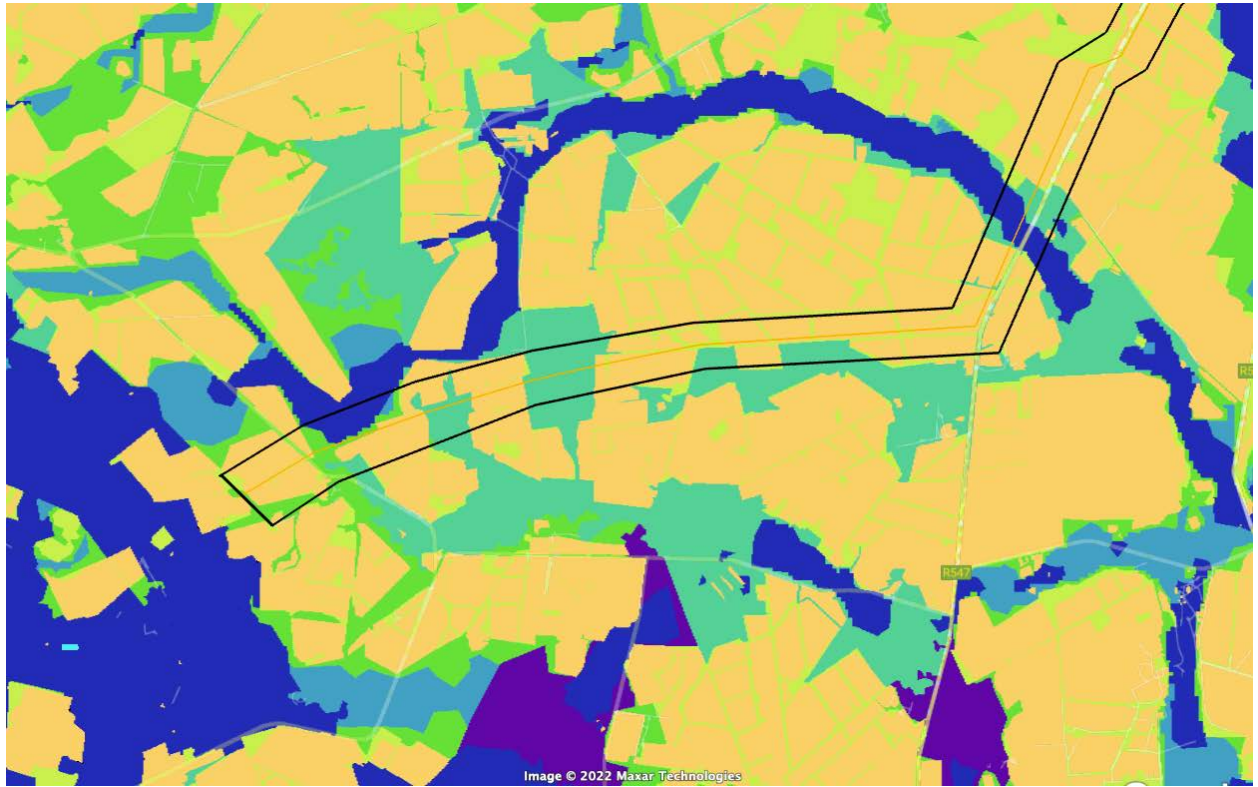
The CBA map (Figure 12) indicates CBAs across a large section of the Impumelelo site and along the southern section of the gridline route to Zandfontein. The two proposed on-site substations fall in CBAs. However, most of the habitats on the Impumelelo WEF site and along the gridline route were rated as having a low sensitivity in the current study (see Chapter 10). Gridline option 2 is slightly longer than option 1, with most of the area between SS1 and SS2 being heavily modified. For most of the route, the options follow the same route. However, where the two routes diverge, option 2 crosses smaller sections of CBA.

Development within Critical Biodiversity Areas is not encouraged. According to the Western Cape Biodiversity Spatial Plan Handbook (Pool-Stanvliet *et al.* 2017) permissible land uses in CBAs are those that are compatible with maintaining the natural vegetation cover of CBAs in a healthy ecological state, and that do not result in loss or degradation of natural habitat. Undesirable land uses in terrestrial CBAs are those that cause loss of natural habitat or ecosystem functionality, such as: (i) mining or prospecting; (ii) intensive agriculture (cultivation) or plantation forestry; (iii) residential, commercial or industrial developments; (iv) game-proof fences in CBA corridors; (v) linear infrastructure that disrupts the connectivity of CBA corridors; and (vi) extensive or intensive grazing that results in species diversity being lost through selective or over-grazing (Pool-Stanvliet *et al.* 2017).

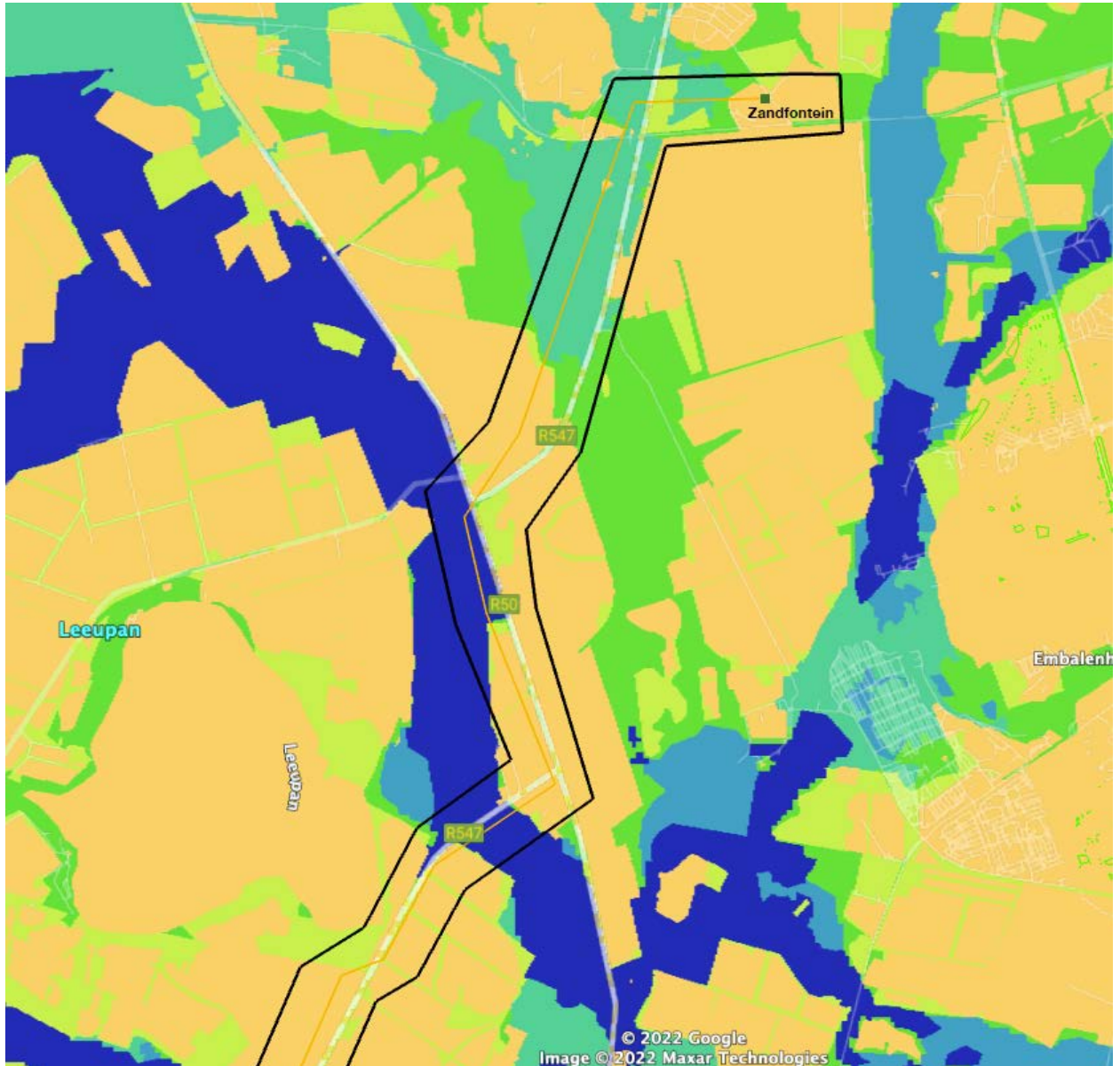
(a)



(b)



(c)



Legend

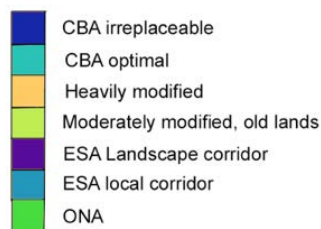


Figure 12a, b & c: Critical Biodiversity Areas (CBAs), Ecological Support Areas (corridors), Other Natural Areas (ONAs), and moderately and heavily modified areas on the Impumelelo site (MBSP 2014; biodiversityadvisor.sanbi.org). SS1 & 2 = Substation 1 (orange square) & Substation 2 (red square).

An Ecological Support Area (ESA) is not essential for meeting biodiversity targets, but plays an important role in supporting the ecological functioning in a CBA. ESAs need to be maintained in at least a functional and often natural state, but some limited habitat loss may be acceptable. It is important that the project should not compromise the

functional (natural) state of the ESAs (Pool-Stanvliet *et al.* 2017). There are some ESA Local corridors demarcated within the Impumelelo gridline route (Figure 12; MBSP 2014; biodiversityadvisor.sanbi.org) and the gridline traverses some of these ESA local corridors. However, limited habitat loss may be acceptable in an ESA and the gridline would not impact negatively on the ESAs.

Other Natural Areas (ONAs) have not been identified as a priority, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Land use guidelines for Terrestrial Other Natural Areas (ONAs) are not required to meet biodiversity targets. Some ONAs were demarcated within the Impumelelo site (Figure 12; MBSP 2014; biodiversityadvisor.sanbi.org) but gridlines are permissible in ONAs.

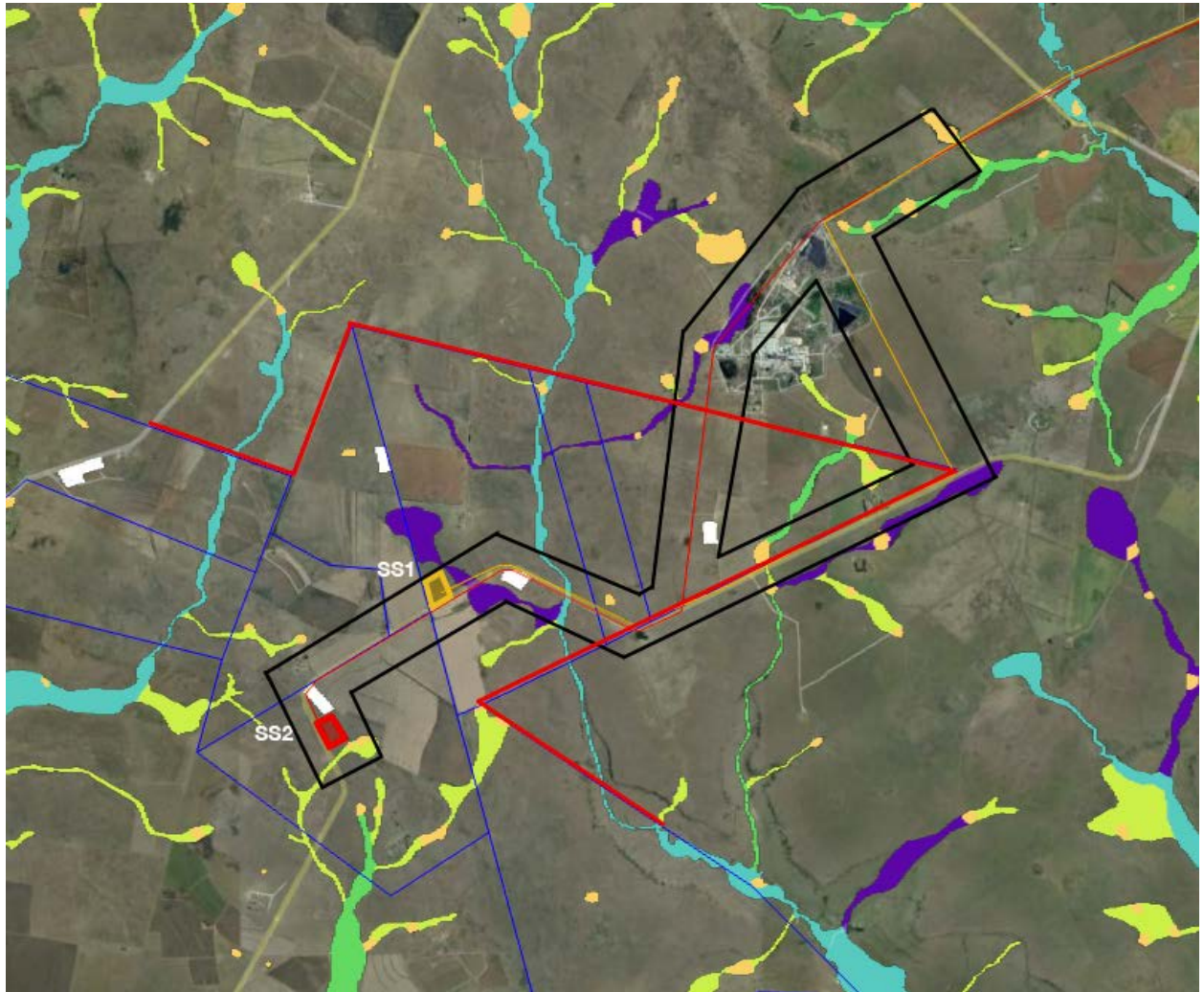
Large portions of the site are demarcated as either 'Heavily modified' or 'Moderately modified – old lands', especially in the east (Figure 12). These MBSP categories, do not have equivalent categories in the SANBI CBA classification system and must be assumed to degraded to such an extent that they cannot qualify as ESAs or ONAs. Wherever possible, the gridlines should be placed in these units.

9.5 Freshwater Ecosystem Priority Areas (FEPAs)

Freshwater Ecosystem Priority Area (FEPA) are priority areas for conserving freshwater ecosystems and supporting sustainable use of water resources and upstream management areas (Driver *et al.* 2012). The entire Impumelelo region is contained in an Upstream Management Area as river FEPA (biodiversityadvisor.sanbi.org). Upstream Management Areas are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas. However, the area mapped as river FEPA did not emerge as being highly sensitive in the current assessment and the sensitivity model that was applied, classified only the drainage lines in the FEPA as being of high sensitivity with most of the area classified as low sensitivity and a few spots of medium sensitivity.

Channelled valley-bottom wetlands, floodplain wetlands, seeps and dams are indicated in Figure 13 (MPHG 2014). Both gridline options cross several wetlands.

(a)



(b)



(c)

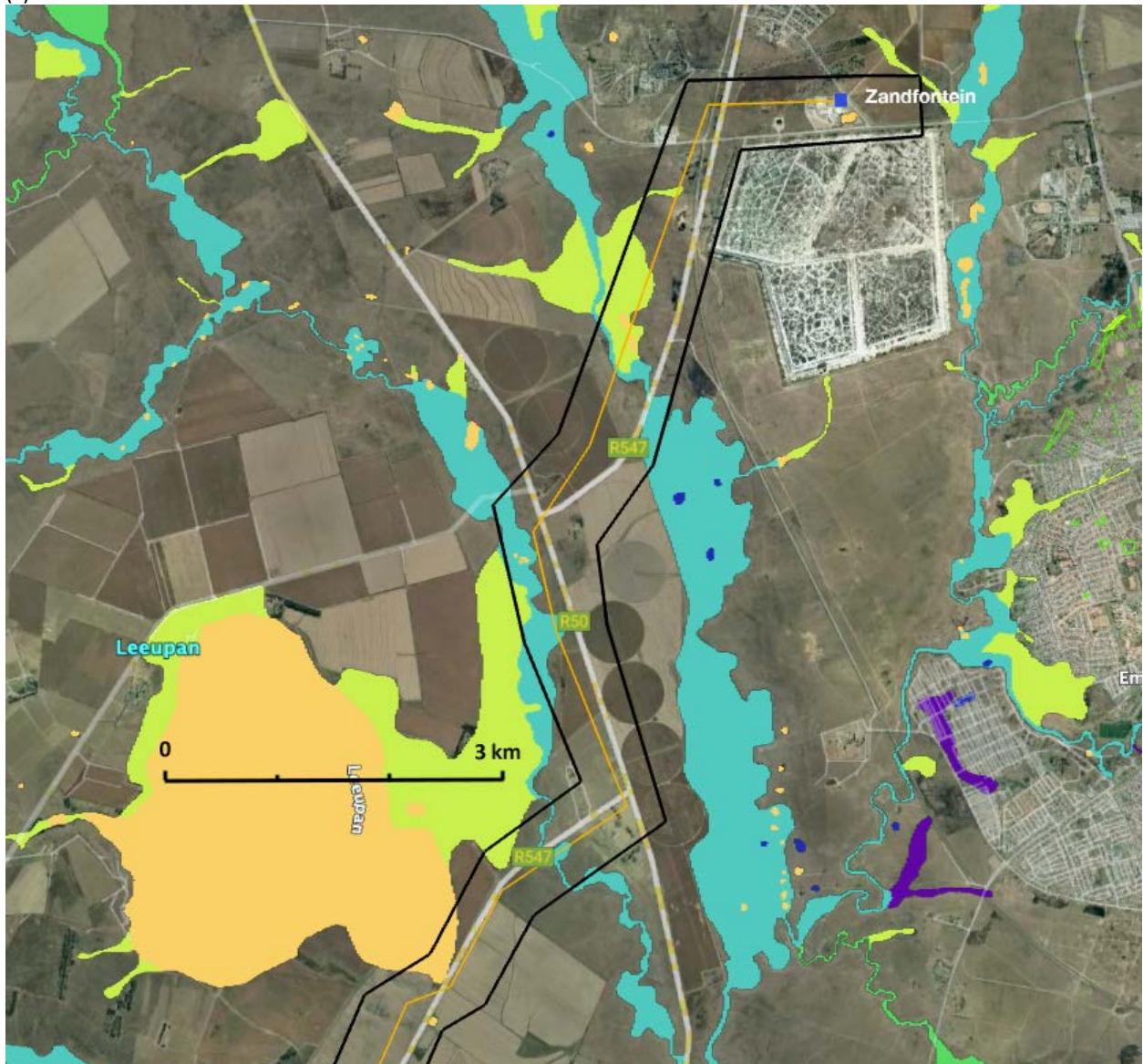


Figure 13a, b & c: Mpumalanga Highveld Wetlands along the Impumelelo gridline routes (MPHG 2014; biodiversityadvisor.sanbi.org). Leeupan is indicated here as a dam. SS1 orange square = on-site substation 1; SS2 red square = Substation 2.

9.6 Ecological processes, functioning and drivers

Ecological processes include primary production, decomposition, nutrient cycling and fluxes of nutrients and energy. These processes will be altered by the clearing of the vegetation at the footprint of the gridline infrastructure. However, the impact is expected to be fairly small. Since grasses are wind pollinated, pollination of the grass

component should not be unduly affected by the development, although the forbs will depend on pollinators. Migration of ground-dwelling organisms will be hindered locally during construction, but ecological connectivity should not be disrupted during the operational phase. Overall, broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions should be able to continue due to the small footprint of the development. The infrastructure, if properly planned, should not cut off ecological corridors and consequently, habitat fragmentation due to the development should not be an issue.

The disturbance caused during construction will inevitably create conditions favourable for invasion by alien species. The level of alien infestation at the site was moderate, but an alien invasive plant species monitoring and control programme needs to be initiated to control invasions.

Fire is considered an important driver of vegetation dynamics in the Grassland and Savanna Biomes. Should fire be suppressed on site this could have long-term effects on the vegetation dynamics. If the grass layer is regularly mowed/brush cut, it should prevent grasses from becoming moribund in the absence of fire.

9.7 Indigenous forests

No indigenous forests occur on the site (NFA 2021).

9.8 Strategic Water Source Areas (SWSA)

The Impumelelo site is not located within a SWSA (biodiversityadvisor.sanbi.org).

10. ECOLOGICAL SENSITIVITY ANALYSIS: VEGETATION

10.1 Introduction

Sensitivity is the vulnerability of a plant community or habitat to an impact, for example a wetland or ridge system would be more vulnerable to development than would a sandy plain. Several features of a site can be assessed to derive a sensitivity score, such as:

1. Threatened status of the regional vegetation types wherein the proposed site is situated.
2. Percentage of IUCN threatened (red-listed) plant species per habitat.
3. Number of protected tree species per habitat.
4. Percentage of provincially protected plant species per habitat.
5. Presence of endemic plant species per habitat or site (endemic to vegetation type).
6. Conservation value of plant community (habitat).
7. Species richness per habitat or per sample plot (number of plant species).
8. Degree of connectivity and/or fragmentation of the habitat, i.e. high connectivity and low fragmentation infers a low rating.
9. Soil erosion potential.
10. Resilience (this is a measure of the ability of a particular habitat to recover after an impact, i.e. high resilience infers low rating).

10.2 Sensitivity model

The following **sensitivity model** (Table 5, Figure 14) was applied to the data for each habitat on site. This was achieved by weighting each criterion and calculating the sum for the habitat, which reflects the sensitivity and sensitivity ranking. A brief description of the sensitivity rating of the parameters is provided below:

1. **Threatened status of the ecosystem** (depends on the percentage area intact, or degree of transformation) (Mucina & Rutherford 2006, NEM:BA 2011, Skowno *et al.* 2018). The ecosystems are classified into the following categories:
 - Low sensitivity: If "Least Concern", the vegetation type has most of its habitat intact, i.e. more than 80%; or the vegetation type is adequately statutory or formally conserved in parks and reserves.
 - Medium sensitivity: If "Vulnerable", the vegetation type has from 60% to 80% of the ecosystem intact; less than 40% has been transformed which could result in some ecosystem functioning being altered, and/or the ecosystem is statutory poorly conserved. For example, the vegetation type is rich in plant species, but is not a pristine example of a vegetation type, therefore some transformation or disturbance occurred, such as human structures and degraded veld due to overgrazing and/or bush encroachment.
 - High sensitivity: If "Endangered", the vegetation type has from 40% to 60% of the ecosystem intact; or 40% to 60% transformed due to disturbance, cultivation or alien species; or the ecosystem is statutory poorly conserved e.g. less than about 3% conserved.
 - Very high sensitivity: If "Critically Endangered", the vegetation type has only 16% to 36% of the ecosystem intact. The richer the ecosystem is in terms of species, the higher the percentage threshold.

Category rating:

Low	(LC)	= 1
Medium	(VU)	= 2
High	(EN)	= 3
Very high	(CE)	= 4

2. **Percentage of IUCN (red-listed) plant species** (IUCN status higher than least Concern): The rating is determined by the presence of red-listed flora in a habitat (calculated as percentage of the total number of species per habitat).

Category rating:

None	(0%)	= 0
Low	(>0 – 2%)	= 1
Medium	(>2 – 5%)	= 2
High	(>5%)	= 3

3. **Presence of protected tree species** (NFA 2021): The presence protected tree species in a habitat is rated as follows:

Category rating:

None	(0 species)	= 0
Low	(1 - 2 species)	= 1
Medium	(3 – 4 species)	= 2
High	(>4 species)	= 3

4. **Percentage of Mpumalanga protected plant species:** The rating depends on the percentage of protected species in relation to the total plant species per habitat.

Category rating:

None	(0%)	= 0
Low	(>0 - 10%)	= 1
Medium	(>10 – 20%)	= 2
High	(>20%)	= 3

5. **Percentage of plant species endemic to the particular vegetation type of Mucina & Rutherford (2006):** Refers to the number of species expressed as a percentage of the total number of species per habitat.

Category rating:

None	(0%)	= 0
Low	(>0 - 2%)	= 1
Medium	(2–5%)	= 2
High	(>5%)	= 3

6. **Species richness per habitat:** Expressed as mean number of species per plot in a habitat.

Category rating:

Low	(<40)	= 1
Medium	(40 – 60)	= 2
High	(>60)	= 3

7. **Conservation value of the habitat:** The assessment is made for the habitat in the broader region. The criteria are low, medium and high. The presence of e.g. quartz outcrops, ridges, wetlands and dunes should be considered to have a medium to high conservation value. However, this should be seen in the context of the presence of representative habitat in the broader region or in conservation areas.

Category rating:

Low		= 1
Medium		= 2
High		= 3

8. **Degree of connectivity and/or fragmentation of the ecosystem:** The degree of connectivity with surrounding or adjacent natural areas and/or fragmentation of habitats, thus high degree of connectivity and low degree of fragmentation infer a high rating.

Category rating (note reverse order):

Low		= 3
Medium		= 2
High		= 1

9. **Erosion potential of the soil:** The erosion potential of the soil is indicated as low, medium or high, e.g. coarse sandy soils on plains have a low erosion potential.

Category rating:

Low	= 1
Medium	= 2
High	= 3

10. **Resilience:** Is a measure of the ability of a particular habitat to recover to its current state after an impact, i.e. high resilience infers low rating.

Category rating (note reverse order):

Low	= 3
Medium	= 2
High	= 1

Each criterium is weighted as follows in the model:

Threatened status of the vegetation type	x5
Percentage of threatened plant species	x4
Presence of protected tree species	x3
Percentage of Mpumalanga protected species	x4
Percentage of endemic species to vegetation type	x2
Species richness	x2
Conservation value (habitat)	x4
Degree of connectivity/fragmentation of habitat	x2
Erosion potential	x2
Resilience	x3

10.2.1 Sensitivity rating

The sum of all criteria is obtained per habitat and the sensitivity rating interpreted as follows:

≤ 40	= low	(L)	(rating scale = 1)
41– 50	= medium	(M)	(rating scale = 2)
51 – 65	= high	(H)	(rating scale = 3)
> 65	= very high	(VH)	(rating scale = 4)

In general, these sensitivity ratings are interpreted as follows:

- **Low** sensitivity means the sensitivity should not have an influence on the decision about the project. It is usually applicable to habitats that have been transformed, especially by human activities. However, no protected species may be removed/destroyed without a permit.
- **Medium** means a sensitivity rating that is real and sufficiently important to require management, e.g. mitigation measures, management or protection of the rare/threatened fauna and flora, protection of a specific habitat on the property and/or rehabilitation.
- **High** means a sensitivity rating where the habitat should be excluded from any development.
- **Very high** means a sensitivity rating that should influence the decision whether or not to proceed with the project.

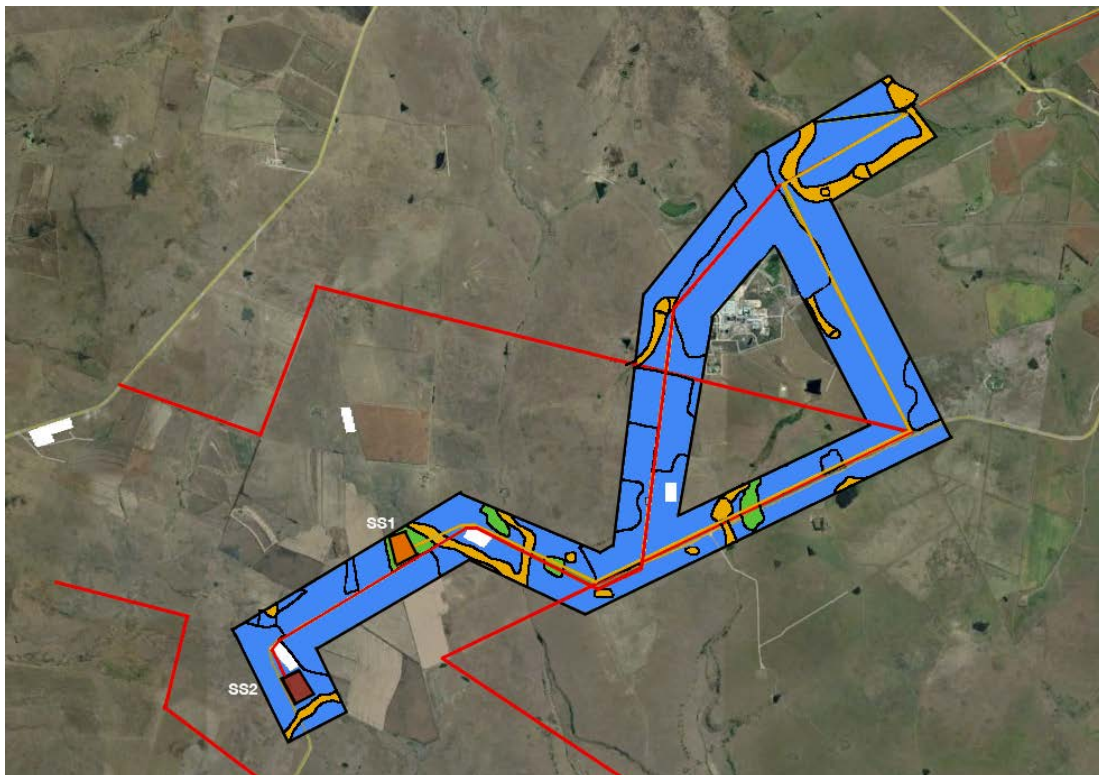
Table 5: Sensitivity of the different habitats (plant communities) identified on site (see Figure 14).

Community/Habitat	1	2	3	4	5	6	7
Threatened status (x5)	10	10	10	10	10	10	10
% Threatened species (x4)	4	0	0	0	0	0	0
Number of protected trees (x3)	0	0	0	0	0	0	0
Mpumalanga species (x4)	4	4	8	8	12	0	8
Endemic species (x2)	0	0	0	0	0	0	0
Species richness (x2)	2	2	4	2	2	2	2
Conservation value (x4)	8	4	8	8	4	4	12
Connectivity (x2)	4	2	4	2	2	2	4
Erosion (x2)	4	4	4	4	2	4	6
Resilience (x3)	9	3	6	3	3	3	9
Sum:	45	29	44	37	35	25	51
Sensitivity rating:	M	L	M	L	L	L	H

Overall, the grassland on shallow soils (rocky sheets) (Habitat 1 – medium sensitivity), grassland of rocky outcrops (Habitat 3) and drainage lines (including dams) (Habitat 7 – high sensitivity) were more sensitive than the other habitats on site. Habitats 6, 8, 9 & 10 are man-made habitats with a low sensitivity rating, e.g. planted pastures, croplands, plantations, wind breaks and diggings.

Substation 1 (SS1) falls in a medium sensitivity area (Figure 14). The gridline route towards Zandfontein crosses many drainage lines and wetlands (high sensitivity), but positioning of pylons should avoid these areas. Along the watercourses, buffers are applicable to the development. A buffer zone of 32 m is usually applied to drainage lines, but the aquatic specialists may apply wider buffer zones along these habitats. **No buffer has been applied in Figure 14, since it is advised to follow the recommendations of the aquatic specialist in this regard.**

(a)



(b)



(c)

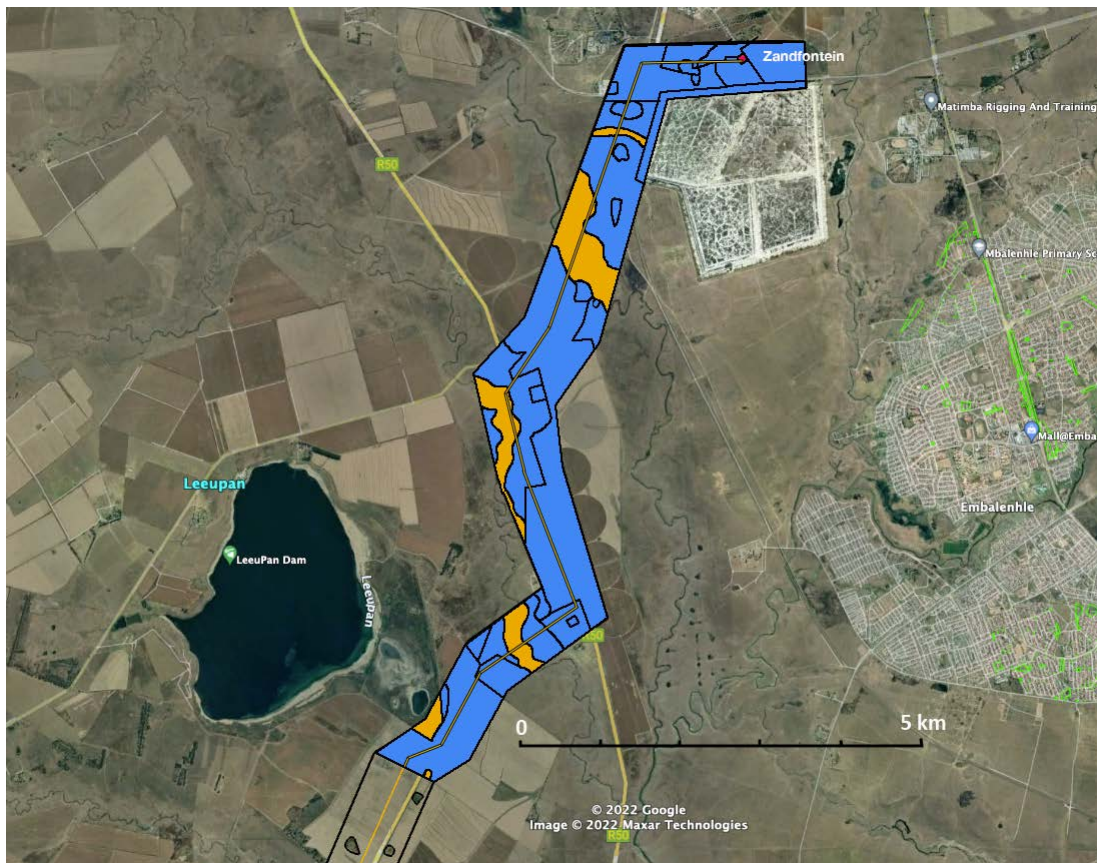


Figure 14a, b & c: Sensitivity map of the Impumelelo site. The sensitivity map is additionally provided as a .kmz file. Orange = high sensitivity; Green = medium sensitivity; Blue = low sensitivity. SS1 orange square = Impumelelo on-site substation 1; SS2 red square = substation 2.

Apart from the drainage lines and wetlands (Habitat 7), with high sensitivity, the CBAs did not emerge as being highly sensitive in the sensitivity model that was applied. The areas mapped as wetlands were largely incorporated into the CBAs.

11. SCREENING TOOL REPORT

11.1 Summary of screening tool results

11.1.1 Plant Species Theme

The screening tool rated the sensitivity of the Plant Species Theme as medium (Figure 15) and highlighted four species with an IUCN status of Vulnerable as being of concern.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

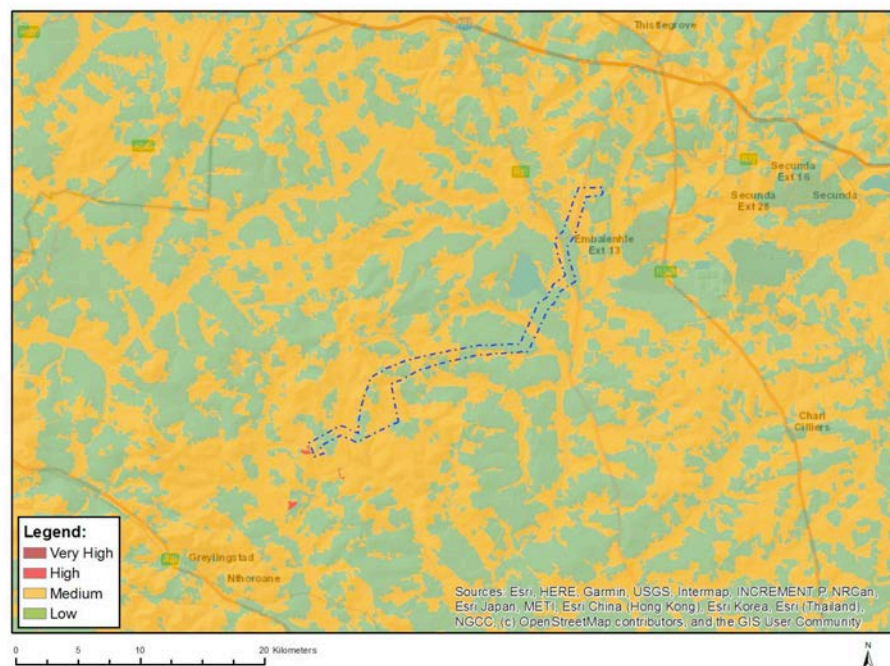


Figure 15: Map and outcome of the Plant Species Theme sensitivity generated by the screening tool.

The following plant species were highlighted as being of concern:

Sensitivity	Feature(s)
Medium	Sensitive species 1252
Medium	Sensitive species 691
Medium	<i>Khadia beswickii</i>
Medium	<i>Pachycarpus suaveolens</i>

Please take note of the following email communication from SANBI: ‘As per the best practise guideline that accompanies the protocol and screening tool, please, remember that the **name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain.** It should be referred to as *sensitive plant* or *sensitive animal* and its threat status may be included, e.g. *critically endangered sensitive plant* or *endangered sensitive animal.*’ It should be noted that the numeric code of the sensitive species is not an unique identifier, since the numbers are randomised from time to time.

11.1.2 Animal Species Theme

The screening tool rated the sensitivity of the Animal Species Theme as high (Figure 16).

Very high sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

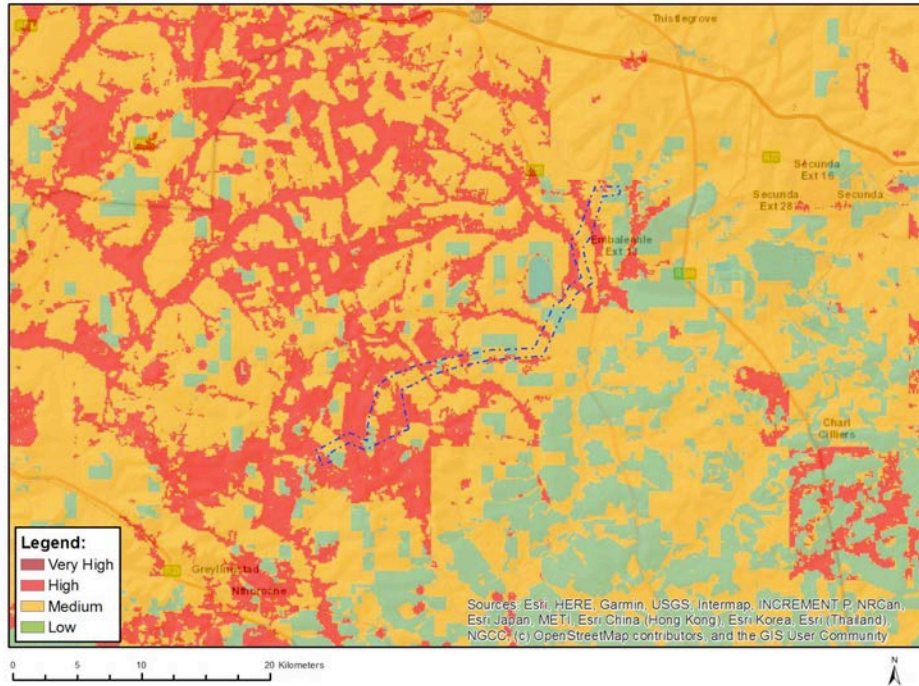


Figure 16: Map and outcome of Animal Species Theme sensitivity generated by the screening tool.

Animal species highlighted by the screening tool for the site:

Sensitivity	Feature(s)
High	Aves-Circus ranivorus
High	Aves-Hydroprogne caspia
High	Aves-Eupodotis senegalensis
High	Aves-Sagittarius serpentarius
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Tyto capensis
Medium	Aves-Circus ranivorus
Medium	Aves-Hydroprogne caspia
Medium	Insecta-Lepidochrysops procera
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Hydrictis maculicollis
Medium	Mammalia-Ourebia ourebi ourebi

11.1.3 Relative Terrestrial Biodiversity theme

The screening tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as very high (Figure 17).

Very high sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

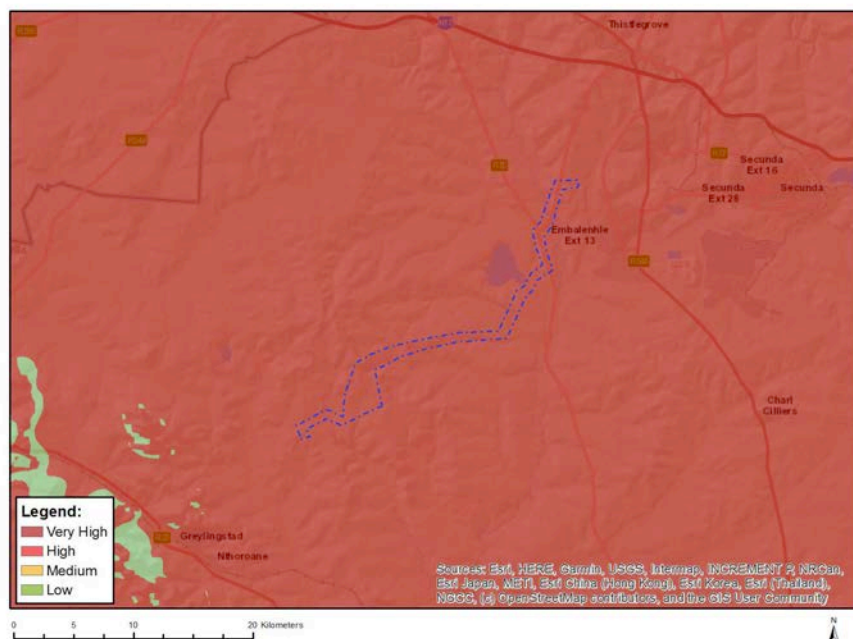


Figure 17: Map and outcome of Relative Terrestrial Biodiversity sensitivity generated by the screening tool.

The following features were highlighted:

Sensitivity	Feature(s)
Very High	Critical biodiversity area 1
Very High	Critical biodiversity area 2
Very High	Ecological support area: landscape corridor
Very High	Ecological support area: local corridor
Very High	Protected Areas Expansion Strategy
Very High	Vulnerable ecosystem

11.2 Screening tool in relation to background study and site verification

11.2.1 Plant Species Theme

Our field survey and application of a sensitivity model indicated that most of gridline had a **low** sensitivity. None of the SCC highlighted by the screening tool were recorded on site.

- The Soweto Highveld Grassland is classified as a Vulnerable vegetation type. Along the gridline, large portions of the route have been heavily or moderately modified (compare CBA map, Figure 12) and not prime examples of the Soweto Highveld Grassland. If the development is thus contained within the heavily or moderately modified areas it would not affect the status of the vegetation type since these modified area were already considered as lost for the allocation of a vulnerable status of the vegetation type.
- Sensitive species 691 occurs in damp depressions in shallow soil over rock sheets. Although not found on site, the substation 1 (SS1) is located in Habitat 1.
- The habitats on site do not present suitable habitat for sensitive species 1252 because of a lack of suitable wooded habitat. Moreover, the rocky outcrops on hilly terrain with a sparse woody cover were avoided by the development. This species was not listed for the region on the NewPosa database nor in the MTPA database for the farms in the immediate vicinity of the Impumelelo site.
- *Khadia beswickii* occurs in rocky habitats on shallow soil (sheetrock) (see Habitat 1 in Figure 5), but was not recorded on site. However, the substation 1 (SS1) is located in Habitat 1. Furthermore, the other rocky habitats (Habitats 2 & 3) did not occur along the gridline route.

- The fourth plant species of concern, *Pachycarpus suaveolens*, prefers grassland, but was not recorded during the site survey. The last collection made was in 1962. Its distribution records show it to be more common northwards from the Secunda sites, e.g. in the Witbank-Carolina area.

11.2.2 Animal Species Theme

- **The avifaunal and bat components will be addressed by the avifaunal and bat specialists.**
- The Screening Tool listed *Lepidochrysops procera* (Lepidoptera) as a SCC for the site. However, it was not listed in the ADU database, the MNCA (1998) provincial species lists or the NEMBA (2007c) ToPS lists. *Lepidochrysops procera* was not recorded on site and is unlikely to occur there because its host plant (*Ocimum obovatum*) was scarce and only recorded in one location on the Impumelelo WEF site.
- The oribi *Ourebia ourebi* is found in patchy distributions in open and wooded mesic grassland. The Impumelelo site falls marginally within the distribution range of the oribi. Its habitat is largely fragmented due to human socioeconomic activities including agriculture, forestry and mining. It was not recorded during the survey or mentioned by the landowners on site.
- The Maquassie Musk Shrew *Crocidura maquassiensis* was not listed for the region in the ADU mammal species list or the MNCA (1998) lists for the Mpumalanga province. It was not recorded on site during the survey. The Maquassie Musk Shrew depends on wetlands as suitable habitat in savanna and grasslands. Although it has a wide inferred extent of occurrence, it appears to be patchily distributed. *Crocidura maquassiensis* has not been reported from Mpumalanga Province post-1999 and thus there is a very low probability for it to occur on site.
- The spotted-necked otter *Hydricteis maculicollis* was not listed for the region in the ADU mammal species list but was included in the MNCA (1998) lists for the Mpumalanga province. It was not recorded on site during the survey. Marginally suitable habitat for the spotted-necked otter is available on site. It occurs widespread, but it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base.
- What the screening tool did not highlight was the possible presence of the giant girdled lizard, a species with a Vulnerable IUCN status. However, the species was not recorded on site nor is it listed in the MTPA database for the farms in the immediate vicinity of the Impumelelo site. Furthermore, according to Bates *et al.* (2014), the distribution of the giant girdled lizard does not include the Impumelelo site.
- The screening did also not highlight the presence of three Near Threatened species, viz. the Southern African hedgehog (*Atelerix frontalis*), serval (*Leptailurus serval*) and Southern African vlei rat (*Otomys auratus*) which have been reported for the Impumelelo site. It is unlikely that the development will affect the Southern African vlei rat, since the vlei habitat should be avoided. During construction the serval will avoid the area, but it could return during the operational phase. Construction workers should be made aware of not harming the Southern African hedgehog, however due to its size most individuals will go unnoticed.
- Overall sensitivity of animal theme (avifaunal and bat components excluded) is thus rated as **medium**. However, if the suggested mitigation measures are followed the animal SCC should not be negatively affected.

11.2.3 Relative Terrestrial Biodiversity Theme

This theme considers the presence of protected areas, National Protected Area Expansion Strategy (NPAES), CBAs, ESAs and National Freshwater Ecosystem Priority Areas (NFEPAs).

- The key issue is that certain sections of the gridline routes have been identified as CBAs, especially the sections close to the Impumelelo WEF site. However, our background study indicated that although there

are CBAs and ESAs present on site, our sensitivity analysis rated most of these areas as being of low sensitivity except for the wetlands (Habitat 7), which have a high sensitivity.

- The study area is not located in a protected area nor does it fall in an area earmarked for the NPAES (NPAES 2010). It is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA).
- Our background study confirms that the Soweto Highveld Grassland vegetation type on site is listed as 'Vulnerable'.
- Sensitivity of Habitat 1 was rated as medium, with substation 1 (SS1) located in such a habitat and its position should be reconsidered. The gridline crosses this habitat on the WEF site but positioning of pylons may avoid the areas.
- Freshwater Ecosystem Priority Areas (FEPAs) or water catchments were not flagged by the screening tool. Based on the site assessment of the vegetation most of the area mapped as upstream river FEPA was rated as having a low or medium sensitivity, with only the drainage lines having a high sensitivity.
- Several Mpumalanga Highveld wetlands are present on site (Figure 13)(see aquatic specialist report), but these were also not highlighted by the Screening Tool.

Unfortunately, the screening tool on site limits the sensitivity outcome of the Relative Terrestrial Biodiversity Theme to either Very High or Low. This is an issue which should be revisited by DFFE since it does not give a proper representation of the site conditions. Although we agree with the presence of the CBA the entire site does not qualify as CBA, since a large proportion of the site is degraded and under cropland or abandoned cropland. Thus if the same 4-tiered scale were to be applied to this theme, as in the case of the other themes, we would rate it as **medium**.

12. ENVIRONMENTAL IMPACTS

12.1 Introduction

In this section the issues, risks and impacts associated with the project from a terrestrial biodiversity and species viewpoint are presented.

12.2 Key issues

The key issues are that large parts of the site have been identified as CBAs and furthermore, both gridline options fall within a 'Vulnerable' vegetation type (Soweto Highveld Grassland). Its status is due to high percentages of transformed habitat. Preference should therefore be given to heavily or moderately modified areas to erect the gridline.

12.3 Impacts during the construction phase

12.3.1 Direct impacts during the construction phase

- **Potential impact 1: The clearing of natural vegetation**
- **Potential impact 2: The loss of threatened, protected, CITES listed and/or endemic plants/animals**
- **Potential impact 3: Loss of faunal habitat**
- **Potential impact 4: Direct faunal mortalities due to construction and increased traffic**
- **Potential impact 5: Increased dust deposition**
- **Potential impact 6: Increased human activity and noise levels**

12.3.2 Indirect impacts during the construction phase

- **Potential impact 1: Establishment of alien vegetation**

12.4 Impacts during the operational phase

12.4.1 Direct impacts during the operational phase

- **Potential impact 1: Refer to avifaunal assessment**

12.4.2 Indirect impacts during the operational phase

- **Potential impact 1: Establishment of alien vegetation**

12.5 Impacts during the decommissioning phase

12.5.1 Direct impacts during the decommissioning phase

- **Potential impact 1: Direct faunal mortalities**
- **Potential impact 2: Increased dust deposition**

12.5.2 Indirect impacts during the decommissioning phase

- Potential impact 1: Establishment of alien vegetation

12.6 Cumulative impacts

- Cumulative impact 1: Vegetation loss and habitat destruction
- Cumulative impact 2: Compromising integrity of CBAs, ESAs and NPAES
- Cumulative impact 3: Reduced ability to meet conservation obligations & targets
- Cumulative impact 4: Loss of landscape connectivity and disruption of broad-scale ecological processes

13. ASSESSMENT OF SIGNIFICANCE OF ENVIRONMENTAL IMPACT

13.1 Introduction

The impacts of the proposed development on the terrestrial biodiversity and species were assessed based on the knowledge gained during the site visit and literature review. Each of the impacts is briefly described below in terms of the nature; proposed mitigation measures; and the significance of the impact without and with the mitigation measures applied. The methodology follows the guidelines provided by the CSIR as set out below (DEAT Guideline 5: Assessment of Alternatives and Impacts (DEAT 2006)), and the following methodology is applied to the prediction and assessment of impacts and risks:

Potential impacts and risks have been rated in terms of the direct, indirect and cumulative impacts:

- **Direct impacts:** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect impacts:** are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative impacts:** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts. The cumulative impacts are assessed by identifying other wind and solar energy project proposals and other applicable projects, such as construction and upgrade of electricity generation, and transmission or distribution facilities within 30 km of the proposed Impumelelo site that have been approved (i.e. positive EA has been issued) or is currently underway.

The impact assessment methodology includes the following aspects (methodology provided by CSIR):

- **Nature of impact/risk** - The type of effect that a proposed activity will have on the environment.
- **Status** - Whether the impact/risk on the overall environment will be
 - Positive - environment will benefit overall from the impact/risk.
 - Negative - environment will be adversely affected overall by the impact/risk.
 - Neutral - environment overall will not be affected.
- **Spatial extent** – The size of the area that will be affected by the impact/risk:
 - Site specific.
 - Local (<10 km from site).
 - Regional (<100 km of site).
 - National.
 - International (e.g. Greenhouse Gas emissions or migrant birds).
- **Duration** – The timeframe during which the impact/risk will be experienced:
 - Very short term – instantaneous.
 - Short term - less than 1 year.

- Medium term - 1 to 10 years.
 - Long term - the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration).
 - Permanent - mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning).
- **Consequence (Severity)** – The anticipated consequence of the risk/impact:
 - Extreme - extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease.
 - Severe - severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease.
 - Substantial - substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease.
 - Moderate - notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function, but in a modified manner.
 - Slight - negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected.
 - **Reversibility of the Impacts** - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
 - High reversibility - impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment.
 - Moderate reversibility of impacts.
 - Low reversibility of impacts.
 - Impacts are non-reversible - impact is permanent, i.e. this is the least favourable assessment for the environment.
 - **Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks** – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):
 - High irreplaceability of resources - project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment.
 - Moderate irreplaceability of resources.
 - Low irreplaceability of resources.
 - Resources are replaceable - the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment.

Using the criteria above, the impacts are further assessed in terms of the following:

- **Probability** – The probability of the impact/risk occurring:
 - Extremely unlikely (little to no chance of occurring)
 - Very unlikely (<30% chance of occurring)
 - Unlikely (30– 50% chance of occurring)
 - Likely (51 – 90% chance of occurring)
 - Very Likely (>90% chance of occurring regardless of prevention measures).

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 18).

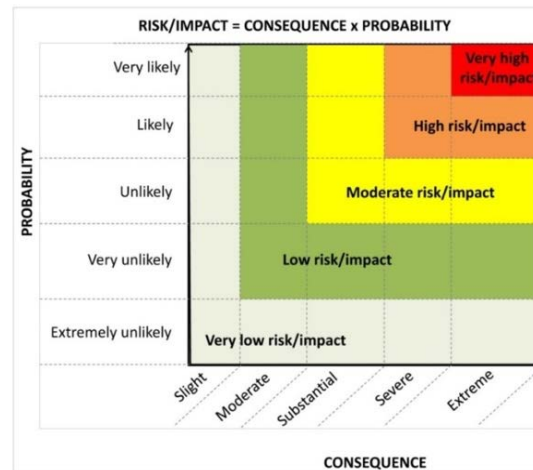


Figure 18: Guide to assessing risk/impact significance as a result of consequence and probability.

- **Significance** – Will the impact cause a notable alteration of the environment?
 - Very low - the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making.
 - Low - the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making.
 - Moderate - the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated.
 - High - the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making.
 - Very high - the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating).

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- Very low = 5
- Low = 4
- Moderate = 3
- High = 2
- Very high = 1.

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- Low
- Medium
- High

13.2 Impacts during the construction phase and their significance

13.2.1 Direct impacts during the construction phase

The clearing of natural vegetation

Nature: Natural vegetation will be cleared for the pylons, new access roads and on-site substation. The removal of indigenous vegetation may cause a loss of individuals of threatened, protected and/or endemic species and will also be accompanied by a loss of faunal habitat. However, no threatened or endemic plant species were found on site and all provincially protected plant species have a Least Concern status. None of the SCC listed by the Screening Tool, were recorded on site. Vegetation loss is generally also associated with increased water run-off and erosion (see indirect impacts).

Since the gridline footprint of especially option 1 will be small, the loss of prime habitat within the Soweto Highveld Grassland vegetation type can be constrained by well-planned positioning of the pylons. Service roads generally have a larger impact on vegetation clearance than the pylons, however since the roads will have a gravel surface animal movement should still be possible. Beyond the permanent infrastructure footprint, environmental functions and processes should however, not be altered.

Proposed mitigation measures:

- Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided. The severity of the vegetation clearance can be mitigated if only a service road would be cleared and a vegetative groundlayer would be retained in the rest of the servitude.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns. This includes awareness as to remaining within demarcated construction areas, no littering, handling of pollution and chemical spills, avoiding fire hazards and minimising wildlife interactions.
- Ensure that all temporary use areas e.g. laydown areas and construction camp, are located in areas of low sensitivity.
- Footprints of the pylons, roads and substation locations should be clearly demarcated.
- Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided.
- Watercourses, wetlands, rocky outcrops/sheets should be avoided (Habitats 1 & 7).
- Observe buffer zones along drainage lines (see Environmental Impact Report of aquatic specialist).
- All vehicles are to remain on demarcated roads and no driving through the veld should be allowed.
- The ECO is to provide supervision on vegetation clearing activities and other activities that may cause damage to the environment.
- No plants may be translocated or otherwise uprooted or disturbed without the applicable permit and ECO oversight.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Long-term	Medium term
Consequence (Severity)	Moderate	Moderate
Probability	Very likely	Likely
Reversibility	Low	Moderate
Irreplaceability	Moderate	Low
Significance	Low	Low
Confidence level of assessment	Medium	Medium

The loss of threatened, protected & endemic plant species

Nature: The loss of the vegetation for the pylons, new access roads, upgrading of existing tracks and substation may cause a loss of individuals of threatened, protected or endemic plant species. The site visit did, however, not reveal the presence of any species with an IUCN threatened status and no endemic species are listed for the Soweto Highveld Grassland. Twelve provincially protected plant species were encountered in the region during the site survey, although all have a Least Concern status, except *Gladiolus robertsoniae* which is Near Threatened. However, *Gladiolus robertsoniae* occurs in Habitat 1 and substations 1 (SS1) is located in this habitat. As the other protected plant species at the site are not threatened, the loss of a small number of individuals (if any) is not likely to threaten the local or regional population of these species. The loss of some individuals of protected species is unlikely to alter the patterns or processes of the natural system, in the sense that environmental functions and processes will temporarily or permanently cease. Nevertheless, permits need to be obtained for the destruction of provincially specially protected or protected species.

Proposed mitigation measures:

- Placement of infrastructure should be done in such a way as to minimise the impact on protected species.
- The construction crew should undergo environmental training (induction) to make them aware of the importance of protected species.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Long-term	Long-term
Consequence (Severity)	Slight	Slight
Probability	Likely	Unlikely
Reversibility	Low	Low
Irreplaceability	Moderate	Moderate
Significance	Very low	Very Low
Confidence level of assessment	Medium	Medium

Loss of faunal habitat

Nature: The loss of the vegetation due to the pylons, new access roads and substation will be accompanied by a loss of some faunal habitat. Although none of the species listed by the screening tool (avifaunal component excluded) were noted on site, several rare species were reported for the region by the landowners. These include the Near Threatened serval *Leptailurus serval*, Southern African hedgehog *Atelerix frontalis* and the Southern African vlei rat *Otomys auratus*.

The screening report refers to *Crocidura maquassiensis* (Maquassie musk shrew), *Hydrictus maculicollis* (spotted-necked otter), oribi *Ourebia ourebi* and *Lepidochrysops procera* as the species of concern. However, there is a very low probability for the Maquassie musk shrew to occur on site. Marginally suitable habitat for the spotted-necked otter is available on site, but that particular habitat should be avoided by the development. The oribi was not recorded during the survey or mentioned by the landowners on site. The Screening Tool listed *Lepidochrysops procera* (Lepidoptera) as a SCC for the site. However, it was not listed in the ADU database, the MNCA (1998) provincial species lists or the NEMBA (2007c) ToPS lists. *Lepidochrysops procera* was not recorded on site and is unlikely to occur there because its host plant (*Ocimum obovatum*) was scarce and only recorded in one location on the Impumelelo WEF site.

Proposed mitigation measures:

- Vegetation clearance should be confined to the smallest possible footprint of the development and unnecessary clearance should be avoided.
- Construction crew should undergo environmental training (induction) to increase their awareness of environmental concerns.
- Speed limits should be set on all roads and strictly adhered to.
- Development should avoid watercourses, wetlands and rocky outcrops/sheets.
- Observe buffer zones along drainage lines.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Long-term	Long-term
Consequence (Severity)	Moderate	Moderate
Probability	Likely	Likely
Reversibility	Low	Moderate
Irreplaceability	Moderate	Moderate
Significance	Low	Low
Confidence level of assessment	Medium	Medium

Direct faunal mortalities due to construction and increased traffic

Nature: Faunal mortalities may be caused by construction at the footprint of the infrastructure, construction vehicles or other operational activities and by electrical fences, should they be erected around the substation. In particular slow-moving species such as tortoises, might be prone to these mortalities. When animals ingest waste material or become ensnared in wires, fatalities might also occur.

Larger more mobile fauna such as antelope and larger predators will most likely move away from areas of high activity during the construction phase. Smaller and less-mobile animals are not as capable of moving away and may seek shelter down burrows and other shelter sites. None of the SCC listed in the screening tool were encountered on site and generally these species occur at a low density and thus it is unlikely that they would be directly encountered by people on the gridline route.

Proposed mitigation measures:

- Construction crew, in particular the drivers, should undergo environmental training to increase their awareness of environmental concerns in order to reduce the number of kills during construction and on roads. The crew should also be made aware of not harming or collecting species such as snakes, tortoises and owls.

- Proper waste management procedures should be in place to avoid litter, food or other foreign material from lying around and all waste material should be removed from the site.
- Speed limits should be set on all roads on site.
- Personnel should not be allowed to roam into the veld.
- Ensure that cabling and electrical infrastructure at the site are buried sufficiently deeply to avoid being excavated by fauna and that where such infrastructure emerges above-ground that it is sufficiently protected from gnawing animals.
- Any dangerous fauna (e.g. snakes, scorpions) that are encountered during construction should not be harmed by construction staff and the ECO (or other suitably qualified person) should be contacted to remove the animals to safety.
- Holes and trenches should not be left open for extended periods of time and should only be dug when needed for immediate construction. Trenches that may stand open for some days, should have an escape ramp to allow any fauna that fall in to escape.
- If there is any part of the site that needs to be lit at night for security reasons, then appropriate lighting should be installed to minimise negative effects on nocturnal animals.
- Should electrical fences be erected it must be done according to the norms and standards of the Nature Conservation Authorities in Mpumalanga.
- Access to the site should be regulated to reduce opportunities for poaching.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Short-term	Short-term
Consequence (Severity)	Moderate	Slight
Probability	Likely	Likely
Reversibility	Low	Low
Irreplaceability	Moderate	Moderate
Significance	Low	Very Low
Confidence level of assessment	Medium	Low

Increased dust deposition

Nature: Increased dust deposition may harm physiological processes of plants and a reduction in the photosynthetic capacity of the plants may occur. The dust layer on the vegetation may also discourage herbivores from grazing or browsing. The increased dust levels will however be temporary.

Proposed mitigation measures:

- Excessive dust can be reduced by spraying water onto the exposed soil surface.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Short-term	Short-term
Consequence (Severity)	Moderate	Slight
Probability	Likely	Unlikely
Reversibility	High	High
Irreplaceability	-	-
Significance	Very Low	Very Low

Confidence level of assessment	High	High
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Increased human activity and noise

Nature: Construction activities will increase human presence and noise at the site. These activities may affect animal behaviour. However, increased noise levels associated with the construction phase are temporary.

Proposed mitigation measures:

- The SANS standards should be adhered to in terms of noise levels.
- No construction should be done at night.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Short-term	Short-term
Consequence (Severity)	Substantial	Moderate
Probability	Likely	Likely
Reversibility	High	High
Irreplaceability	-	-
Significance	Moderate	Low
Confidence level of assessment	High	High

13.2.2 Indirect impacts during the construction phase

Establishment of alien vegetation

Nature: As a result of the clearance of indigenous vegetation and resulting degradation, alien species might invade the area. Twelve declared alien invasive plant species were recorded on the three Enertrag sites and 35 naturalised species (Appendic B). Another four naturalised alien species were listed by NewPosa for the region.

Six declared invasive species were noted on the Impumelelo site and increased vehicle traffic may further facilitate the introduction of seeds of alien species. Infestation by invasive alien species may cause changes to the structure and functioning of the ecosystem which often exacerbate the further loss of indigenous vegetation. Bare areas that are not actively rehabilitated and areas receiving runoff are particularly vulnerable to alien infestation.

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species.
- A control program should be employed to combat declared alien invasive plant species in the most environmentally friendly manner that does not result in undesirable secondary impacts.
- Herbicides for the control of alien species should be applied according to the relevant instructions and by appropriately trained personnel.
- No alien species should be used in rehabilitation or landscaping.
- Use only plants and seed collected on-site for revegetation.
- Cleared areas may need to be fenced-off during rehabilitation to exclude livestock and wildlife.
- Material brought onto site e.g. building sand should be regularly checked for the germination of alien species.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Local	Local
Duration	Long-term	Long-term
Consequence (Severity)	Moderate	Slight
Probability	Likely	Likely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Low	Very low
Confidence level of assessment	Medium	Medium

13.3 Impacts during the operational phase and their significance

13.3.1 Direct impacts during the operational phase

Refer to avifaunal assessment.

13.3.2 Indirect impacts during the operational phase

Establishment of alien vegetation

Nature: As a result of the loss of indigenous vegetation and resulting degradation, primarily during the construction phase, alien species might invade the area. Alien invasive species are generally more common along roads than the adjacent undisturbed farmland. The invasion by alien species will continue unless controlled. Increased vehicle traffic may further facilitate the introduction of seeds of alien species. Infestation by invasive alien species may eventually cause changes to the structure and functioning of the ecosystem which often exacerbate the further loss of indigenous vegetation.

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species and a control program to combat declared alien invasive plant species should be employed.
- No alien species should be used for landscaping, rehabilitation or any other purpose.
- Clearing of alien species should be done on a regular basis.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Local	Local
Duration	Long-term	Long-term
Consequence (Severity)	Moderate	Slight
Probability	Likely	Likely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Low	Very Low
Confidence level of assessment	Medium	Medium

13.4 Impacts during the decommissioning phase and their significance

13.4.1 Direct impacts during the decommissioning phase

Faunal mortalities

Nature: Faunal mortalities may be caused by vehicles or other decommissioning activities and waste. In particular slow-moving species such as tortoises, might be prone to road mortalities. When animals ingest waste material or become ensnared in it fatalities might also occur.

Proposed mitigation measures:

- Decommissioning crew should undergo environmental training to increase their awareness of environmental concerns.
- Speed limits should be adhered to.
- Proper waste management procedures should be in place and no material should be left on site in order to prevent instances of ensnarement or ingestion of foreign material.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Short-term	Short-term
Consequence (Severity)	Slight	Slight
Probability	Likely	Unlikely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Very Low	Very low
Confidence level of assessment	Medium	Medium

Increased dust deposition

Nature: Increased dust deposition may harm physiological processes of plants and a reduction in the photosynthetic capacity of the plants may occur. The dust layer on the vegetation may also discourage herbivores from grazing or browsing the dust covered vegetation. The increased dust levels will be temporary.

Proposed mitigation measures:

- Excessive dust can be reduced by spraying water onto the soil.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Site specific	Site specific
Duration	Short-term	Short-term
Consequence (Severity)	Moderate	Slight
Probability	Likely	Unlikely
Reversibility	High	High
Irreplaceability	-	-
Significance	Low	Very low
Confidence level of assessment	High	High

13.4.2 Indirect impacts during the decommissioning phase

Establishment of alien vegetation

Nature: As a result of the decommissioning activities, areas will be disturbed and alien species might invade. Increased vehicle traffic may facilitate the introduction of seeds of alien species.

Proposed mitigation measures:

- Implement a monitoring program for at least three years after decommissioning to document vegetation recovery and alien infestation across the site.
- A control program to combat declared alien invasive plant species should be employed.
- Areas where infrastructure are removed, must be revegetated with indigenous plant species.
- No alien species should be used for rehabilitation/revegetation or any other purpose.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Local	Local
Duration	Long-term	Long-term
Consequence (Severity)	Moderate	Slight
Probability	Likely	Likely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Low	Very low
Confidence level of assessment	Medium	Medium

13.5 Cumulative impacts

Some renewable energy developments occur within 50 km from the site and were taken into consideration for cumulative impacts. These include:

- Mukondeleli WEF and gridline to the east.
- Vhuvhili SEF and gridline to the east.
- Clark Energy & Habitat SEF south of Heidelberg.
- Tutuka SEF to the southeast.
- Grootvlei SEF to the west.

Vegetation loss and habitat destruction

Nature: Vegetation loss, habitat destruction and possibly loss of SCC, can occur when considering all developments. The habitat destruction will lead to changes in the physical features of the habitat, with concomitant changes in ecological processes. Secondary vegetation will develop at sites where the vegetation was cleared or the soil compacted. The species composition may change and alien species might invade. Vegetation loss will also constitute the loss of animal habitat. It should however be noted that if a ground layer is maintained along the roads in the servitude, vegetation loss will be minimal and the contribution by the Impumelelo gridline site to the cumulative impact will be small.

Proposed mitigation measures:

- All projects should adhere to the site-specific recommendations of the ecologists to ensure that impacts are mitigated where possible.
- Placement of infrastructure should be done in such a way that no SCC are affected and CBAs avoided.
- Positioning of the pylons in the most environmentally responsible manner is crucial.

- Maintain a vegetation ground layer along the roads in the servitude.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Regional	Regional
Duration	Long-term	Long-term
Consequence (Severity)	Substantial	Moderate
Probability	Likely	Likely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Moderate	Low
Confidence level of assessment	Medium	Medium

Compromising integrity of CBA, ESA and NPAES

Nature: According to the mapping of CBAs in Mpumalanga, some of the proposed developments are located/partially located within CBAs in the current layout. Development within CBAs is not encouraged as such development may result in biodiversity loss and therefore compromise the integrity of the CBA. Although there are currently not many projects within 50 km from the Impumelelo site, this could in future change and the integrity of the CBAs could be compromised and consequently the biodiversity target for the ecosystem could be affected.

It is assumed that authorisation would only be granted to projects that have similarly avoided CBAs. The development does not affect a NPAES (2010). The site is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA). The contribution by the Impumelelo gridline site to the cumulative impact will be small.

Proposed mitigation measures:

- Placement of infrastructure should strive to avoid CBAs.
- Minimise the development footprint as far as possible.
- Maintain a vegetation ground layer in the gridline servitude.
- Stringent construction-phase monitoring of activities at the site to ensure that mitigation measures are adhered to and that the overall ecological impact of the development is maintained at a low level.
- Align roads and other infrastructure so that transformation within the CBAs is minimised.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Regional	Regional
Duration	Long-term	Long-term
Consequence (Severity)	Moderate	Moderate
Probability	Likely	Likely
Reversibility	Low to moderate	Low to moderate
Irreplaceability	Low	Low
Significance	Moderate	Low
Confidence level of assessment	Medium	Medium

Reduced ability to meet conservation obligations & targets

Nature: The loss of unprotected vegetation types on a cumulative basis from the area may impact the countries' ability to meet its conservation targets. Very few statutorily conserved areas occur in the 'Vulnerable' Soweto Highveld Grassland and almost half of it has been transformed mostly by cultivation, plantations, mining and urbanisation. It has a conservation target of 24% and was classified as Not Protected (0.6%) in the 2018 National Biodiversity Assessment (Skowno *et al.* 2018). According to the current layout, the on-site substations fall in CBAs and areas of medium sensitivity and should be re-positioned (micro-sited) if possible. CBAs also occur across large sections of the Impumelelo site and along the gridline route to Zandfontein. However, most of the habitats on the Impumelelo WEF site and along the gridline route were rated as having a low sensitivity in the current study (see Chapter 10). The layout of the Impumelelo gridline should preferably fall within the heavily modified and moderately transformed areas. These areas have already been included as lost in the transformed % for the vegetation type and will thus not affect its conservation status. However, neither of the Impumelelo gridline routes is not located in a protected area nor does it fall within a protected area expansion strategy and thus will not have an impact on the expansion of Protected Areas.

Proposed mitigation measures:

- Minimise the development footprint as far as possible.
- Avoid highly sensitive areas and CBAs.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Regional	Regional
Duration	Long-term	Long-term
Consequence (Severity)	Substantial	Moderate
Probability	Likely	Likely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Moderate	Low
Confidence level of assessment	Medium	Medium

Loss of landscape connectivity and disruption of broad-scale ecological processes

Nature: The gridline could pose a minimal threat to the connectivity of the landscape. For fauna the disruption would depend largely on whether a ground layer of vegetation will be maintained in the servitude or not. Subterranean species that have to emerge from the soil to cross roads might be affected. The severity of these impacts for subterranean species is likely to be relatively low as the roads required for operation are likely to still be of a natural surface such as gravel and would experience low traffic volumes.

If a ground layer of vegetation is maintained beneath the gridline, the facility is unlikely to disrupt pollination and dispersal processes that could cause spatial fragmentation of populations.

Proposed mitigation measures:

- Minimising the development footprint wherever possible.
- Revegetation of all cleared and bare areas created by the facility with local plant species.
- Fences and other structures which impede faunal movement should be avoided.
- Roads should not have steep curbs.

Significance without and with mitigation measures:

Parameter	Without mitigation	With mitigation
Status	Negative	Negative
Spatial extent	Regional	Regional
Duration	Long-term	Long-term
Consequence (Severity)	Moderate	Moderate
Probability	Likely	Unlikely
Reversibility	Moderate	Moderate
Irreplaceability	Low	Low
Significance	Low	Low
Confidence level of assessment	Medium	Medium

13.6 Impact assessment summary

Tables 6-9 summarise the impact assessment across all phases of the development and the integrated assessment post-mitigation per phase is provided in Table 9.

Table 6: Summary assessment of (a) direct and (b) indirect impacts and their mitigation measures during the construction phase

(a) Direct impacts

Impact	Impact Criteria (after mitigation)	Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE: DIRECT IMPACTS					
The clearing of natural vegetation	Status	Negative	<ul style="list-style-type: none"> Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided. The severity of the vegetation clearance can be mitigated if only a service road would be cleared and a vegetative groundlayer would be retained in the rest of the servitude. Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns. This includes awareness as to remaining within demarcated construction areas, no littering, handling of pollution and chemical spills, avoiding fire hazards and minimising wildlife interactions. Ensure that all temporary use areas e.g. laydown areas and construction camp, are located in areas of low sensitivity. Footprints of the pylons, roads and substation locations should be clearly demarcated. Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided. Watercourses, wetlands, rocky outcrops/sheets should be avoided (Habitats 1 & 7). Observe buffer zones along drainage lines (see Environmental Impact Report of aquatic specialist). All vehicles are to remain on demarcated roads and no driving through the veld should be allowed. The ECO is to provide supervision on vegetation clearing activities and other 	Low - 4	Medium
	Spatial Extent	Site specific			
	Duration	Medium term			
	Consequence	Moderate (considering entire site)			
	Probability	Likely			
	Reversibility	Moderate			
	Irreplaceability	Low			

				<p>activities that may cause damage to the environment.</p> <ul style="list-style-type: none"> No plants may be translocated or otherwise uprooted or disturbed without the applicable permit and ECO oversight. 		
The loss of threatened, protected & endemic plant and animal species	Status	Negative	Very Low	<ul style="list-style-type: none"> Placement of infrastructure should be done in such a way as to minimise the impact on protected species. The construction crew should undergo environmental training (induction) to make them aware of the importance of protected species. 	Very low - 5	Medium
	Spatial Extent	Site specific				
	Duration	Long-term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	Low				
Irrreplaceability	Moderate					
Loss of faunal habitat	Status	Negative	Low	<ul style="list-style-type: none"> Vegetation clearance should be confined to the smallest possible footprint of the development and unnecessary clearance should be avoided. Construction crew should undergo environmental training (induction) to increase their awareness of environmental concerns. Speed limits should be set on all roads and strictly adhered to. Development should avoid watercourses, wetlands and rocky outcrops/sheets. Observe buffer zones along drainage lines. 	Low - 4	Medium
	Spatial Extent	Site-specific				
	Duration	Long-term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
Irrreplaceability	Moderate					
Direct faunal mortalities	Status	Negative	Low	<ul style="list-style-type: none"> Construction crew, in particular the drivers, should undergo environmental training to increase their awareness of environmental concerns in order to reduce the number of kills during construction and on roads. The crew should also be made aware of not harming or collecting species such as snakes, tortoises and owls. Proper waste management procedures should be in place to avoid litter, food or other foreign material from lying around and all waste material should be removed from the site. Speed limits should be set on all roads on site. Personnel should not be allowed to roam into the veld. Ensure that cabling and electrical infrastructure at the site are buried sufficiently deeply to avoid being excavated by fauna and that where such infrastructure emerges above-ground that it is sufficiently protected from gnawing animals. Any dangerous fauna (e.g. snakes, scorpions) that are encountered during construction should not be handled or harmed by construction staff and the ECO (or other suitably qualified person) should be contacted to remove the animals to safety. Holes and trenches should not be left open for extended periods of time and should only be dug when needed for immediate construction. Trenches that may stand open for some days, should have an escape ramp to allow any fauna that fall in to escape. If there is any part of the site that needs to be lit at night for security reasons, 	Very low - 5	Medium
	Spatial Extent	Site specific				
	Duration	Short-term				
	Consequence	Slight				
	Probability	Likely				
	Reversibility	Low				
Irrreplaceability	Moderate					

				<p>then appropriate lighting should be installed to minimise negative effects on nocturnal animals.</p> <ul style="list-style-type: none"> Should electrical fences be erected it must be done according to the norms and standards of the Nature Conservation Authorities in Mpumalanga. Access to the site should be regulated to reduce opportunities for poaching. 		
Increased dust deposition	Status	Negative	Very low	<ul style="list-style-type: none"> Excessive dust can be reduced by spraying water onto the soil. 	Very low - 5	High
	Spatial Extent	Site specific				
	Duration	Short-term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
Irreplaceability	-					
Increased human activity and noise	Status	Negative	Moderate	<ul style="list-style-type: none"> The SANS standards should be adhered to in terms of noise levels. No construction should be done at night. 	Low - 4	High
	Spatial Extent	Site specific				
	Duration	Short-term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	High				
Irreplaceability	-					

(b) Indirect impacts

<i>Impact</i>	<i>Impact Criteria (after mitigation)</i>		<i>Significance and Ranking (Pre-Mitigation)</i>	<i>Potential mitigation measures</i>	<i>Significance and Ranking (Post-Mitigation)</i>	<i>Confidence Level</i>
CONSTRUCTION PHASE: INDIRECT IMPACTS						
Establishment of alien vegetation	Status	Negative	Low	<ul style="list-style-type: none"> Implement a monitoring program for the early detection of alien invasive plant species. A control program should be employed to combat declared alien invasive plant species in the most environmentally friendly manner that does not result in undesirable secondary impacts. Herbicides for the control of alien species should be applied according to the relevant instructions and by appropriately trained personnel. No alien species should be used in rehabilitation or landscaping. Use only plants and seed collected on-site for revegetation. Cleared areas may need to be fenced-off during rehabilitation to exclude livestock and wildlife. Material brought onto site e.g. building sand should be regularly checked for the germination of alien species. 	Very Low - 4	Medium
	Spatial Extent	Local				
	Duration	Long-term				
	Consequence	Slight				
	Probability	Likely				
	Reversibility	Moderate				
Irreplaceability	Low					

Table 7: Summary assessment of (a) direct and (b) indirect impacts and their mitigation measures during the operational phase

(a) Direct impacts

<i>Impact</i>	<i>Impact Criteria (after mitigation)</i>	<i>Significance and Ranking (Pre-Mitigation)</i>	<i>Potential mitigation measures</i>	<i>Significance and Ranking (Post-Mitigation)</i>	<i>Confidence Level</i>
OPERATIONAL PHASE: DIRECT IMPACTS					
Refer to avifaunal assessment.					

(b) Indirect impacts

<i>Impact</i>	<i>Impact Criteria (after mitigation)</i>	<i>Significance and Ranking (Pre-Mitigation)</i>	<i>Potential mitigation measures</i>	<i>Significance and Ranking (Post-Mitigation)</i>	<i>Confidence Level</i>	
OPERATIONAL PHASE: INDIRECT IMPACTS						
Establishment of alien vegetation	Status	Negative	Low	<ul style="list-style-type: none"> Implement a monitoring program for the early detection of alien invasive plant species and a control program to combat declared alien invasive plant species should be employed. No alien species should be used for landscaping, rehabilitation or any other purpose. Clearing of alien species should be done on a regular basis. 	Very low - 5	Medium
	Spatial Extent	Local				
	Duration	Long-term				
	Consequence	Slight				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	Low				

Table 8: Summary assessment of (a) direct and (b) indirect impacts and their mitigation measures during the decommissioning phase

(a) Direct impacts

<i>Impact</i>	<i>Impact Criteria (after mitigation)</i>	<i>Significance and Ranking (Pre-Mitigation)</i>	<i>Potential mitigation measures</i>	<i>Significance and Ranking (Post-Mitigation)</i>	<i>Confidence Level</i>	
DECOMMISSIONING PHASE: DIRECT IMPACTS						
Increased dust deposition	Status	Negative	Low	<ul style="list-style-type: none"> Excessive dust can be reduced by spraying water onto the soil. 	Very low - 5	High
	Spatial Extent	Site specific				
	Duration	Short-term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	-				
Direct faunal mortalities	Status	Negative	Very low	<ul style="list-style-type: none"> Decommissioning crew should undergo environmental training to increase their awareness of environmental concerns. Speed limits should be adhered to. Proper waste management procedures should be in place and no material should be left on site in order to prevent instances of ensnarement or ingestion of foreign material. 	Very low - 5	Medium
	Spatial Extent	Site specific				
	Duration	Short-term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	Moderate				
	Irreplaceability	Low				

(b) Indirect impacts

<i>Impact</i>	<i>Impact Criteria (after mitigation)</i>	<i>Significance and Ranking (Pre-Mitigation)</i>	<i>Potential mitigation measures</i>	<i>Significance and Ranking (Post-Mitigation)</i>	<i>Confidence Level</i>	
DECOMMISSIONING PHASE: INDIRECT IMPACTS						
Establishment of alien vegetation	Status	Negative	Low	<ul style="list-style-type: none"> Implement a monitoring program for at least three years after decommissioning to document vegetation recovery and alien infestation across the site. A control program to combat declared alien invasive plant species should be employed. 	Very low - 5	Medium
	Spatial Extent	Local				
	Duration	Long-term				
	Consequence	Slight				
	Probability	Likely				
	Reversibility	Moderate				
	Irreplaceability	Low				

				<ul style="list-style-type: none"> • Areas where infrastructure are removed, must be revegetated with indigenous plant species. • No alien species should be used for rehabilitation/revegetation or any other purpose. 		
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Table 9: Summary assessment of cumulative impacts

Impact	Impact Criteria (after mitigation)		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
Loss of vegetation, habitat and threatened species	Status	Negative	Moderate	<ul style="list-style-type: none"> • All projects should adhere to the site-specific recommendations of the ecologists to ensure that impacts are mitigated where possible. • Placement of infrastructure should be done in such a way that no SCC are affected and CBAs avoided. • Positioning of the pylons in the most environmentally responsible manner is crucial. • Maintain a vegetation ground layer along the roads in the servitude. 	Low - 4	Medium
	Spatial Extent	Regional				
	Duration	Long-term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
Irreplaceability	Low					
Compromising integrity of CBA, ESA and NPAES	Status	Negative	Moderate	<ul style="list-style-type: none"> • Placement of infrastructure should strive to avoid CBAs. • Minimise the development footprint as far as possible. • Maintain a vegetation ground layer in the gridline servitude. • Stringent construction-phase monitoring of activities at the site to ensure that mitigation measures are adhered to and that the overall ecological impact of the development is maintained at a low level. • Align roads and other infrastructure so that transformation within the CBAs is minimised. 	Low – 4	Medium
	Spatial Extent	Regional				
	Duration	Long-term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Low to Moderate				
Irreplaceability	Low					
Reduced ability to meet conservation obligations & targets	Status	Negative	Moderate	<ul style="list-style-type: none"> • Minimise the development footprint as far as possible. • Avoid highly sensitive areas and CBAs. 	Low – 4	Medium
	Spatial Extent	Regional				
	Duration	Long-term				
	Consequence	Moderate				
	Probability	Likely				
	Reversibility	Moderate				
Irreplaceability	Low					
Loss of landscape connectivity and disruption of broad-scale ecological processes	Status	Negative	Low	<ul style="list-style-type: none"> • Minimising the development footprint wherever possible. • Revegetation of all cleared and bare areas created by the facility with local plant species. • Fences and other structures which impede faunal movement should be avoided. • Roads should not have steep curbs. 	Low - 4	Medium
	Spatial Extent	Regional				
	Duration	Long-term				
	Consequence	Moderate				
	Probability	Unlikely				
	Reversibility	Moderate				
Irreplaceability	Low					

Table 10: Overall Impact Significance (Post Mitigation)

Phase	Overall Impact Significance after mitigation
Construction	Low to Very low
Operational	Very low
Decommissioning	Very low
Cumulative	Low

14. LEGISLATIVE AND PERMIT REQUIREMENTS

The following legislation is relevant to the development and may require permits from the relevant authority.

14.1 National Forest Act (Act No. 84 of 1998)(NFA 2021)

The National Forest Act provides for the protection of forests, as well as for specific tree species. In the case where a protected tree would have to be destroyed by the development an application for a license would have to be made. However, **no protected trees**, according to the protected tree list (NFA 2021), were observed and it is unlikely that any such species occur within the development footprint.

14.2 National Environmental Management: Biodiversity Act (Act No. 10 of 2004)(ToPS list)(NEMBA 2007c)

The NEMBA ToPS list deals with endangered, threatened and otherwise controlled species, under the ToPS Regulations (Threatened or Protected Species Regulations). A ToPS permit is required for any activities involving a ToPS listed species.

No threatened or protected plant species (ToPS; NEMA 2007c) were recorded during the Impumelelo site survey, thus none of the ToPs listed plant species are expected to be negatively affected by the development.

The following protected threatened or protected **faunal species** (ToPS) are listed for the general region:

Mammals:

<i>Aonyx capensis</i>	African Clawless otter	Protected
<i>Atelerix frontalis</i>	Southern African hedgehog	Protected
<i>Connochaetes gnou</i>	Black wildebeest	Protected
<i>Felis nigripes</i>	Black-footed cat	Vulnerable
<i>Leptailurus serval</i>	Serval	Protected
<i>Ourebia ourebi</i>	Oribi	Endangered
<i>Panthera pardus</i>	Leopard	Vulnerable
<i>Vulpes chama</i>	Cape fox	Protected

The Southern African hedgehog and serval are likely to occur on site.

Reptiles:

The giant girdled lizard (*Smaug giganteus*), classified as Endangered in the NEMBA (2007c) ToPS list, is listed for the broader region on the ADU database, but was not highlighted by the Screening Tool nor listed in the MTPA database for the farms in the immediate vicinity of the Impumelelo site. Furthermore, according to Bates *et al.* (2014), the distribution of the giant girdled lizard does not include the Impumelo site. No individuals were recorded on site.

Amphibians:

None of the listed amphibians for the region are ToPS protected species.

14.3 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species.

Seven declared invasive alien species were noted on site. Currently alien species abundance at the site is low to moderate in places. Disturbance associated with the construction phase would encourage alien invasion and the alien invasive species would need to be cleared on a regular basis. No permitting would be required for such activities, but an alien invasive species control programme should be initiated. Invasive alien species (and their category) likely to occur on site as listed in Chapter 6 and Appendix B.

14.4 Mpumalanga Nature Conservation Act (No. 10 of 1998)(MNCA 1998) – permit requirements

The Mpumalanga Tourism and Parks Agency (MTPA) is the regulatory authority in Mpumalanga for the issuing of permits for fauna, flora, hunting and CITES.

14.4.1 Flora (see Appendix B):

Subject to some of the provisions in terms of Schedule 11 Protected plants and Schedule 12 Specially Protected plants of the Mpumalanga Nature Conservation Act (No. 10 of 1998) (Chapter 6):

- No person shall pick a Protected plant without a permit.
- No person shall pick an indigenous plant in a nature reserve without a permit.
- No person shall pick an indigenous plant on a public road, land next to a public road or within a distance of 100 meters from the centre of the road without a permit.
- No person shall pick an indigenous plant which is not a Protected plant or Specially Protected plant on land which he or she is not the owner or occupier.
- No person shall donate, sell, export or remove from the Province a Protected plant without a permit.
- No person shall possess, pick, sell, purchase, donate or receive as a donation, import or export or remove from the Province a Specially Protected plant without a permit.

Schedule 11: Protected Plants (Section 69(1)(a) of the MNCA 1998)

A total of thirty (30) plant species are listed as Schedule 11 Protected plant species in the region according to the MNCA (1998) (Appendix B). Most of these species are members of the Amaryllidaceae and Orchidaceae. Twelve Protected plant species (Schedule 11) were recorded during the survey of the three Enertrag sites in December 2021 of which nine species were recorded on Impumelelo.

The 12 species recorded on all three Enertrag sites:

<i>Aloe ecklonis</i>	<i>Gladiolus crassifolius</i>
<i>Aloe transvaalensis</i>	<i>Gladiolus dalenii</i>
<i>Boophone disticha</i>	<i>Gladiolus robertsoniae</i>
<i>Crinum bulbispermum</i>	<i>Haemanthus humilis</i>
<i>Cyrtanthus stenanthus</i>	<i>Haemanthus sp.</i>
<i>Eucomis autumnalis</i>	<i>Huernia hystrix</i>

Another five species are on the Mpumalanga Red list although not included in the MNCA (1998) list for Mpumalanga:

<i>Drimia angustifolia</i>	LC
<i>Hypoxis hemerocallidea</i>	LC
<i>Khadia beswickii</i>	VU
<i>Nerine gracilis</i>	VU
<i>Trachyandra erythrorrhiza</i>	NT

Schedule 12: Specially Protected Plants (Section 69(1)(b) of the MNCA 1998)

No Schedule 12 plant species are listed or were recorded during the site survey.

Schedule 13: Invader weeds and plants (MNCA 1998)

Six Schedule 13 species were recorded on site (Appendix B). No person shall possess, sell, purchase, donate or receive as a donation, convey, import or cultivate a Schedule 13 declared invader weed or plant without a permit.

14.4.2 Fauna (see Appendix C)

Schedule 1: Specially Protected Game (Section 4 (1)(a) of MNCA 1998)

No Schedule 1 species are listed or were recorded on site during the site survey.

Schedule 2: Protected Game (Section 4 (1)(a) of MNCA 1998)

Under the provincial Act (MNCA 1998), the majority of mammals, reptiles and amphibians are listed as Schedule 2: Protected Game (see Appendix C). Three species (steenbok, Southern African hedgehog and serval) were recorded on site or confirmed by the landowners for Impumelelo (Appendix C).

Schedule 3: Ordinary Game (Section 4(1)(c) of MNCA 1998)

Three species (springbok, blesbok and scrub hare) were recorded on site or confirmed by the landowners for Impumelelo (Appendix C).

Schedule 4: Protected Wild Animals (Section 4(1)(d) of MNCA 1998)

No species were recorded on site (Appendix C).

Schedule 5: Wild Animals to which Section 33 apply (MNCA 1998)

Provisions of Section 33 apply (MNCA 1998): No person shall import into the province, keep, possess, sell, purchase, donate or receive as a donation or convey a Schedule 5 live wild animal without a permit. Five species were recorded on site or confirmed by the landowners (Appendix C): serval, Egyptian mongoose, yellow mongoose, slender mongoose, common genet, meerkat, springhare, civet and rinkhals.

Schedule 6: Exotic Animals to which the provisions of Section 34 apply (MNCA 1998)

Provisions of Section 34 apply (MNCA 1998): No person shall keep, possess, sell, donate or receive as a donation or convey a Schedule 6 live exotic animal without a permit. No species were recorded on site (Appendix C).

Schedule 7: Invertebrates (Section 35 (1) of the MNCA 1998)

Provisions of Section 35(1) apply (MNCA 1998): No person shall collect, catch, kill, keep, purchase, sell, donate or receive as a donation, convey, import or export a Schedule 7 invertebrate without a permit.

Schedule 8: Problem Animals (Section 44(1) of the MNCA 1998)

One species (black-backed jackal) was recorded on site (Appendix C).

No permits are required for animal species since none should be harmed by the development.

14.5 CITES (Convention on the International Trade in Endangered Species of Wild Fauna and Flora)

South Africa is a signatory to CITES and as such must comply with the import, export and re-export procedure as stipulated by CITES. MTPA is the CITES Management and Scientific Authority for exports out of and imports into the respective province from or to other countries. Therefore no person shall import into or export or remove from the Province an endangered species or a rare species, unless he is the holder of a permit which authorises him to do so. No permits are required for animal species since none should be harmed by the development on Impumelelo.

The following species listed for the broader region on the ADU database are CITES listed fauna (Appendix C):

Fauna:

Mammal:	Serval	(CITES Appendix II)
Reptiles:	Giant girdled lizard	(CITES Appendix II)
	Common girdled lizard	(CITES Appendix II)

Flora:

Aloe transvaalensis, *Aloe ecklonis* and *Euphorbia clavarioides* were the only CITES listed plant species found during the surveys. Ten species of the Orchidaceae are also listed for the region.

15. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUT

Impact	Mitigation / Management Objectives	Mitigation / Management actions	Monitoring		
			Methodology	Frequency	Responsibility
A. IMPACTS ON TERRESTRIAL BIODIVERSITY AND SPECIES					
A. DESIGN PHASE					
Potential impact on terrestrial biodiversity and species as a result of the proposed gridline.	Avoid or minimise impacts on terrestrial biodiversity and species on site regarding the placement of the infrastructure. Avoiding wetlands, rocky sheets and rocky outcrops will reduce the chances of loss of protected species. Avoid areas delineated as CBA.	Ensure that the placing of infrastructure takes the sensitivity mapping of the ecological assessment into account to avoid and reduce impacts on sensitive habitats and protected species. Avoid areas delineated as CBA.	Ensure that this is taken into consideration during the planning and design phase.	During design cycle and before construction commences.	Project Developer and Appointed Ecological Specialist.
B. CONSTRUCTION PHASE					
Clearance of vegetation	Confine vegetation clearance to footprint and minimise disturbance of adjacent areas.	Demarcate all infrastructure sites clearly to avoid unnecessary clearance of the vegetation. Permits have to be obtained for the removal of Mpumalanga protected species within the footprint of the development.	Ensure that mitigation measures are enforced.	Daily	The Environmental Control Officer (ECO) should monitor and report any incidents to the Holder of the EA
Impact on animal species	Avoid or minimise impacts that could potentially affect animal behaviour.	Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns. Holes and trenches should not be left open for long periods of time. These should be regularly inspected for the presence of trapped animals. Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site. Speed limits should be strictly adhered to.	Ensure compliance with these mitigation measures.	Daily	The ECO should monitor and report to the Holder of the EA.
Increased dust levels	Avoid or minimise increased dust levels.	Dust control measures should be implemented.	Ensure that dust control measures are in place.	Daily	The ECO should monitor and report to the Holder of the EA.
Alien species invasion	Avoid invasion by alien species.	Implement a monitoring program for the early detection of alien invasive plant species. Employ a control program to combat declared alien invasive plant species.	Ensure implementation of a control programme to combat alien invasive plants.	Daily	The ECO should monitor and report to the Holder of the EA.
C. OPERATIONAL PHASE					

Impact	Mitigation / Management Objectives	Mitigation / Management actions	Monitoring		
			Methodology	Frequency	Responsibility
Impact on animal species	Avoid or minimise impacts that could potentially affect animal behaviour.	Proper waste management procedures should be put in place.	Ensure compliance with these mitigation measures.	Monthly	The ECO should monitor and report to the Holder of the EA.
Alien species invasion	Avoid invasion by alien species.	Implement a monitoring program for the early detection of alien invasive plant species and employ a control program to combat declared alien invasive plant species.	Ensure implementation of a monitoring and control programme to combat alien invasive plants.	Every three months	The ECO should monitor and report to the Holder of the EA.
C. DECOMMISSIONING PHASE					
Clearance of vegetation	Minimise disturbance and clearance of vegetation.	Unnecessary clearance of natural vegetation should be avoided.	Ensure that mitigation measures are enforced.	Every three months	The ECO should monitor and report to the Holder of the EA.
Impact on animal behaviour	Avoid or minimise impacts that could potentially affect animal behaviour.	Proper waste management procedures should be put in place.	Ensure compliance with these mitigation measures.	Monthly	The ECO should monitor and report to the Holder of the EA.
Alien species invasion	Avoid invasion by alien species.	Implement a monitoring program for the early detection of alien invasive plant species and employ a control program to combat declared alien invasive plant species.	Ensure implementation of a monitoring and control programme to combat alien invasive plants.	Every three months	The ECO should monitor and report to the Holder of the EA.

16. SUMMARY OF ISSUES IDENTIFIED DURING THE PUBLIC PARTICIPATION PROCESS

To be completed after comments have been received from Stakeholders during the Public Consultation Phase

17. Final Specialist Statement and Authorisation Recommendation

Our findings related to the Terrestrial Ecology and Species are the following:

Provided the positioning of gridline infrastructure takes sensitive habitats, CBAs and Highveld Wetlands into consideration, the resulting low sensitivity rating and low impact significance for many of the habitats means the project could go ahead, provided all mitigation measures and management actions proposed to conserve protected fauna and flora on the site, are complied with. **We thus recommend authorisation of the project provided all mitigation measures are implemented.**

A brief summary of the most important considerations is provided below:

Vegetation and flora:

- **Vegetation types:** The Soweto Highveld Grassland vegetation type is listed as “Vulnerable” and consequently the layout of the wind and gridline infrastructure should give preference to the habitats on site where past disturbance has occurred e.g. disturbed areas, cultivated cropland or abandoned cropland. The threat status of the vegetation type will not be affected if the development occurs in areas of past disturbance.
- **Threatened plant species:** No IUCN threatened or red-listed plant species were encountered during the field survey.
- **Near Threatened Species:** *Gladiolus robertsoniae* was recorded in Habitat 1. Substation 1 (SS1) falls in Habitat 1 (medium sensitivity) and should be relocated if possible.
- **Screening Tool:** None of the plant species highlighted by the Screening Tool were encountered on site.
- **Protected plant species:** No ToPS plant species or nationally protected tree species were recorded on site. A number of Mpumalanga protected species were recorded on site, but none with a threatened IUCN status.
- **CITES:** Two CITES listed species occur on the Impumelelo WEF site, i.e. *Aloe transvaalensis* and *Euphorbia clavarioides*.
- **Habitats:** Three of the five habitats along the gridline had a low sensitivity rating with one habitats rated as of medium sensitivity, i.e. Habitat 1 (rocky sheets). The wetland habitat (Habitat 7) had a high sensitivity.
- **Overall sensitivity of plant theme based on the status of the habitats (plant communities):** Rated as **low** – provided some infrastructure is repositioned to habitats of low sensitivity, CBAs and highly sensitive habitats are avoided. The Soweto Highveld Grassland has a ‘Vulnerable’ threat status and to minimise the impact on the vegetation a ground cover should be maintained in the servitude along the gridline.

Fauna (avifaunal and bat component excluded):

- **Screening Tool:** The species that were highlighted by the Screening tool, included *Crocidura maquassiensis*, *Hydriectis maculicollis*, *Ourebia ourebi ourebi* and *Lepidochrysops procera*. None of these species were listed in the MTPA database for the farms participating in the proposed Impumelelo WEF development and none were encountered during the site visit. The Maquassie musk shrew *Crocidura maquassiensis* and *Lepidochrysops procera* are also not listed on the ADU database for the region. The Impumelelo site falls marginally within the distribution range of *Ourebia ourebi ourebi*, however it was not encountered during the site visit and also not reported as present by the landowners.
- **Threatened animal species:** The giant girdled lizard (*Smaug giganteus*), a reptile with a Vulnerable IUCN status occurs in the broader region. This species was however not highlighted by the Screening Tool, nor

was it recorded on site or listed as present in the MTPA databasis for farms in the immediate vicinity of the Impumelelo site. Furthermore, according to Bates *et al.* (2014), the distribution of the giant girdled lizard does not include the Impumelo site.

- **Near Threatened species:** Three Near Threatened mammal species are reported for the site according to the land owners, i.e. the serval *Leptailurus serval*; Southern African hedgehog *Atelerix frontalis* and the Southern African vlei rat *Otomys auratus*). None of these species were however highlighted by the Screening Tool as SCC.
- **Overall sensitivity of animal theme (avifaunal and bat components excluded):** This is rated as **medium**. If the suggested mitigation measures are followed the animal SCC should not be negatively affected.

Conservation:

- **Protected Areas:** The study area is not located in a protected area.
- **National Protected Areas Expansion Strategy (NPAES):** The development will not interfere with the protected areas expansion strategy according to the NPAES spatial data of 2010 and it is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA).
- **Critical Biodiversity Areas (CBAs):** Both the on-site substations are located partially or fully in CBAs and should be repositioned even though the habitat of substation 1 (SS1) had a medium sensitivity and substation 2 (SS2) had a low sensitivity in our current assessment (Figure 14). Large sections of the power line route have been delineated as CBAs. Pylon positions can largely be selected to avoid drainage lines. It should however be noted that the mapping of CBAs in the region is not always secure. For example, almost the entire Impumelelo mine has been mapped as part of a CBA1 (irreplaceable). Such gross inaccuracies leaves a question mark over the entire CBA mapping effort.
- **Ecological Support Areas (ESAs):** ESA Local corridors occur within the boundary of the Impumelelo gridline site. The gridline option 1 does not cross any ESAs, but the alternative route traverse ESAs. However, these areas had a low sensitivity rating in the current assessment and the gridline should not further degrade the landscape functionality.
- **Freshwater Ecosystem Priority Area (FEPA):** Although the entire site is classified as an upstream management area, the site assessment of the vegetation and the application of a sensitivity model rated most of the river FEPA area as being of low to medium sensitivity, with only the drainage lines having a high sensitivity.
- **Mpumalanga Highveld Wetlands:** Channelled valley-bottom wetlands, floodplain wetlands, seeps and dams were distinguished on site. These wetlands were largely incorporated into the delineation of the CBAs (refer to aquatic specialist report for wetlands).

Ecological processes, function and drivers:

- Overall, it is highly unlikely that the development will contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions.
- The disturbance caused by the construction of the infrastructure will inevitably create conditions favourable for invasion by alien species and thus a programme for the early detection as well as control of alien invasive plant species must be implemented.
- Fire is an important driver of vegetation dynamics in the Grassland Biome and can occur when the fuel load is high. To avoid damage to the infrastructure, fire will have to be suppressed. If the grass layer is regularly mowed/brush cut, it should prevent grasses from becoming moribund in the absence of fire, although regular mowing could affect seed set.

Significance of environmental impacts:

Overall the significance of the environmental impacts was rated as very low to low. In summary:

- Since the development footprint is expected to be relatively small, the loss of habitat within the Soweto

Highveld Grassland vegetation type will be fairly small. However, our impact assessment was based on the assumptions (i) only a service track would be cleared and a vegetative groundlayer would be retained beneath the rest of the servitude; and (ii) where the vegetation was destroyed at the pylon sites during construction, that it will be rehabilitated and allowed to recover. Beyond the permanent infrastructure footprint, environmental functions and processes should however, not be altered.

- **From an ecological point of view**, large portions of the site have been heavily modified (compare CBA map, Figure 12) and not prime examples of the Soweto Highveld Grassland. If the development is thus contained within the heavily or moderately modified areas it would not affect the status of the vegetation type since these modified area were already considered as lost for the allocation of a vulnerable status of the vegetation type.
- Habitat 7 was rated as highly sensitive and Habitat 1 was rated as medium sensitive in the current assessment. Optional substation 1 (SS1) is located in a medium sensitive habitat (Figure 14).
- Most of the habitats covered by the proposed infrastructure were rated as having a low sensitivity in the current assessment.
- None of the species highlighted by the screening tool were encountered on site, thus the impact on populations of threatened or protected species will be negligible if all mitigation measures are applied.
- Depending on the type of fencing to be erected at some of the infrastructure, the gridline will contribute minimally to obstruction of animal movement.

Key environmental mitigation and management actions proposed

- Ensure that the placing of infrastructure takes the sensitivity mapping of the ecological assessment into account to avoid and reduce impacts on species and habitats of conservation concern.
- Infrastructure should be micro-sited prior to approval of final layout to ensure that any sensitive areas are avoided.
- Demarcate all infrastructure sites clearly to avoid unnecessary clearance of the vegetation.
- Avoid or minimise impacts that could potentially affect animal behaviour.
- Trenches should not be left open for long periods of time. Trenches should regularly be inspected for the presence of trapped animals.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns.
- Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site.
- Speed limits should be strictly adhered to.
- Dust control measures should be implemented.
- Permits have to be obtained for the removal of Mpumalanga protected species.
- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species.

Preferred infrastructure locations

Gridline:

There is no preferred option regarding the gridline route. Large sections of the power line routes, especially in the south, have been delineated as CBAs.

Impumelelo on-site substation:

Both the on-site substations are located partially or fully in CBAs and should be repositioned even though the habitat of substation 1 (SS1) had a medium sensitivity and substation 2 (SS2) had a low sensitivity in our current assessment (Figure 14).

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APPENDIX A

SYNOPTIC TABLE OF THE HABITATS
(PLANT COMMUNITIES)

Plant community/Habitat	1	2	3	4	5	6	7		
							7a	7b	7c
Species group 1									
<i>Euryops laxus</i>	5				1				
<i>Microchloa caffra</i>	5			1	1				
<i>Dipcadi ciliare</i>	5			1					
<i>Euphorbia inaequilatera</i>	5			1					
<i>Panicum repens</i>	5			1	1		1	3	
<i>Jamesbrittenia stricta</i>	5								
<i>Tragus berteronianus</i>	4								3
<i>Hermannia cf coccocarpa</i>	4			1	1				
<i>Colchicum striatum</i>	3								
<i>Oropetium capense</i>	3								
<i>Trachyandra saltii</i>	3								
<i>Gladiolus robertsoniae</i>	2								
<i>Huernia hystrix</i>	2								
<i>Sporobolus discosporus</i>	2								
<i>Albucca sp. 1</i>	2								
<i>Cotula sp.</i>	2								
Species group 2									
<i>Kohautia amatymbica</i>		3							
<i>Melinis repens</i>		3							
<i>Pellaea calomelanos</i>		2							
Species group 3									
<i>Cyperus rupestris</i>	4	3		1					
<i>Aristida diffusa</i>	3	5		1					
<i>Tulbaghia acutiloba</i>	3	2							
<i>Euphorbia clavarioides</i>	2	2		1	1				
Species group 4									
<i>Diospyros lycioides</i>		2	3						
<i>Ajuga ophrydis</i>			3						
<i>Tephrosia capensis</i>			3	1					
<i>Acalypha angustata</i>			3		1				
<i>Indigofera hiliaris</i>			2	1					
<i>Aloe ecklonis</i>			2	1					
<i>Tristachya biseriata</i>			3						
<i>Erythrina zeyheri</i>			2	1					
<i>Turbina oblongata</i>			3						
<i>Afrosciadium magalismontanum</i>			3						
<i>Eucomis autumnalis</i>			2						
<i>Polygala hottentotta</i>			2						
<i>Artemisia afra</i>			2						
<i>Ledebouria graminifolia</i>			2						
<i>Oxalis obliquifolia</i>			2						
Species group 5									
<i>Searsia rigida</i>		2	2						
<i>Ziziphus zeyheriana</i>		2	1						
<i>Senecio othonniflorus</i>		2	3	1	1				
<i>Euphorbia striata</i>		2	3	1				2	
Species group 6									
<i>Cymbopogon pospischilii</i>	2	4	1	2	1				
<i>Cyperus semitrifidus</i>	4	3		1	1				
<i>Felicia muricata</i>	2	5		1	1				
<i>Chaetacanthus costatus</i>	2			1					
<i>Heteropogon contortus</i>	1	2	1	1					

<i>Gazania krebsiana</i>	1	2	1	2			
Species group 7							
<i>Hibiscus microcarpus</i>			2	2			
<i>Hypoxis acuminata</i>			1	2	1		
<i>Hibiscus aethiopicus</i>			2	1			
<i>Asclepias</i> sp.			1	1	1		
<i>Rhynchosia adenodes</i>			2	1	1		
Species group 8							
<i>Dianthus mooiensis</i>			4	3	2	1	
<i>Hermannia depressa</i>			4	3	2	1	
<i>Eragrostis capensis</i>			3	3	2		
<i>Eragrostis racemosa</i>			5		1	1	
<i>Cynodon incompletus</i>			2	1	1	1	
<i>Helichrysum nudifolium</i>			2	2	1	1	
Species group 9							
<i>Scabiosa columbaria</i>			3	3	4	2	3 3
<i>Elionurus muticus</i>	1		5	2	3	2	
<i>Indigofera hedyantha</i>			3	2	3	2	
<i>Nemesia</i> cf. <i>umbonata</i>			2	3	3	1	1
<i>Helichrysum pilosellum</i>			2		4	1	
<i>Hilliardiella elaeagnoides</i>			4	3	2	1	
<i>Abildgaardia ovata</i>	1			1	3	1	
<i>Kyllinga erecta</i>				3	2	1	
<i>Crabbea acaulis</i>				1	2	1	
<i>Polygala amatymbica</i>				2	1	1	
<i>Hypoxis hemerocallidea</i>				1	1	1	
<i>Gladiolus crassifolius</i>				1	1	1	
Species group 10							
<i>Berkheya setifera</i>			1	4	5	4	3
<i>Helichrysum rugulosum</i>			1	5	5	4	3
<i>Ipomoea crassipes</i>			3	3	3	5	2
<i>Brachiaria serrata</i>			2	4	4	5	1
<i>Commelina africana</i>			4	3	5	2	2
<i>Hypoxis rigidula</i>			1	2	3	4	1
<i>Crassula lanceolata</i>			1	2	3	1	2
<i>Cyanotis speciosa</i>			3	3	3	2	1
<i>Geigeria burkei</i>			3	2		2	1
<i>Sonchus oleraceus</i>			1		2	1	2
<i>Eragrostis planiculmis</i>						3	1
<i>Gomphrena celosioides</i>			1	2	1	1	1
<i>Bulbine abyssinica</i>			2	2		1	1
<i>Setaria pumila</i>			1	3		1	1
<i>Hermannia grandistipula</i>			1	2	3	1	1
<i>Monsonia angustifolia</i>			3			1	1
<i>Selago densiflora</i>				2	2	2	1
Species group 11							
<i>Eragrostis chloromelas</i>			5	5	5	5	4
<i>Hyparrhenia hirta</i>			1	3	3	4	4
<i>Digitaria eriantha</i>			3		1	1	1
<i>Setaria sphacelata</i>			1	2	3	2	2
<i>Aristida bipartita</i>			1		1	1	3
Species group 12							
<i>Ischaemum fasciculatum</i>						3	3
<i>Andropogon appendiculatus</i>						2	4
<i>Fingerhuthia sesleriiformis</i>						2	2
<i>Trifolium pratense</i>			2	3	1	1	1
<i>Galium capense</i>				2	1	1	1
<i>Salix babylonica</i>						1	2
<i>Schizoglossum bidens</i>						1	3
Species group 13							
<i>Setaria incrassata</i>			2	2	5	4	4
<i>Asclepias stellifera</i>			1	3	4	4	3
<i>Chlorophytum fasciculatum</i>			3	3	2	5	3
<i>Jamesbrittenia aurantiaca</i>			2		2	4	3
<i>Salvia</i> sp.			1	2	3	2	2
<i>Ledebouria</i> cf. <i>revoluta</i>			3		2	2	2
<i>Hypoxis argentea</i>			3		2	1	2
Species group 14							
<i>Typha capensis</i>						1	5
<i>Phragmites australis</i>							5

<i>Senecio coronatus</i>	2						
<i>Hemizygia pretoriae</i>	2						
<i>Lessertia stricta</i>	2						
<i>Leobordea divaricata</i>		1	1	1			
<i>Oxalis corniculata</i>		1	1	1			
<i>Solanum nigrum</i>		2				1	
<i>Trachyandra asperata</i>		1	1		2		
<i>Solanum campylacanthum</i>		1	1				
<i>Gladiolus dalenii</i>		1	1				
<i>Xysmalobium undulatum</i>		1			2		
<i>Conyza albida</i>			1	1	2	1	
<i>Cyclospermum leptophyllum</i>			1	1		1	2
<i>Senecio sp.</i>			1	1			
<i>Helichrysum aureonitens</i>			1	1			
<i>Ruellia sp.</i>			1	1			
<i>Portulaca quadrifida</i>			1	1			
<i>Cuscuta campestris</i>			1	1	2		
<i>Datura ferox</i>			1			1	3
<i>Ruellia patula</i>			1				
<i>Galinsoga parviflora</i>			1	1			
<i>Vigna vexillata</i>			1			1	
<i>Senecio isatideus</i>			1			1	
<i>Trachyandra sp.</i>			1	1			
<i>Physalis viscosa</i>			1				3
<i>Ipomoea sp.</i>			1	1			
<i>Pennisetum clandestinum</i>				1	2	2	
<i>Amaranthus hybridus</i>				1		1	
<i>Wahlenbergia sp.</i>				1			
<i>Cyrtanthus stenanthus</i>				1			
<i>Ipomoea bathycolpos</i>				1			2
<i>Amaranthus sp.</i>				1			3
<i>Guilleminea densa</i>					2		
<i>Harpochloa falx</i>							2
<i>Veronica anagallis-aquatica</i>							2
<i>Haemanthus humilis</i>							2
<i>Leptochloa fusca</i>							2
<i>Ascolepis sp.</i>							3
<i>Cheilanthes sp.</i>	1						
<i>Crassula sp.</i>	1						
<i>Crassula cf. setulosa</i>	1						
<i>Eriospermum flagelliforme</i>	1						
<i>Portulaca hereroensis</i>	1						
<i>Corchorus asplenifolius</i>	1						
<i>Lapeirousia sp.</i>	1						
<i>Kohautia cynanchica</i>	1						
<i>Ledebouria sp.</i>	1						
<i>Chaenostoma calycina</i>	1						
<i>Eriospermum sp.</i>	1						
<i>Portulaca kermesina</i>	1						
<i>Chaenostoma sp.</i>	1						
<i>Aristida adscensionis</i>	1						
<i>Eragrostis inamoena</i>	1						
<i>Cyperus capensis</i>	1						
<i>Indigofera sp.</i>	1						
<i>Cynoglossum hispidum</i>		1					
<i>Gnidia sp.</i>		1					
<i>Tribulus terrestris</i>		1					
<i>Albica sp. 3</i>		1					
<i>Asparagus cooperi</i>		1					
<i>Berkheya pinnatifida</i>		1					
<i>Ledebouria cooperi</i>		1					
<i>Searsia magalismsontana</i>		1					
<i>Sphenostylis angustifolium</i>		1					
<i>Aster harveyanus</i>		1					
<i>Rhynchosia monophylla</i>		1					
<i>Vernonia glabra</i>		1					
<i>Athrixia elata</i>		1					
<i>Cephalaria zeyheriana</i>		1					
<i>Opuntia ficus-indica</i>		1					
<i>Pelargonium alchemilloides</i>		1					

<i>Thesium cf. goetzeanum</i>	1		
<i>Tragopogon dubius</i>	1		
<i>Ocimum obovatum</i>	1		
<i>Osteospermum muricatum</i>	1		
<i>Cannabis sativa</i>		1	
<i>Cymbopogon caesius</i>		1	
<i>Lotononis sp.</i>		1	
<i>Haplocarpha lyrata</i>		1	
<i>Verbena rigida</i>		1	
<i>Rhynchosia caribaea</i>		1	
<i>Chamaesyce hirta</i>		1	
<i>Pelargonium minimum</i>		1	
<i>Capsella bursa-pastoris</i>		1	
<i>Lolium perenne</i>		1	
<i>Blepharis integrifolia</i>		1	
<i>Eragrostis superba</i>		1	
<i>Plectranthu cf. madagascariensis</i>			1
<i>Seriphium plumosum</i>			1
<i>Hemizygia sp.</i>			1
<i>Becium species</i>			1
<i>Echinochloa colona</i>			1
<i>Panicum sp.</i>			1
<i>Indigofera sp.</i>			1
<i>Senecio consanguineus</i>			1
<i>Senna italica</i>			1
<i>Leucas sp.</i>			1
<i>Nidorella hottentotica</i>			1
<i>Pelargonium luridum</i>			1
<i>Haemanthus sp.</i>			1
<i>Panicum natalense</i>			1
<i>Trifolium cf. africanum</i>			1
<i>Cyperus sp.</i>			1
<i>Alternanthera sessilis</i>			1
<i>Schoenoplectus sp.</i>			1
<i>Oxalis sp.</i>			1

APPENDIX B

PLANT SPECIES CHECKLIST

¹Newposa list (SANBI)²Plants observed during January 2022 site survey³MBSP = Mpumalanga Biodiversity Sector Plan redlist⁴IUCN category⁵MBSP = Mpumalanga Biodiversity Sector Plan redlist status⁶MNCA (1998) Schedules⁷CITES = Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES 2020)⁸NAT = Naturalised alien species¹⁰AIS = Alien and invasive species

Family	Species	New Posa ¹	Current survey ²	MBSP ³	IUCN ⁴	MBSP status ⁵	MNCA ⁶	CITES ⁷	ToPS ⁸	Naturalised ⁹	IAS ¹⁰
Cyperaceae	<i>Abildgaardia ovata</i>		X		LC						
Fabaceae	<i>Acacia mearnsii</i>		X								1b
Euphorbiaceae	<i>Acalypha angustata</i>		X		LC						
Euphorbiaceae	<i>Acalypha caperonioides var. caperonioides</i>	X			DD						
Lamiaceae	<i>Aeollanthus buchnerianus</i>	X			LC						
Apiaceae	<i>Afroscidium magalismontanum</i>		X		LC						
Asparagaceae	<i>Agave americana</i>		X			Sch 13					
Lamiaceae	<i>Ajuga ophrydis</i>	X	X		LC						
Hyacinthaceae	<i>Albuca sp. 1</i>		X								
Hyacinthaceae	<i>Albuca sp. 2</i>		X								
Hyacinthaceae	<i>Albuca sp. 3 geel</i>		X								
Hyacinthaceae	<i>Albuca virens subsp. virens</i>	X			LC						
Orobanchaceae	<i>Alectra orobanchoides</i>	X			LC						
Asphodelaceae	<i>Aloe ecklonis</i>		X		LC	Sch 11	App II				
Asphodelaceae	<i>Aloe transvaalensis</i>		X		LC	Sch 11	App II				
Amaranthaceae	<i>Alternanthera sessilis</i>		X							Nat	
Amaranthaceae	<i>Amaranthus hybridus</i>		X							Nat	
Amaranthaceae	<i>Amaranthus sp.</i>		X							Nat	
Poaceae	<i>Andropogon appendiculatus</i>		X		LC						
Poaceae	<i>Andropogon schirensis</i>	X			LC						
Rubiaceae	<i>Anthospermum rigidum subsp. pumilum</i>	X			LC						
Asteraceae	<i>Arctotis arctotoides</i>		X		LC						
Fabaceae	<i>Argyrolobium campicola</i>	X			NT						
Poaceae	<i>Aristida adscensionis</i>	X	X		LC						
Poaceae	<i>Aristida bipartita</i>	X	X		LC						
Poaceae	<i>Aristida diffusa</i>		X		LC						
Poaceae	<i>Aristida sp.</i>		X								
Asteraceae	<i>Artemisia afra var. afra</i>	X	X		LC						
Poaceae	<i>Arundo donax</i>		X			Sch 13					1b
Apocynaceae	<i>Asclepias albens</i>	X			LC						
Apocynaceae	<i>Asclepias gibba var. gibba</i>	X	X		LC						
Apocynaceae	<i>Asclepias multicaulis</i>	X			LC						
Apocynaceae	<i>Asclepias sp.</i>		X								
Apocynaceae	<i>Asclepias stellifera</i>		X		LC						
Apocynaceae	<i>Ascolepis sp.</i>		X								
Asparagaceae	<i>Asparagus cooperi</i>		X		LC						
Asparagaceae	<i>Asparagus setaceus</i>	X			LC						
Apocynaceae	<i>Aspidoglossum lamellatum</i>	X			LC						
Aspleniaceae	<i>Asplenium adiantum-nigrum var. solidum</i>	X			LC						

Aspleniaceae	<i>Asplenium aethiopicum</i>	X			LC			
Asteraceae	<i>Aster harveyanus</i>		X		LC			
Asteraceae	<i>Athrix elata</i>		X		LC			
Lamiaceae	<i>Becium obovatum</i>		X		LC			
Lamiaceae	<i>Becium sp.</i>		X					
Asteraceae	<i>Berkheya pinnatifida</i>		X		LC			
Asteraceae	<i>Berkheya radula</i>		X		LC			
Asteraceae	<i>Berkheya setifera</i>		X		LC			
Asteraceae	<i>Bidens bipinnata</i>		X					Nat
Asteraceae	<i>Bidens pilosa</i>	X	X			Sch 13		Nat
Acanthaceae	<i>Blepharis integrifolia</i>		X		LC			
Orchidaceae	<i>Bonatea porrecta</i>	X			LC	Sch 11	App II	
Amaryllidaceae	<i>Boophone disticha</i>		X	X	LC	Dec	Sch 11	
Poaceae	<i>Brachiaria advena</i>	X						Nat
Poaceae	<i>Brachiaria eruciformis</i>	X			LC			
Poaceae	<i>Brachiaria serrata</i>		X		LC			
Apocynaceae	<i>Brachystelma foetidum</i>	X			LC		Sch 11	
Poaceae	<i>Bromus catharticus</i>		X					Nat
Asphodelaceae	<i>Bulbine abyssinica</i>		X		LC			
Asphodelaceae	<i>Bulbine capitata</i>	X			LC			
Cyperaceae	<i>Bulbostylis humilis</i>		X		LC			
Cannabaceae	<i>Cannabis sativa</i>		X					Nat
Brassicaceae	<i>Capsella bursa-pastoris</i>		X					Nat
Cyperaceae	<i>Carex glomerabilis</i>	X	X		LC			
Poaceae	<i>Catalepis gracilis</i>	X			LC			
Dipsacaceae	<i>Cephalaria zeyheriana</i>		X		LC			
Cactaceae	<i>Cereus jamacaru</i>		X			Sch 13		1b
Scrophulariaceae	<i>Chaenostoma calycina</i>		X		LC			
Scrophulariaceae	<i>Chaenostoma patrioticum</i>	X			LC			
Scrophulariaceae	<i>Chaenostoma sp.</i>		X					
Acanthaceae	<i>Chaetacanthus costatus</i>		X		LC			
Fabaceae	<i>Chamaecrista mimosoides</i>		X		LC			
Euphorbiaceae	<i>Chamaesyce hirta</i>		X		LC			
Pteridaceae	<i>Cheilanthes sp.</i>		X					
Poaceae	<i>Chloris virgata</i>	X			LC			
Agavaceae	<i>Chlorophytum cooperi</i>	X			LC			
Agavaceae	<i>Chlorophytum fasciculatum</i>		X		LC			
Asteraceae	<i>Cineraria geraniifolia</i>	X			LC			
Asteraceae	<i>Cirsium vulgare</i>		X			Sch 13		1b
Peraceae	<i>Clutia pulchella var. pulchella</i>	X			LC			
Colchicaceae	<i>Colchicum striatum</i>	X	X		LC			
Commelinaceae	<i>Commelina africana var. africana</i>	X	X		LC			
Convolvulaceae	<i>Convolvulus multifidus</i>	X			LC			
Convolvulaceae	<i>Convolvulus sagittatus</i>	X	X		LC			
Asteraceae	<i>Conyza albida</i>		X					Nat
Asteraceae	<i>Conyza podocephala</i>		X		LC			
Malvaceae	<i>Corchorus asplenifolius</i>		X		LC			
Apocynaceae	<i>Cordylogyne globosa</i>	X			LC			
Asteraceae	<i>Cosmos bipinnatus</i>	X	X					Nat
Asteraceae	<i>Cotula sp.</i>		X					
Acanthaceae	<i>Crabbea acaulis</i>		X		LC			
Crassulaceae	<i>Crassula cf. setulosa</i>		X		LC			
Crassulaceae	<i>Crassula lanceolata</i>		X		LC			
Crassulaceae	<i>Crassula sp.</i>		X					
Amaryllidaceae	<i>Crinum bulbispermum</i>		X	X	LC	DEC	Sch 11	
Amaryllidaceae	<i>Crinum graminicola</i>	X			LC		Sch 11	
Amaryllidaceae	<i>Crinum lugardiae</i>	X			LC		Sch 11	
Cucurbitaceae	<i>Cucumis hirsutus</i>	X			LC			
Cucurbitaceae	<i>Cucumis zeyheri</i>	X			LC			
Convolvulaceae	<i>Cuscuta campestris</i>		X			Sch 13		1b
Commelinaceae	<i>Cyanotis speciosa</i>		X		LC			

Cyperaceae	<i>Fimbristylis complanata</i>	X						LC	
Poaceae	<i>Fingerhuthia sesleriiformis</i>			X				LC	
Asteraceae	<i>Galinsoga parviflora</i>			X					Nat
Rubiaceae	<i>Galium capense</i>			X				LC	
Asteraceae	<i>Garuleum woodii</i>	X						LC	
Asteraceae	<i>Gazania krebsiana</i>			X				LC	
Asteraceae	<i>Gazania sp.</i>			X					
Asteraceae	<i>Geigeria burkei</i>			X				LC	
Asteraceae	<i>Geigeria burkei subsp. burkei var. burkei</i>	X						NE	
Asteraceae	<i>Geigeria burkei subsp. burkei var. zeyheri</i>	X						NE	
Iridaceae	<i>Gladiolus crassifolius</i>	X	X					LC	Sch 11
Iridaceae	<i>Gladiolus dalenii</i>			X				LC	Sch 11
Iridaceae	<i>Gladiolus elliotii</i>	X						LC	Sch 11
Iridaceae	<i>Gladiolus longicollis subsp. longicollis</i>	X						LC	Sch 11
Iridaceae	<i>Gladiolus robertsoniae</i>	X	X	x				NT	NT Sch 11
Thymelaeaceae	<i>Gnidia gymnostachya</i>	X						LC	
Thymelaeaceae	<i>Gnidia sp.</i>			X					
Apocynaceae	<i>Gomphocarpus fruticosus subsp. fruticosus</i>	X	X					LC	
Apocynaceae	<i>Gomphocarpus rivularis</i>	X						LC	
Amaranthaceae	<i>Gomphrena celosioides</i>			X					Nat
Malvaceae	<i>Grewia flava</i>	X						LC	
Amaranthaceae	<i>Guilleminia densa</i>			X					Nat
Orchidaceae	<i>Habenaria barbertoni</i>	X		x				NT	NT Sch 11 App II
Orchidaceae	<i>Habenaria epipactidea</i>	X						LC	Sch 11 App II
Amaryllidaceae	<i>Haemanthus humilis</i>			X				LC	Sch 11
Amaryllidaceae	<i>Haemanthus montanus</i>	X						LC	Sch 11
Amaryllidaceae	<i>Haemanthus sp.</i>			X					Sch 11
Asteraceae	<i>Haplocarpha lyrata</i>	X	X					LC	
Asteraceae	<i>Haplocarpha scaposa</i>			X				LC	
Poaceae	<i>Harpochloa falx</i>	X	X					LC	
Asteraceae	<i>Helichrysum aureonitens</i>			X				LC	
Asteraceae	<i>Helichrysum lepidissimum</i>	X						LC	
Asteraceae	<i>Helichrysum nudifolium</i>			X				LC	
Asteraceae	<i>Helichrysum pilosellum</i>			X				LC	
Asteraceae	<i>Helichrysum rugulosum</i>			X				LC	
Poaceae	<i>Trisetopsis imberbis</i>			X				LC	
Lamiaceae	<i>Hemizygia pretoriae</i>			X				LC	
Lamiaceae	<i>Hemizygia sp.</i>			X					
Malvaceae	<i>Hermannia coccocarpa</i>	X	X					LC	
Malvaceae	<i>Hermannia cristata</i>	X						LC	
Malvaceae	<i>Hermannia depressa</i>			X				LC	
Malvaceae	<i>Hermannia erodioides</i>			X				LC	
Malvaceae	<i>Hermannia grandistipula</i>			X				LC	
Poaceae	<i>Heteropogon contortus</i>			X				LC	
Malvaceae	<i>Hibiscus aethiopicus</i>			X				LC	
Malvaceae	<i>Hibiscus microcarpus</i>			X				LC	
Malvaceae	<i>Hibiscus trionum</i>	X	X						Nat
Asteraceae	<i>Hilliardiella elaeagnoides</i>			X				LC	
Apocynaceae	<i>Huernia hystrix</i>			X				LC	Sch 11
Poaceae	<i>Hyparrhenia anamesa</i>	X						LC	
Poaceae	<i>Hyparrhenia hirta</i>			X				LC	
Poaceae	<i>Hyparrhenia tamba</i>			X				LC	
Hypoxidaceae	<i>Hypoxis acuminata</i>	X	X					LC	
Hypoxidaceae	<i>Hypoxis argentea</i>			X				LC	
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>			X	X			LC	DEC
Hypoxidaceae	<i>Hypoxis rigidula</i>			X				LC	
Hypoxidaceae	<i>Hypoxis rigidula var. rigidula</i>	X						LC	
Poaceae	<i>Imperata cylindrica</i>			X				LC	
Fabaceae	<i>Indigofera dregeana</i>	X						LC	
Fabaceae	<i>Indigofera hedyantha</i>	X	X					LC	
Fabaceae	<i>Indigofera hilaris</i>			X				LC	

Fabaceae	<i>Indigofera sp.</i>		X					
Fabaceae	<i>Indigofera sp.</i>		X					
Convolvulaceae	<i>Ipomoea bathycolpos</i>		X		LC			
Convolvulaceae	<i>Ipomoea bolusiana</i>		X		LC			
Convolvulaceae	<i>Ipomoea crassipes</i>		X		LC			
Convolvulaceae	<i>Ipomoea oblongata</i>	X			LC			
Convolvulaceae	<i>Ipomoea sp.</i>		X					
Poaceae	<i>Ischaemum fasciculatum</i>		X		LC			
Scrophulariaceae	<i>Jamesbrittenia aurantiaca</i>		X		LC			
Scrophulariaceae	<i>Jamesbrittenia stricta</i>		X		LC			
Aizoaceae	<i>Khadia beswickii</i>			X	VU	VU		
Asphodelaceae	<i>Kniphofia typhoides</i>			X	NT	NT	Sch 11	
Poaceae	<i>Koeleria capensis</i>	X			LC			
Rubiaceae	<i>Kohautia amatymbica</i>		X		LC			
Rubiaceae	<i>Kohautia cynanchica</i>		X		LC			
Cyperaceae	<i>Kyllinga erecta</i>		X		LC			
Asteraceae	<i>Lactuca inermis</i>		X					Nat
Iridaceae	<i>Lapeirousia sp.</i>		X					
Asteraceae	<i>Launaea rarifolia var. rarifolia</i>	X			LC			
Hyacinthaceae	<i>Ledebouria burkei subsp. burkei</i>	X			LC			
Hyacinthaceae	<i>Ledebouria cf. minima</i>		X		LC			
Hyacinthaceae	<i>Ledebouria cf. revoluta</i>		X		LC			
Hyacinthaceae	<i>Ledebouria cooperi</i>		X		LC			
Hyacinthaceae	<i>Ledebouria graminifolia</i>		X		LC			
Hyacinthaceae	<i>Ledebouria sp.</i>		X					
Poaceae	<i>Leersia hexandra</i>		X		LC			
Fabaceae	<i>Leobordea divaricata</i>	X	X		LC			
Fabaceae	<i>Leobordea mucronata</i>	X			LC			
Brassicaceae	<i>Lepidium africanum</i>		X		LC			
Poaceae	<i>Leptochloa fusca</i>		X		LC			
Fabaceae	<i>Lessertia stricta</i>		X		LC			
Lamiaceae	<i>Leucas sp.</i>		X		LC			
Poaceae	<i>Lolium perenne</i>		X					Nat
Fabaceae	<i>Lotononis sp.</i>		X					
Fabaceae	<i>Medicago laciniata var. laciniata</i>	X			NE			Nat
Poaceae	<i>Melinis nerviglumis</i>	X			LC			
Poaceae	<i>Melinis repens</i>		X		LC			
Fabaceae	<i>Melolobium calycinum</i>	X	X		LC			
Lamiaceae	<i>Mentha longifolia</i>		X		LC			
Poaceae	<i>Microchloa caffra</i>		X		LC			
Geraniaceae	<i>Monsonia angustifolia</i>		X		LC			
Brassicaceae	<i>Nasturtium officinale</i>		X					Nat
Scrophulariaceae	<i>Nemesia cf. umbonata</i>		X		LC			
Amaryllidaceae	<i>Nerine graciis</i>			X	VU	NT		
Amaryllidaceae	<i>Nerine krigei</i>	X			LC			
Asteraceae	<i>Nidorella hottentotica</i>		X		LC			
Asteraceae	<i>Nidorella resedifolia subsp. resedifolia</i>	X			LC			
Asteraceae	<i>Nolletia jeanettae</i>	X			LC			
Onagraceae	<i>Oenothera rosea</i>		X					Nat
Onagraceae	<i>Oenothera tetraptera</i>	X	X					Nat
Cactaceae	<i>Opuntia ficus-indica</i>		X				Sch 13	1b
Apocynaceae	<i>Orbea cooperi</i>	X			LC		Sch 11	
Poaceae	<i>Oropetium capense</i>		X		LC			
Orchidaceae	<i>Orthochilus leontoglossus</i>	X			LC		Sch 11	App II
Asteraceae	<i>Osteospermum muricatum</i>		X		LC			
Oxalidaceae	<i>Oxalis corniculata</i>		X					Nat
Oxalidaceae	<i>Oxalis obliquifolia</i>		X		LC			
Oxalidaceae	<i>Oxalis sp.</i>		X					
Poaceae	<i>Panicum natalense</i>		X		LC			
Poaceae	<i>Panicum repens</i>		X		LC			
Poaceae	<i>Panicum sp.</i>		X					

Poaceae	<i>Paspalum dilatatum</i>		X	LC		
Poaceae	<i>Paspalum distichum</i>	X		LC		Nat
Geraniaceae	<i>Pelargonium alchemilloides</i>		X	LC		
Geraniaceae	<i>Pelargonium luridum</i>	X	X	LC		
Geraniaceae	<i>Pelargonium minimum</i>		X	LC		
Pteridaceae	<i>Pellaea calomelanos</i>		X	LC		
Poaceae	<i>Pennisetum clandestinum</i>		X	LC		
Polygonaceae	<i>Persicaria lapathifolia</i>		X			Nat
Poaceae	<i>Phragmites australis</i>		X	LC		
Phyllanthaceae	<i>Phyllanthus parvulus var. garipensis</i>	X		LC		
Solanaceae	<i>Physalis viscosa</i>		X			Nat
Plantaginaceae	<i>Plantago lanceolata</i>		X	LC		
Lamiaceae	<i>Plectranthus cf. madagascariensis</i>		X	LC		
Lamiaceae	<i>Plectranthus ramosior</i>	X		LC		
Polygalaceae	<i>Polygala amatymbica</i>		X	LC		
Polygalaceae	<i>Polygala hottentotta</i>		X	LC		
Poaceae	<i>Polypogon viridis</i>	X				Nat
Portulacaceae	<i>Portulaca hereroensis</i>		X	LC		
Portulacaceae	<i>Portulaca kermesina</i>		X	LC		
Portulacaceae	<i>Portulaca quadrifida</i>		X	LC		
Potamogetonaceae	<i>Potamogeton thunbergii</i>		X	LC		
Rosaceae	<i>Prunus persica</i>		X			Alien
Molluginaceae	<i>Psammotropha myriantha</i>	X		LC		
Asteraceae	<i>Pseudognaphalium luteo-album</i>		X	LC		
Orchidaceae	<i>Pterygodium nigrescens</i>	X		LC	Sch 11	App II
Cyperaceae	<i>Pycneus cooperi</i>	X		LC		
Ranunculaceae	<i>Ranunculus multifidus</i>		X	LC		
Apocynaceae	<i>Raphionacme sp.</i>		X			
Fabaceae	<i>Rhynchosia adenodes</i>		X	LC		
Fabaceae	<i>Rhynchosia caribaea</i>		X	LC		
Fabaceae	<i>Rhynchosia monophylla</i>		X	LC		
Acanthaceae	<i>Ruellia patula</i>		X	LC		
Acanthaceae	<i>Ruellia sp.</i>		X			
Polygonaceae	<i>Rumex crispus</i>		X			Nat
Polygonaceae	<i>Rumex lanceolatus</i>	X		LC		
Salicaceae	<i>Salix babylonica</i>		X			Alien
Lamiaceae	<i>Salvia sp.</i>		X			
Orchidaceae	<i>Satyrium stenopetalum subsp. brevicealcaratum</i>	X		LC	Sch 11	App II
Caprifoliaceae	<i>Scabiosa columbaria</i>		X	LC		
Hyacinthaceae	<i>Schizocarphus nervosus</i>	X		LC		
Apocynaceae	<i>Schizoglossum bidens</i>		X	LC		
Asteraceae	<i>Schkuhria pinnata</i>	X	X			Nat
Cyperaceae	<i>Schoenoplectus cf. muricinux</i>		X	LC		
Cyperaceae	<i>Schoenoplectus decipiens</i>	X		LC		
Cyperaceae	<i>Schoenoplectus sp.</i>		X			
Anacardiaceae	<i>Searsia discolor</i>	X		LC		
Anacardiaceae	<i>Searsia lancea</i>		X	LC		
Anacardiaceae	<i>Searsia magalismsontana</i>		X			
Anacardiaceae	<i>Searsia rigida</i>		X	LC		
Gentianaceae	<i>Sebaea leiostyla</i>	X		LC		
Selaginellaceae	<i>Selaginella caffrorum var. caffrorum</i>	X		LC		
Scrophulariaceae	<i>Selago densiflora</i>		X	LC		
Scrophulariaceae	<i>Selago tenuifolia</i>		X	LC		
Asteraceae	<i>Senecio consanguineus</i>		X	LC		
Asteraceae	<i>Senecio coronatus</i>		X	LC		
Asteraceae	<i>Senecio erubescens</i>		X	LC		
Asteraceae	<i>Senecio inaequidens</i>		X	LC		
Asteraceae	<i>Senecio inornatus</i>		X	LC		
Asteraceae	<i>Senecio isatideus</i>		X	LC		
Asteraceae	<i>Senecio othonniflorus</i>		X	LC		
Asteraceae	<i>Senecio sp.</i>		X	LC		

Fabaceae	<i>Senna italica</i>		X	LC		
Asteraceae	<i>Seriphium plumosum</i>	X	X	LC		
Poaceae	<i>Setaria incrassata</i>		X	LC		
Poaceae	<i>Setaria nigrirostris</i>	X	X	LC		
Poaceae	<i>Setaria pumila</i>		X	LC		
Poaceae	<i>Setaria sphacelata</i>		X	LC		
Poaceae	<i>Setaria sphacelata var. sericea</i>	X		LC		
Poaceae	<i>Setaria sphacelata var. sphacelata</i>	X		LC		
Brassicaceae	<i>Erucastrum austroafricanum</i>		X			Nat
Solanaceae	<i>Solanum campylacanthum</i>		X	LC		
Solanaceae	<i>Solanum elaeagnifolium</i>		X			1b
Solanaceae	<i>Solanum nigrum</i>		X			Nat
Asteraceae	<i>Sonchus oleraceus</i>		X			Nat
Fabaceae	<i>Sphenostylis angustifolium</i>		X	LC		
Poaceae	<i>Sporobolus africanus</i>	X		LC		
Poaceae	<i>Sporobolus discosporus</i>		X	LC		
Apocynaceae	<i>Stenostelma periglossoides</i>	X		LC		
Apocynaceae	<i>Stenostelma umbelluliferum</i>	X		NT		
Orobanchaceae	<i>Striga elegans</i>		X	LC		
Lamiaceae	<i>Syncolostemon canescens</i>	X		LC		
Asteraceae	<i>Tagetes minuta</i>	X	X			Nat
Fabaceae	<i>Tephrosia capensis</i>	X	X	LC		
Poaceae	<i>Themeda triandra</i>	X	X	LC		
Santalaceae	<i>Thesium cf. goetzeanum</i>		X	LC		
Asphodelaceae	<i>Trachyandra asperata</i>		X	LC		
Asphodelaceae	<i>Trachyandra erythrorrhiza</i>	X		LC	NT	
Asphodelaceae	<i>Trachyandra saltii var. saltii</i>	X	X	LC		
Asphodelaceae	<i>Trachyandra sp.</i>		X			
Asteraceae	<i>Tragopogon dubius</i>		X			Nat
Poaceae	<i>Tragus berteronianus</i>	X	X	LC		
Zygophyllaceae	<i>Tribulus terrestris</i>		X	LC		
Fabaceae	<i>Trifolium cf. africanum</i>		X			
Fabaceae	<i>Trifolium pratense</i>		X			Nat
Poaceae	<i>Tristachya biseriata</i>		X	LC		
Poaceae	<i>Tristachya leucothrix</i>	X		LC		
Alliaceae	<i>Tulbaghia acutiloba</i>	X	X	LC		
Alliaceae	<i>Tulbaghia leucantha</i>	X		LC		
Convolvulaceae	<i>Turbina oblongata</i>		X	LC		
Typhaceae	<i>Typha capensis</i>		X	LC		
Poaceae	<i>Urochloa panicoides</i>		X	LC		
Fabaceae	<i>Vachellia karroo</i>		X	LC		
Verbenaceae	<i>Verbena bonariensis</i>		X			1b
Verbenaceae	<i>Verbena brasiliensis</i>		X			1b
Verbenaceae	<i>Verbena rigida</i>		X			Nat
Asteraceae	<i>Vernonia glabra</i>		X	LC		
Plantaginaceae	<i>Veronica anagallis-aquatica</i>		X	LC		
Fabaceae	<i>Vigna vexillata</i>		X	LC		
Campanulaceae	<i>Wahlenbergia sp.</i>		X	LC		
Asteraceae	<i>Xanthium spinosum</i>		X		Sch 13	1b
Apocynaceae	<i>Xysmalobium undulatum</i>		X	LC		
Rhamnaceae	<i>Ziziphus zeyheriana</i>		X	LC		

APPENDIX C

FAUNA CHECKLISTS (ADU DATABASE)

¹ADU Database = Animal Demography Unit, University of Cape Town²Landowners reporting³Current survey⁴IUCN red list category⁵MNCA (1998) Schedules⁶MBSP = Mpumalanga Biodiversity Sector Plan redlist⁷NEMBA (ToPS) - Threatened or Protected Species⁸CITES = Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES 2020)

Mammals

Family	Scientific name	Common name	ADU ¹	Impumelelo ²	Current survey ³	IUCN ⁴	MNCA ⁵ 1998	MBSP ⁶ 2629CB	ToPS ⁷	CITES ⁸
Bathyergidae	<i>Cryptomys hottentotus</i>	Southern African Mole-rat	x			LC				
Bathyergidae	<i>Cryptomys hottentotus pretoriae</i>	Highveld mole-rat	x			NE				
Bovidae	<i>Antidorcas marsupialis</i>	Springbok	x	X	X	LC	Sch 3	Sch 3 LC		
Bovidae	<i>Connochaetes gnou</i>	Black Wildebeest	x			LC	Sch 2	Sch 2 LC	Prot	
Bovidae	<i>Connochaetes taurinus</i>	Blue Wildebeest	x			LC	Sch 3			
Bovidae	<i>Damaliscus pygargus phillipsi</i>	Blesbok	x	X	X	LC	Sch 3	Sch 3 LC		
Bovidae	<i>Oryx gazella</i>	Gemsbok	x			LC	Sch 3			
Bovidae	<i>Ourebia ourebi</i>	Oribi	x			EN	Sch 2		EN	
Bovidae	<i>Raphicerus campestris</i>	Steenbok	x	X	X	LC	Sch 2			
Bovidae	<i>Taurotragus oryx</i>	Cape Eland	x			LC	Sch 2			
Bovidae	<i>Alcelaphus buselaphus</i>	Red hartebeest	x			LC	Sch 3	Sch 3 LC		
Bovidae	<i>Kobus ellipsiprymnus</i>	Waterbuck	x			LC	Sch 2	Sch 2 LC		
Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	x	X	X	LC	Sch 8			
Canidae	<i>Vulpes chama</i>	Cape Fox	x			LC	Sch 5		Prot	
Canidae	<i>Panthera pardus</i>	Leopard	x			VU	X Sch 4	Sch 4 VU	VU	App I
Chrysochloridae	<i>Amblysomus septentrionalis</i>	Highveld Golden Mole	x			NT				
Equidae	<i>Equus quagga</i>	Plains Zebra	x			LC	Sch 3	Sch 3 LC		
Erinaceidae	<i>Atelerix frontalis</i>	Southern African Hedgehog	x	X		NT	Sch 2		Prot	
Felidae	<i>Caracal caracal</i>	Caracal	x			LC	Sch 8			App II
Felidae	<i>Felis catus</i>	Domestic Cat	x	X	X	Introd				
Felidae	<i>Felis nigripes</i>	Black-footed Cat	x			VU			Prot	App I
Felidae	<i>Felis silvestris</i>	African Wildcat	x			LC	Sch 5			
Felidae	<i>Leptailurus serval</i>	Serval	x	X		NT	Sch 5		Prot	App II
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	x	X	X	LC	Sch 5			
Herpestidae	<i>Herpestes ichneumon</i>	Egyptian Mongoose	x			LC	Sch 5			
Herpestidae	<i>Herpestes sanguineus</i>	Slender Mongoose	x			LC	Sch 5			
Herpestidae	<i>Ichneumia albicauda</i>	White-tailed Mongoose	x			LC	Sch 5			
Herpestidae	<i>Suricata suricatta</i>	Meerkat	x	X	X	LC	Sch 5			
Hystricidae	<i>Hystrix africaeaustralis</i>	Cape Porcupine	x	X	X	LC				
Leporidae	<i>Lepus capensis</i>	Cape Hare	x			LC	Sch 3			
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	x	X	X	LC	Sch 3			
Muridae	<i>Gerbilliscus brantsii</i>	Highveld Gerbil	x			LC				
Muridae	<i>Mastomys natalensis</i>	Natal Mastomys	x			LC				
Muridae	<i>Mus (Nannomys) minutoides</i>	Southern African Pygmy Mouse	x			LC				
Muridae	<i>Mus musculus musculus</i>	House mouse	x	X	X	LC				
Muridae	<i>Otomys angoniensis</i>	Angoni Vlei Rat	x			LC				
Muridae	<i>Otomys auratus</i>	Southern African Vlei Rat (Grassland type)	x	X		NT				

Muridae	<i>Rattus rattus</i>	Roof Rat	x	X		LC		
Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	x			LC		
Mustelidae	<i>Aonyx capensis</i>	African Clawless Otter	x			NT	Sch 2	Prot App II
Mustelidae	<i>Ictonyx striatus</i>	Striped Polecat	x			LC		
Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	x			NT	NT	
Nesomyidae	<i>Dendromus melanotis</i>	Gray African Climbing Mouse	x			LC		
Nesomyidae	<i>Dendromus mystacalis</i>	Chestnut African Climbing Mouse	x			LC		
Pedetidae	<i>Pedetes capensis</i>	South African Spring Hare	x			LC	Sch 5	
Sciuridae	<i>Xerus inauris</i>	South African Ground Squirrel	x	X	X	LC		
Soricidae	<i>Crociodura mariquensis</i>	Swamp Musk Shrew	x			NT		
Suidae	<i>Phacochoerus africanus</i>	Warthog	x			LC	Sch 5	
Vespertilionidae	<i>Neoromicia capensis</i>	Cape Serotine	x			LC		
Viverridae	<i>Civettictis civetta</i>	African Civet	x			LC	Sch 5	
Viverridae	<i>Genetta genetta</i>	Common Genet	x	X		LC	Sch 5	
Viverridae	<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	x			LC	Sch 5	

Reptiles

Family	Scientific name	Common name	Red list	MNCA 1998	Mpu Redlist 2629CB	ToPS	CITES
Agamidae	<i>Agama aculeata distanti</i>	Distant's Ground Agama	LC	Sch 2	LC		
Agamidae	<i>Agama atra</i>	Southern Rock Agama	LC	Sch 2			
Chamaeleonidae	<i>Bradypodion ventrale</i>	Eastern Cape Dwarf Chameleon	LC	Sch 2			
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	LC	Sch 5	LC		
Colubridae	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC	Sch 5			
Cordylidae	<i>Chamaesaura aenea</i>	Coppery Grass Lizard	NT	Sch 2			
Cordylidae	<i>Cordylus vittifer</i>	Common Girdled Lizard	LC	Sch 2			X
Cordylidae	<i>Pseudocordylus melanotus melanotus</i>	Common Crag Lizard	LC	Sch 2			
Cordylidae	<i>Smaug giganteus</i>	Giant Girdled Lizard	VU	Sch 2		EN	X
Elapidae	<i>Hemachatus haemachatus</i>	Rinkhals	LC	Sch 5	LC (on site Impumelelo)		
Gekkonidae	<i>Pachydactylus capensis</i>	Cape Gecko	LC	Sch 2			
Gekkonidae	<i>Pachydactylus vansonii</i>	Van Son's Gecko	LC	Sch 2			
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	LC	Sch 2			
Lamprophiidae	<i>Amplorhinus multimaculatus</i>	Many-spotted Snake	LC	Sch 5			
Lamprophiidae	<i>Aparallactus capensis</i>	Black-headed Centipede-eater	LC	Sch 5			
Lamprophiidae	<i>Duberria lutrix lutrix</i>	South African Slug-eater	LC	Sch 5			
Lamprophiidae	<i>Homoroselaps lacteus</i>	Spotted Harlequin Snake	LC	Sch 5			
Lamprophiidae	<i>Lamprophis aurora</i>	Aurora House Snake	LC	Sch 5			
Lamprophiidae	<i>Lycodonomorphus rufulus</i>	Brown Water Snake	LC	Sch 5			
Lamprophiidae	<i>Psammophis crucifer</i>	Cross-marked Grass Snake	LC	Sch 5			
Lamprophiidae	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	LC	Sch 5			
Lamprophiidae	<i>Psammophylax tritaeniatus</i>	Striped Grass Snake	LC	Sch 5			
Leptotyphlopidae	<i>Leptotyphlops scutifrons conjunctus</i>	Eastern Thread Snake		Sch 5	LC		
Leptotyphlopidae	<i>Leptotyphlops scutifrons scutifrons</i>	Peters' Thread Snake		Sch 5	LC		
Leptotyphlopidae	<i>Leptotyphlops incognitus</i>	Incognito Worm Snake		Sch 5	LC		
Scincidae	<i>Acontias gracilicauda</i>	Thin-tailed Legless Skink	LC	Sch 2			
Scincidae	<i>Panaspis wahlbergii</i>	Wahlberg's Snake-eyed Skink	LC	Sch 2			
Scincidae	<i>Trachylepis capensis</i>	Cape Skink	LC	Sch 2			
Scincidae	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	LC	Sch 2	X		
Scincidae	<i>Trachylepis varia sensu lato</i>	Common Variable Skink Complex	LC	Sch 2	X		
Typhlopidae	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake	LC	Sch 5	LC		
Varanidae	<i>Varanus niloticus</i>	Water Monitor	LC	Sch 5	LC		

Frogs

Family	Scientific name	Common name	Red list	MNCA (1998)	Mpu Redlist 2629CB	ToPS	CITES
Bufonidae	<i>Poyntonophrynus vertebralis</i>	Southern Pygmy Toad	LC				
Bufonidae	<i>Sclerophrys capensis</i>	Raucous Toad	LC		LC		
Bufonidae	<i>Sclerophrys gutturalis</i>	Guttural Toad	LC		LC		
Bufonidae	<i>Sclerophrys pusilla</i>	Flatbacked Toad	LC				
Hyperoliidae	<i>Kassina senegalensis</i>	Bubbling Kassina	LC		LC		
Hyperoliidae	<i>Semnodactylus wealii</i>	Rattling Frog	LC		LC		
Phrynobatrachidae	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC				
Pipidae	<i>Xenopus laevis</i>	Common Platanna	LC		LC		
Pyxicephalidae	<i>Amietia delalandii</i>	Delalande's River Frog	LC				
Pyxicephalidae	<i>Amietia fuscigula</i>	Cape River Frog	LC		LC		
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Common Caco	LC		LC		
Pyxicephalidae	<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC				
Pyxicephalidae	<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	LC		LC		
Pyxicephalidae	<i>Tomopterna natalensis</i>	Natal Sand Frog	LC		LC		

Lepidoptera

Family	Scientific name	Common name	Red list
HESPERIIDAE	<i>Afrogegenes letterstedti</i>	Brown dodger	LC
HESPERIIDAE	<i>Andronymus neander neander</i>	Nomad dart	LC
HESPERIIDAE	<i>Eretis umbra umbra</i>	Small marbled elf	LC
HESPERIIDAE	<i>Kedestes barberae barberae</i>	Freckled ranger	LC
HESPERIIDAE	<i>Metisella meninx</i>	Marsh sylph	LC
HESPERIIDAE	<i>Spialia asterodia</i>	Star sandman	LC
HESPERIIDAE	<i>Spialia ferax</i>	Striped sandman	LC
HESPERIIDAE	<i>Spialia mafa mafa</i>	Mafa sandman	LC
HESPERIIDAE	<i>Spialia spio</i>	Mountain sandman	LC
HESPERIIDAE	<i>Tsitana tsita</i>	Dismal sylph	LC
LYCAENIDAE	<i>Actizera lucida</i>	Rayed blue	LC
LYCAENIDAE	<i>Aloeides aranda</i>	Yellow russet	LC
LYCAENIDAE	<i>Aloeides dentatis maseruna</i>	Maluti toothed russet	LC
LYCAENIDAE	<i>Aloeides henningi</i>	Hillside russet	LC
LYCAENIDAE	<i>Aloeides molomo molomo</i>	Mottled russet	LC
LYCAENIDAE	<i>Aloeides trimeni trimeni</i>	Brown russet	LC
LYCAENIDAE	<i>Azonus jesous</i>	Topaz babul blue	LC
LYCAENIDAE	<i>Azonus ubaldus</i>	Velvet-spotted babul blue	LC
LYCAENIDAE	<i>Cacyreus marshalli</i>	Common geranium bronze	LC
LYCAENIDAE	<i>Chilades trochylus</i>	Grass jewel blue	LC
LYCAENIDAE	<i>Chrysochrysis aureus</i>	Golden opal	EN
LYCAENIDAE	<i>Chrysochrysis chrysaor</i>	Burnished opal	LC
LYCAENIDAE	<i>Chrysochrysis lycegenes</i>	Mooi river opal	LC
LYCAENIDAE	<i>Cigaritis mozambica</i>	Mozambique silverline	LC
LYCAENIDAE	<i>Cupidopsis cissus cissus</i>	Meadow blue	LC
LYCAENIDAE	<i>Eicochrysops messapus mahallakoena</i>	Cupreous ash blue	LC
LYCAENIDAE	<i>Lampides boeticus</i>	Pea blue	LC
LYCAENIDAE	<i>Lepidochrysops ketsi ketsi</i>	Ketsi giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops letsea</i>	Free State giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops patricia</i>	Patrician giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops variabilis</i>	Variable giant cupid	LC
LYCAENIDAE	<i>Leptomyrina henningi henningi</i>	Plain black-eye	LC
LYCAENIDAE	<i>Leptotes pirthous pirthous</i>	Common zebra blue	LC
LYCAENIDAE	<i>Lycaena clarki</i>	Eastern sorrel copper	LC

LYCAENIDAE	<i>Orachrysops lacrimosa</i>	Restless cupid	LC
LYCAENIDAE	<i>Tarucus sybaris sybaris</i>	Dotted pierrot	LC
LYCAENIDAE	<i>Thestor basutus basutus</i>	Basuto skolly	LC
LYCAENIDAE	<i>Zizeeria knysna knysna</i>	African grass blue	LC
LYCAENIDAE	<i>Zizula hylax</i>	Tiny grass blue	LC
NYMPHALIDAE	<i>Acraea horta</i>	Garden acraea	LC
NYMPHALIDAE	<i>Acraea neobule neobule</i>	Wandering donkey acraea	LC
NYMPHALIDAE	<i>Aeropetes tulbaghia</i>	Table mountain beauty	LC
NYMPHALIDAE	<i>Byblia ilithyia</i>	Spotted joker	LC
NYMPHALIDAE	<i>Catacroptera cloanthe cloanthe</i>	Pirate	LC
NYMPHALIDAE	<i>Danaus chrysippus orientis</i>	African plain tiger	LC
NYMPHALIDAE	<i>Hypolimnas misippus</i>	Common diadem	LC
NYMPHALIDAE	<i>Junonia hierta cebrene</i>	Yellow pansy	LC
NYMPHALIDAE	<i>Junonia oenone oenone</i>	Dark blue pansy	LC
NYMPHALIDAE	<i>Junonia orithya madagascariensis</i>	African blue pansy	LC
NYMPHALIDAE	<i>Precis archesia archesia</i>	Garden inspector	LC
NYMPHALIDAE	<i>Stygionympha wichgrafi wichgrafi</i>	Wichgraf's hillside brown	LC
NYMPHALIDAE	<i>Telchinia rahira rahira</i>	Marsh telchinia	LC
NYMPHALIDAE	<i>Vanessa cardui</i>	Painted lady	LC
PAPILIONIDAE	<i>Papilio demodocus demodocus</i>	Citrus swallowtail	LC
PIERIDAE	<i>Belenois aurota</i>	Pioneer caper white	LC
PIERIDAE	<i>Catopsilia florella</i>	African migrant	LC
PIERIDAE	<i>Colias electo electo</i>	African clouded yellow	LC
PIERIDAE	<i>Eurema brigitta brigitta</i>	Broad-bordered grass yellow	LC
PIERIDAE	<i>Pontia helice helice</i>	Southern meadow white	LC
SPHINGIDAE	<i>Basiothia medea</i>		Not listed

Spiders

Family	Scientific name	Common name	Red list	MNCA 1998	ToPS
Sparassidae	FAMILY Sparassidae	Huntsman spiders			
Theraphosidae	<i>Brachionopus sp.</i>				
Theraphosidae	<i>Harpactira hamiltoni</i>	Baboon spider		Sch 7	Prot

Scorpion

Family	Scientific name	Common name	Red list	MNCA 1998	ToPS
BUTHIDAE	<i>Uroplectes triangulifer</i>	Highveld Lesser-Thicktail scorpion		LC	

APPENDIX D

SITE SENSITIVITY VERIFICATION

Prior to commencing with the Terrestrial Biodiversity Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of site visit	January 2021 and December 2021
Specialist name	Dr Noel van Rooyen; Prof. Gretel van Rooyen
Professional registration number	401430/83 Botanical Science (NvR); 400509/14 Ecological Science (GvR)
Specialist affiliation / company	Ekotrust cc

The site sensitivity verification was undertaken using the following means:

- desk top analysis using satellite imagery;
- consulting geological, land type and vegetation type maps of the region;
- consulting provincial datasets on the latest versions of the mapping of CBAs, ESAs, ONAs, NPAES and PAs;
- checking distribution ranges of IUCN red-listed species and species highlighted by the screening tool;
- compiling plant and animal species checklist for the region; and
- on-site inspection.

To verify the site sensitivity of the screening tool, Google satellite images were studied beforehand and the site stratified into relatively homogenous physiographic-physionomic units or habitats. Sites were then selected to represent these habitats. During the field survey, 20 sampling sites were surveyed at the proposed Impumelelo development. However, a further 60 sample plots were surveyed on the Vhuvhili and Mukondeleli sites in the vicinity and the total of 80 sample plots were used to improve the identification and description of habitat types in the area.

Animal Species Theme

Screening tool: The screening tool rated the sensitivity of the Animal Species Theme as high and listed the following species as being SCC.

Sensitivity	Feature(s)
High	<i>Aves-Circus ranivorus</i>
High	<i>Aves-Hydroprogne caspia</i>
High	<i>Aves-Eupodotis senegalensis</i>
High	<i>Aves-Sagittarius serpentarius</i>
Medium	<i>Aves-Sagittarius serpentarius</i>
Medium	<i>Aves-Eupodotis senegalensis</i>
Medium	<i>Aves-Tyto capensis</i>
Medium	<i>Aves-Circus ranivorus</i>
Medium	<i>Aves-Hydroprogne caspia</i>

Medium	Insecta- <i>Lepidochrysops procera</i>
Medium	Mammalia- <i>Crocidura maquassiensis</i>
Medium	Mammalia- <i>Hydrictis maculicollis</i>
Medium	Mammalia- <i>Ourebia ourebi ourebi</i>

Site verification:

- **Note - the avifaunal and bat component will be addressed by the avifaunal and bat specialists.**
- *Lepidochrysops procera* (Lepidoptera) was not listed in the ADU database, the MNCA (1998) provincial species lists or the NEMBA (2007c) ToPS lists. *Lepidochrysops procera* was not recorded on site and is unlikely to occur there because its host plant (*Ocimum obovatum*) was scarce and only recorded in one location.
- The oribi *Ourebia ourebi* is found in patchy distributions in open and wooded mesic grassland. The Impumelelo gridline site falls marginally within the distribution range of *Ourebia ourebi ourebi*. Its habitat is largely fragmented due to human socio-economic activities including agriculture, forestry and mining. It was not recorded during the survey or mentioned by the landowners on site.
- The Maquassie Musk Shrew *Crocidura maquassiensis* was not listed for the region in the ADU mammal species list or the MNCA (1998) lists for the Mpumalanga province. It was not recorded on site during the survey. The Maquassie Musk Shrew depends on wetlands as suitable habitat in savanna and grasslands. Although it has a wide inferred extent of occurrence, it appears to be patchily distributed. *Crocidura maquassiensis* has not been reported from Mpumalanga Province post-1999 and thus there is a very low probability for it to occur on site.
- The spotted-necked otter *Hydrictis maculicollis* was not listed for the region in the ADU mammal species list, but was included in the MNCA (1998) lists for the Mpumalanga province. It was not recorded on site during the survey. Marginally suitable habitat for the spotted-necked otter is available on site. It occurs widespread, but it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base.
- What the screening tool did not highlight was the possible presence of the giant girdled lizard, a species with a Vulnerable IUCN status. However, the species was not recorded on site nor listed in the MTPA database for the farms in the immediate vicinity of the Impumelelo site. Furthermore, according to Bates *et al.* (2014), the distribution of the giant girdled lizard does not include the Impumelo site.
- The screening did also not highlight the presence of three Near Threatened species, viz. the Southern African hedgehog (*Atelerix frontalis*), serval (*Leptailurus serval*) and Southern African vlei rat (*Otomys auratus*) which have been reported for the Impumelelo WEF site. It is unlikely that the development will affect the Southern African vlei rat, since the vlei habitat should be avoided. During construction the serval will avoid the area, but it could return during the operational phase. Construction workers should be made aware of not harming the Southern African hedgehog, however due to its size most individuals will go unnoticed.

Based on the information provided above, we would rate the sensitivity of the Animal Theme as **Medium**.

Plant Species Theme

Screening tool: The screening tool rated the sensitivity of the Plant Species Theme as medium and provided the following list of plant SCC.

	Feature(s)
Medium	Sensitive species 1252
Medium	Sensitive species 691
Medium	<i>Khadia beswickii</i>
Medium	<i>Pachycarpus suaveolens</i>

Site verification: Our background study indicated that most of site had a **low** sensitivity. None of the SCC highlighted by the screening tool were recorded on site.

- The Soweto Highveld Grassland is classified as a Vulnerable vegetation type. However, large portions of the site have been heavily or moderately modified (compare CBA map, Figure 11) and not prime examples of the Soweto Highveld Grassland. If the development is thus contained within the heavily or moderately modified areas it would not affect the status of the vegetation type since these modified area were already considered as lost for the allocation of a vulnerable status of the vegetation type.
- Sensitive species 691 occurs in damp depressions in shallow soil over rock sheets. This type of habitat (Habitat 1) occurs on site, but the species was not encountered during the vegetation survey.
- The habitats on site do not present suitable habitat for sensitive species 1252 because of a lack of suitable wooded habitat. This species was not listed for the region on the NewPosa database nor in the MTPA database for the farms in the immediate vicinity of the Impumelelo site.
- *Khadia beswickii* occurs in rocky habitats on shallow soil (sheetrock) (see Habitat 1 in Figure 5), but was not recorded on site. Furthermore, the rocky habitat (Habitat 1) was avoided in the layout of the infrastructure on the Impumelelo gridline site.
- The fourth plant species of concern, *Pachycarpus suaveolens*, prefers grassland, but was not recorded during the site survey. The last collection made was in 1962. It occurs in areas that are currently extensively transformed by urban development, crop cultivation, mining and invasive alien plants. Its distribution records show it to be more common northwards from the Secunda sites, e.g. in the Witbank-Carolina area.

Based on the information provided above, we would rate the sensitivity of the Plant Species Theme as **Low**.

Relative Terrestrial Biodiversity Theme

Screening tool: The screening tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as very high and listed the following features of concern:

Sensitivity	Feature(s)
Very High	Critical biodiversity area 1
Very High	Critical biodiversity area 2
Very High	Ecological support area: landscape corridor
Very High	Ecological support area: local corridor
Very High	Protected Areas Expansion Strategy
Very High	Vulnerable ecosystem

Site verification:

- This theme considers the presence of protected areas, National Protected Area Expansion Strategy (NPAES), CBAs, ESAs and National Freshwater Ecosystem Priority Area (FEPAs).
- Our background study concurred with the findings of the screening tool on the presence of these features, except for the inclusion in the NPAES (2010). The site is also not earmarked in the 5-year plan of the Mpumalanga PAES (data supplied by M. Lötter, MTPA).
- The gridline site is not located in a protected area.
- Our background study confirms that the Soweto Highveld Grassland vegetation type on site is listed as 'Vulnerable'.
- Our background study indicated that although there are CBAs and ESAs present on site, our sensitivity analysis rated most of these areas as being of low sensitivity except for the wetlands (Habitat 7), which have a high sensitivity. Sensitivity of Habitats 1 and 3 was rated as moderate, but the development has not encroached onto these habitats.

- There are ESA Local corridors indicated on the alternative gridline site, but the presence of the gridline would not impact negatively on them.
- Although the entire Impumelelo gridline site is contained in an Upstream Management Area as River FEPA, **the screening tool did not highlight the presence of any FEPAs.** Furthermore, the area mapped as river FEPA did not emerge as being highly sensitive in the current assessment and the sensitivity model that was applied, classified only the drainage lines as being of high sensitivity.
- **Mpumalanga Highveld Wetlands:** These wetlands are present on site but these were also not highlighted by the Screening Tool. **The recommendations of the aquatic specialist should be followed when observing buffers around drainage lines as well as for Mpumalanga Highveld Wetlands.**

Outcome of the site sensitivity verification:

- We suggest that the Plant Theme's site sensitivity is changed to **Low**.
- We would suggest the Animal Theme's site sensitivity to be rated as **Medium**.
- Unfortunately, the screening tool limits the sensitivity of the Relative Terrestrial Biodiversity Theme to either Very High or Low. This is an issue which should be revisited by DFFE, since it does not give a proper representation of the site conditions. The entire site does merit a high sensitivity, since a large proportion of the site is degraded and under cropland or abandoned cropland. Thus if the same 4-tiered scale were to be applied to this theme, as in the case of the other themes, we would rate it as **Medium**.

Compliance Statement: Terrestrial Plant Species

- None of the species listed by the Screening tool were found during the site visit.
- Sensitive species 691 occurs in damp depressions in shallow soil over rock sheets. This type of habitat (Habitat 1) occurs on site, but the species was not encountered during the vegetation survey.
- The habitats on site do not present suitable habitat for sensitive species 1252 because of a lack of suitable wooded habitat. Moreover, the rocky outcrops on hilly terrain with a sparse woody cover were avoided by the development. Neither of these species were listed for the region on the NewPosa database nor in the MTPA database for the farms in the immediate vicinity of the Impumelelo site.
- *Khadia beswickii* occurs in rocky habitats on shallow soil (sheetrock) (see Habitat 1 in Figure 5), but was not recorded on site. Furthermore, Habitat 1 was avoided in the turbine and construction site layout on the Impumelelo site. The one substation, SS1 (which is part of the gridline infrastructure) does fall in Habitat 1 and should be relocated.

Based on the information provided above, we would rate the sensitivity of the Plant Species Theme as **Low**.

APPENDIX E

COMPLIANCE WITH THE TERRESTRIAL
BIODIVERSITY PROTOCOL (GN 320, 20
MARCH 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity	Section where this has been addressed in the Specialist Report
<i>The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:</i>	
2.3.1. <i>a description of the ecological drivers or processes of the system and how the proposed development will impact these;</i>	Chapters 9, Section 9.6; Chapter 17
2.3.2. <i>ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;</i>	Chapter 9, Section 9.6
2.3.3. <i>the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;</i>	Chapter 9, Sections 9.4 & 9.6
2.3.4. <i>the description of any significant terrestrial landscape features (including rare or important flora- faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;</i>	Chapters 4 – 9
2.3.5. <i>a description of terrestrial biodiversity and ecosystems on the preferred site, including:</i>	(a) Chapter 5
a) <i>main vegetation types;</i>	(b) Chapters 5 & 9
b) <i>threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;</i>	(c) Chapters 5 & 9
c) <i>ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and</i>	(d) Chapters 5 – 9; Appendix A, B & C
d) <i>species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;</i>	
2.3.6. <i>the assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and</i>	Chapter 12
2.3.7. <i>the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:</i>	(a) Chapter 9, Appendix D
2.3.7.1. <i>terrestrial critical biodiversity areas (CBAs), including:</i>	(b) Chapter 9; Section 9.4
a) <i>the reasons why an area has been identified as a CBA;</i>	(c) Chapter 12, 13 & 17
b) <i>an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;</i>	(d) Chapter 17
c) <i>the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);</i>	(e) n.a.
d) <i>the impact on ecosystem threat status;</i>	(f) Chapters 12 & 13
e) <i>the impact on explicit subtypes in the vegetation;</i>	(g) Chapters 12 & 13
f) <i>the impact on overall species and ecosystem diversity of the site; and</i>	
g) <i>the impact on any changes to threat status of populations of species of conservation concern in the CBA;</i>	
2.3.7.2. <i>terrestrial ecological support areas (ESAs), including:</i>	(a) Chapter 9
a) <i>the impact on the ecological processes that operate within or across the site;</i>	(b) Chapter 9
b) <i>the extent the proposed development will impact on the functionality of the ESA; and</i>	(c) Chapter 9
c) <i>loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;</i>	
2.3.7.3. <i>protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-</i>	n.a.
a) <i>an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;</i>	
2.3.7.4. <i>priority areas for protected area expansion, including-</i>	n.a.

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity	Section where this has been addressed in the Specialist Report
a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;	
2.3.7.5. SWSAs including: a) the impact(s) on the terrestrial habitat of a SWSA; and b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in watercourses);	n.a. (Chapter 9 (section 9.8))
2.3.7.6. FEPA subcatchments, including- a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;	Chapter 9; Section 9.5
2.3.7.7. indigenous forests, including: a) impact on the ecological integrity of the forest; and b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.	n.a.
3.1. The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix G
3.1.2. a signed statement of independence by the specialist;	p. viii
3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Chapter 2
3.1.4. a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Chapter 2
3.1.5. a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	p. xvii
3.1.6. a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Chapters 9, 10, 12, 13; Figures 11, 12 & 13 Sensitivity.kmz file
3.1.7. additional environmental impacts expected from the proposed development;	n.a.
3.1.8. any direct, indirect and cumulative impacts of the proposed development;	Chapters 12 & 13
3.1.9. the degree to which impacts and risks can be mitigated;	Chapters 12 & 13
3.1.10. the degree to which the impacts and risks can be reversed;	Chapters 12 & 13
3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	Chapters 12 & 13
3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Chapter 15
3.1.13. a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	n.a.
3.1.14. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Chapter 17
3.1.15. any conditions to which this statement is subjected.	Chapter 17
3.2. The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr, where relevant.	For EAP to incorporate
3.2.1. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	For EAP to append

APPENDIX F

Photographs of the Impumelelo gridline route – taken from Impumelelo mine

Impumelelo site and mine in background.



Impumelelo mine in background.



Gridline (eastern route) past the Impumelelo mine and following the conveyor belt eastwards.



Route along the Impumelelo conveyor belt



Route along the conveyor belt – junction at the R547, photograph taken westwards.



Conveyor belt – junction at the R547, photograph taken westwards.



Gridline alternative follows the R547 northwards.



Gridline alternative follows the R547 northwards.



Gridline alternative follows the R547 northwards.



Gridline alternative follows the R547 northwards.



Gridline alternative follows the R547 northwards.



Turn-off at R50 - gridline alternative follows the R50 northwards.



Gridline alternative follows the R50 northwards.



Gridline alternative follows the R50 northwards – turn-off northeastwards on Kinross road.



Gridline alternative follows the R547 northwards towards Kinross.



Gridline alternative follows the R547 northwards towards Kinross.



Gridline alternative follows the R547 northwards towards Kinross.



Gridline alternative follows the R547 northwards towards Kinross.



Turn-off eastwards towards Zandfontein substation on Brendon Village road.



Tailings dam south of road.



Zandfontein substation site on left of Brendon Village road.



APPENDIX G

Curriculum vitae: DR NOEL VAN ROOYEN

1. Biographical information

Surname	Van Rooyen
First names	Noel
ID number	501225 5034 084
Citizenship	South African
Business address	Ekotrust CC 7 St George Street Lionviham 7130 Somerset West South Africa
Mobile	082 882 0886
e-mail	noel@ekotrust.co.za
Current position	Member of Ekotrust cc
Professional registration	Botanical Scientist : Pr.Sci.Nat; Reg no. 401430/83

Academic qualifications include BSc (Agric), BSc (Honours), MSc (1978) and DSc degrees (1984) in Plant Ecology at the University of Pretoria, South Africa. Until 1999 I was Professor in Plant Ecology at the University of Pretoria and at present I am a member of Ekotrust cc.

2. Publications

I am the author/co-author of 128 peer reviewed research publications in national and international scientific journals and was supervisor or co-supervisor of 9 PhD and 33 MSc students. More than 350 projects were undertaken by Ekotrust cc as consultant over a period of more than 40 years.

Books

VAN ROOYEN, N. 2001. *Flowering plants of the Kalahari dunes*. Ekotrust CC, Pretoria. (In collaboration with H. Bezuidenhout & E. de Kock).

VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. *Flowering plants of the southern Kalahari*. Somerset West.

Author / co-author of various chapters on the Savanna and Grassland Biomes in:

LOW, B. & REBELO, A.R. 1996. *Vegetation types of South Africa, Lesotho and Swaziland*, Department of Environmental Affairs and Tourism, Pretoria.

KNOBEL, J. (Ed.) 1999, 2006. *The Magnificent Natural Heritage of South Africa*. (Chapters on the Kalahari and Lowveld).

VAN DER WALT, P.T. 2010. *Bushveld*. Briza, Pretoria. (Chapter on Sour Bushveld).

Contributed to chapters on vegetation, habitat evaluation and veld management in the book:

BOTHMA, J. du P. & DU TOIT, J.G. (Eds). 2016. *Game Ranch Management*. 5th edition. Van Schaik, Pretoria.

BOTHMA, J. du P. & DU TOIT, J.G. (Eds). 2021. *Wildplaasbestuur*. 5th edition. Van Schaik, Pretoria.

Co-editor of the book:

BOTHMA, J. du P. & VAN ROOYEN, N. (eds). 2005. *Intensive wildlife production in southern Africa*. Van Schaik, Pretoria.

3. Ekotrust CC: Core Services

Ekotrust CC specializes in vegetation surveys, classification and mapping, wildlife management, wildlife production and economic assessments, vegetation ecology, veld condition assessment, carrying capacity, biodiversity assessments, rare species assessments, carbon pool assessments and alien plant management.

4. Examples of projects previously undertaken

Numerous vegetation surveys and vegetation impact assessments for Baseline, Scoping and Environmental Impact Assessments (BAs & EIA's) were made both locally and internationally.

Numerous projects have been undertaken in game ranches and conservation areas covering aspects such as vegetation surveys, range condition assessments and wildlife management. Of note is the Kgalagadi Transfrontier Park; iSimangaliso Wetland Park, Ithala Game Reserve, Phinda Private Game Reserve, Mabula Game Reserve, Tswalu Kalahari Desert Reserve, Maremani Nature Reserve and Associate Private Nature Reserve (previously Timbavati, Klaserie & Umbabat Private Game Reserve).

Involvement in various research programmes: vegetation of the northern Kruger National Park, Savanna Ecosystem Project at Nylsvley, Limpopo; Kuiseb River Project (Namibia); Grassland Biome Project; Namaqualand and Kruger Park Rivers Ecosystem research programme.

5. Selected references of other projects done by Ekotrust CC

- VAN ROOYEN, N., THERON, G.K., BREDEKAMP, G.J., VAN ROOYEN, M.W., DEUTSCHLÄNDER, M. & STEYN, H.M. 1996. *Phytosociology, vegetation dynamics and conservation of the southern Kalahari*. Final report: Department of Environmental Affairs & Tourism, Pretoria.
- VAN ROOYEN, N. 1999 & 2017. The vegetation types, veld condition and game of Tswalu Kalahari Desert Reserve.
- VAN ROOYEN, N. 2000. Vegetation survey and mapping of the Kgalagadi Transfrontier Park. Peace Parks Foundation, Stellenbosch.
- VAN ROOYEN, N., VAN ROOYEN, M.W. & GROBLER, A. 2004. Habitat evaluation and stocking rates for wildlife and livestock - PAN TRUST Ranch, Ghanzi, Botswana.
- VAN ROOYEN, N. 2004. Vegetation and wildlife of the Greater St Lucia Wetland Park, KZN.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2008. Vegetation classification, habitat evaluation and wildlife management of the proposed Royal Big Six Nsubane-Pongola Transfrontier Park, Swaziland. Ekotrust cc.
- VAN ROOYEN, N., VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011. The vegetation of the NECSA Vaalputs site. Report to NECSA.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2014. Ecological evaluation and wildlife management on Ndzalama Nature Reserve and adjacent farms, Gravelotte, Limpopo province.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2016. Ecological evaluation of the farm Springbokoog in the Van Wyksvlei region of Northern Cape, including a habitat assessment for the introduction of black rhinoceros. Ekotrust.
- VAN ROOYEN, M.W. & VAN ROOYEN, N. & VAN DEN BERG, H. 2016. Kathu Bushveld study: Research offset for first development phase of Adams Solar Energy Facility. Project conducted for Department of Environment and Nature Conservation Northern Cape (DENC) and the Department of Agriculture, Forestry and Fisheries (DAFF).
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2018. Environmental screening study for the proposed essential oils and Moringa oil enterprise on Ferndale farm, Bathurst, Eastern Cape. Ekotrust cc, Somerset West.
- VAN ROOYEN, M.W., GAUGRIS, J.Y. & VAN ROOYEN, N. 2018. Dish Mountain gold project, Republic of Ethiopia: Natural resource use evaluation - baseline report. FFMES, Report to SRK Consulting.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2018. Report on the terrestrial ecology (flora & fauna). Basic assessment report for the proposed development of the 325 MW Kudusberg Wind Energy Facility in the Northern and Western Cape. Ekotrust cc, Somerset West.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. Proposed amendments to the Ishwati Emoyeni Wind Energy Facility (WEF) of Special Energy Project (PTY) LTD, a subsidiary of Windlab Systems (PTY) LTD. Ekotrust cc, Somerset West.

6. Selected peer-reviewed research publications

- VAN ROOYEN, N. 1978. A supplementary list of plant species for the Kruger National Park from the Pafuri area. *Koedoe* 21: 37 - 46.
- VAN ROOYEN, N., THERON, G.K. & GROBBELAAR, N. 1981. A floristic description and structural analysis of the plant

- communities of the Punda Milia - Pafuri - Wambiya area in the Kruger National Park, Republic of South Africa. 2. The sandveld communities. *Jl S. Afr. Bot.* 47: 405 - 449.
- VAN ROOYEN, N., THERON, G.K. & GROBBELAAR, N. 1986. The vegetation of the Roodeplaat Dam Nature Reserve. 4. Phenology and climate. *S. Afr. J. Bot.* 52: 159 - 166.
- VAN ROOYEN, N. 1989. Phenology and water relations of two savanna tree species. *S. Afr. J. Sci.* 85: 736 - 740.
- VAN ROOYEN, N., BREDENKAMP, G.J. & THERON, G.K. 1991. Kalahari vegetation: Veld condition trends and ecological status of species. *Koedoe* 34: 61 - 72.
- VAN ROOYEN, M.W., GROBBELAAR, N., THERON, G.K. & VAN ROOYEN, N. 1992. The ephemerals of Namaqualand: effect of germination date on development of three species. *J. Arid. Environ.* 22: 51 - 66.
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- STEYN, H.M., VAN ROOYEN, N., VAN ROOYEN, M.W. & THERON, G.K. 1996. The phenology of Namaqualand ephemeral species: the effect of sowing date. *J. Arid Environ.* 32: 407 - 420.
- JELTSCH, F., MILTON, S.J., DEAN, W.R.J. & VAN ROOYEN, N. 1997. Analyzing shrub encroachment in the southern Kalahari: a grid-based modelling approach. *Journal of Applied Ecology* 34 (6): 1497 - 1509.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 1998. Vegetation of the south-western arid Kalahari: an overview. *Trans. Roy. Soc. S. Afr.* 53: 113 -140.
- DE VILLIERS, A.J., VAN ROOYEN, M.W., THERON, G.K. & VAN ROOYEN, N. 1999. Vegetation diversity of the Brand-se-Baai coastal dune area, West Coast, South Africa: a pre-mining benchmark survey for rehabilitation. *Land Degradation & Development* 10: 207 - 224.
- VAN ESSEN, L.D., BOTHMA, J. DU P., VAN ROOYEN, N. & TROLLOPE, W.S.W. 2002. Assessment of the woody vegetation of Ol Choro Oiroua, Masai Mara, Kenya. *Afr. J. Ecol.* 40: 76 - 83.
- MATTHEWS, W.S., VAN WYK, A.E., VAN ROOYEN, N. & BOTHA, G.A. 2003. Vegetation of the Tembe Elephant Park, Maputaland, South Africa. *South African Journal of Botany* 67: 573-594.
- BOTHMA, J. DU P., VAN ROOYEN, N. & VAN ROOYEN, M.W. 2004. Using diet and plant resources to set wildlife stocking densities in African savannas. *Wildlife Society Bulletin* 32 (3): 840-851.
- VAN ROOYEN, M.W., THERON, G.K., VAN ROOYEN, N., JANKOWITZ, W.J. & MATTHEWS, W.S. 2004. Mysterious circles in the Namib Desert: review of hypotheses on their origin. *Journal of Arid Environments* 57: 467-48.
- STEENKAMP, J.C. VOGEL, A., VAN ROOYEN, N., & VAN ROOYEN, M.W. 2008. Age determination of *Acacia erioloba* trees in the Kalahari. *Journal of Arid Environments* 72: 302 - 313.
- VAN DER MERWE, H., VAN ROOYEN, M.W. & VAN ROOYEN, N. 2008. Vegetation of the Hantam-Tanqua-Roggeveld subregion, South Africa Part 2. Succulent Karoo Biome-related vegetation. *Koedoe* 50: 160-183.
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- VAN ROOYEN, M.W., LE ROUX, A., GELDENHUYS, C., VAN ROOYEN, N., BROODRYK, N. & VAN DER MERWE, H. 2015. Long-term vegetation dynamics (40 yr) in the Succulent Karoo South Africa: effects of rainfall and grazing. *Applied Vegetation Science* 18: 311-322.
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