D3.1: Terrestrial Biodiversity Assessment

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TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT FOR THE PROPOSED CARPE DIEM NORTH AND SOUTH SOLAR PV FACILITIES

located on Portion 5 of Farm Varkenslaagte No. 119 and Portion 27 of Farm Doornfontein No. 118, Gauteng Province

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For

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Table of Contents

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION AND PROJECT BACKGROUND

Enviro-Insight was requested to conduct the Terrestrial Biodiversity assessment for the proposed Carpe Diem North and Carpe Diem South Solar PV Facilities located on Portion 5 of Farm Varkenslaagte No. 119 and Portion 27 of Farm Doornfontein No. 118. All properties are located within the Merafong City Municipality, Gauteng Province, within proximity of the Carmel Distribution Centre (DC) (Eskom Power).

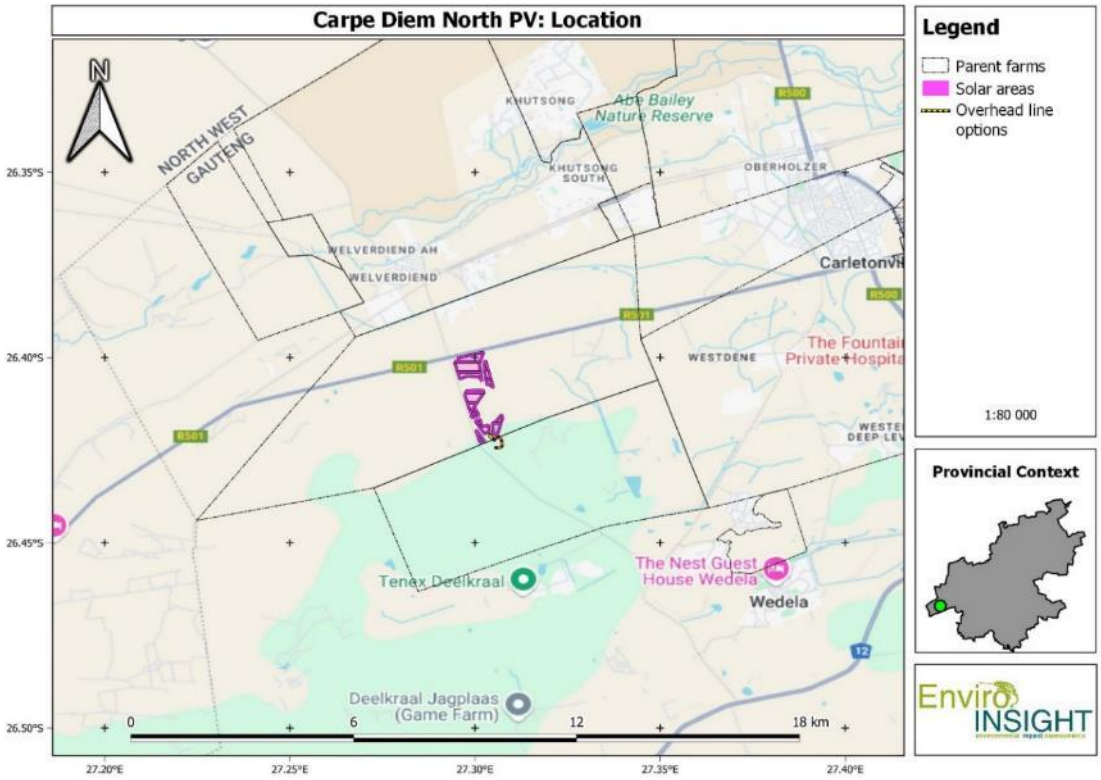

Figure 1-1: Location of the proposed Carpe Diem North Solar Photovoltaic Plant.

1.1 STUDY AIMS & LEGAL CONTEXT

This report contains the Terrestrial Biodiversity and Sensitive Plant Species Themes of the Scoping and Environmental Impact Assessment (S&EIA) required for the environmental authorisation process for a proposed development. The following legislation and guidelines are applicable to the proposed development:

- 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), published on 20 March 2020, in Government Gazette 43110, GN No. 320, with regards to Terrestrial Biodiversity.
- 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), published on 30 October 2020, in Government Gazette 43855, GN 1150 with regards to Terrestrial Plant Species.
- South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 3.1.2022.
- Alien and Invasive Species lists in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

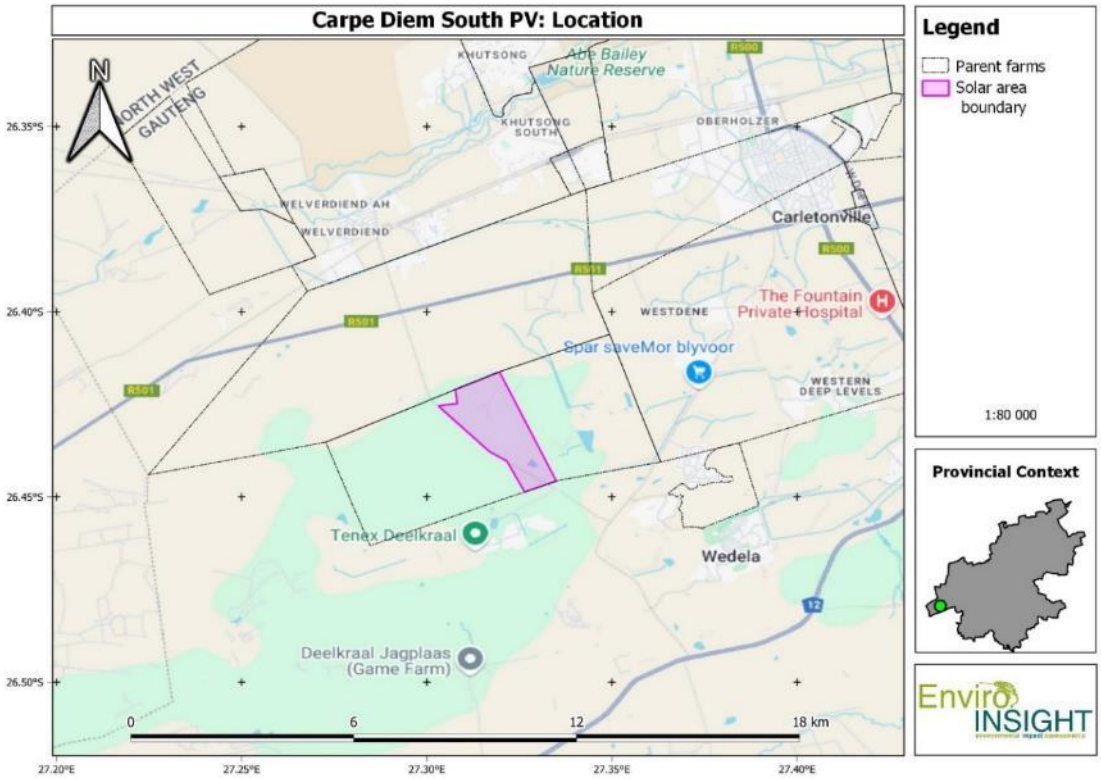

Figure 1-2: Location of the proposed Carpe Diem South Solar Photovoltaic Plant.

2 LEGISLATIVE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL SCREENING TOOL AND ENVIRONMENTAL THEME PROTOCOLS

2.1.1 Screening Report

The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool[1], as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, will be compulsory from 4 October 2019 when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014.

In addition, a set of protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process were developed, and on 20 March 2020, the Minister of Forestry, Fisheries and the Environment gazetted the Protocols for national implementation purposes. The gazette '*Procedures to be followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in terms of Section 24(5)(a) and (h) of the National Environmental Management Act (1998) when Applying for Environmental Authorisation*', has protocols that have been developed for environmental themes.

The protocols set requirements for the assessment and reporting of environmental impacts of activities requiring EA. The higher the sensitivity rating of the features on the proposed site as identified by the screening tool report, the more rigorous the assessment and reporting requirements. A screening report was generated on 25/03/2024.

[1] https://screening.environment.gov.za/screeningtool/#/pages/welcome

Terrestrial Biodiversity Theme

The Terrestrial Biodiversity Theme is indicated as Very High sensitivity as Carpe Diem South (Figure 2-1) intersects with ecological support areas, ESA1 and ESA2, while Carpe Diem North (Figure 2-2) intersects CBA1 and CBA2, ESA1 and ESA2 and National Protected Area Expansion Strategy (NPAES).

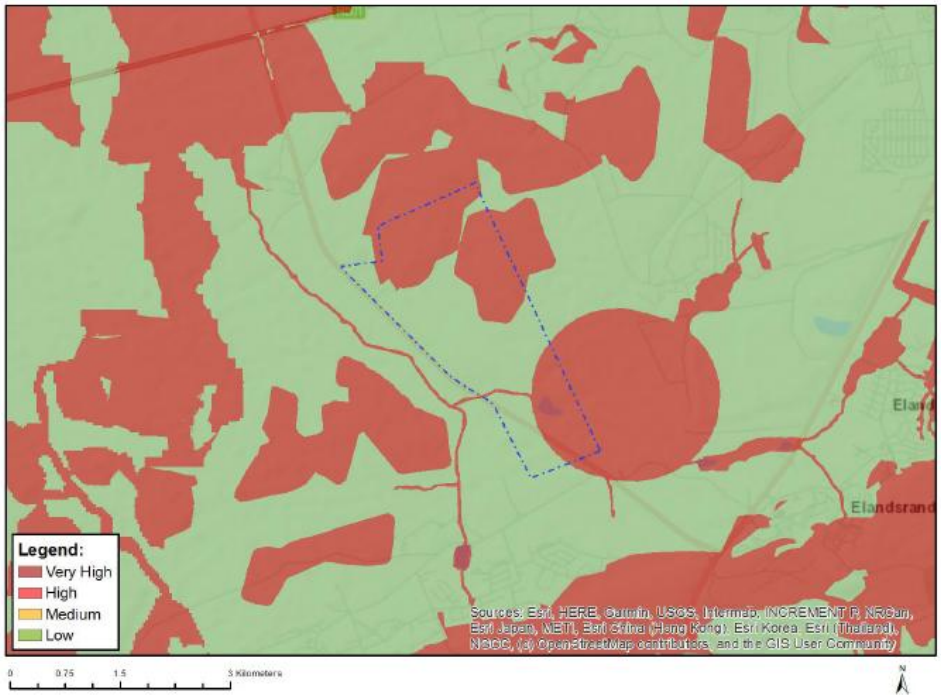

Figure 2-1: Environmental Screening Tool terrestrial biodiversity theme map for the proposed Carpe Diem South PV.

Figure 2-2: Environmental Screening Tool terrestrial biodiversity theme map for the proposed Carpe Diem North PV.

Plant Species Theme

The Plant Species Theme Sensitivity is indicated as Medium sensitivity for both Carpe Diem South PV (Figure 2-3) and Carpe Diem North PV (Figure 2-4) owing to suitable habitat for the following sensitive species: *Khadia beswickii,* Sensitive species 1147 and Sensitive species 1248.

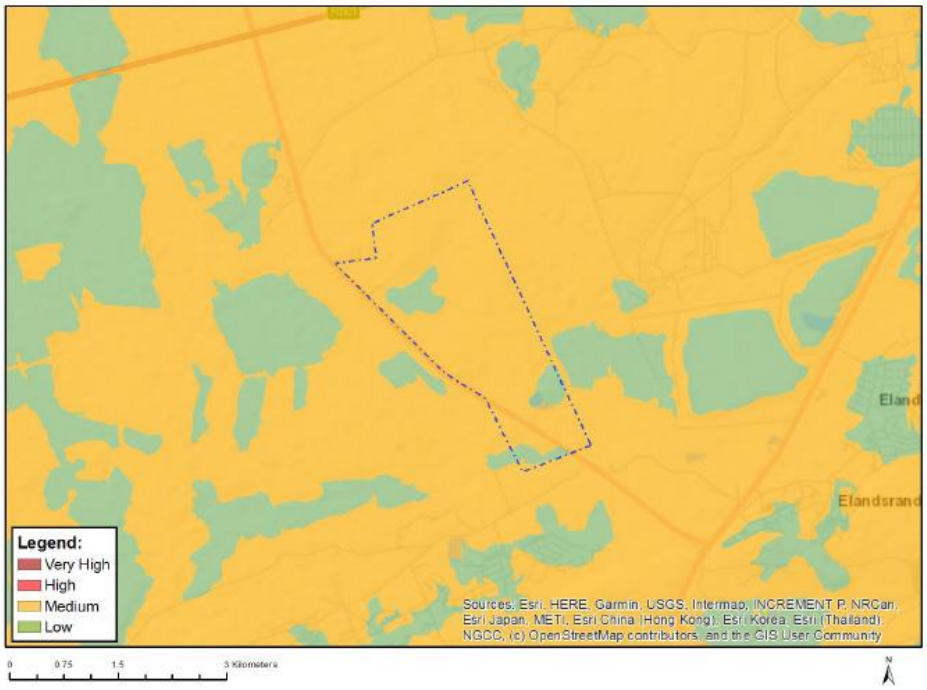

Figure 2-3: Environmental Screening Tool Plant Species Theme Sensitivity map for the proposed Carpe Diem South PV.

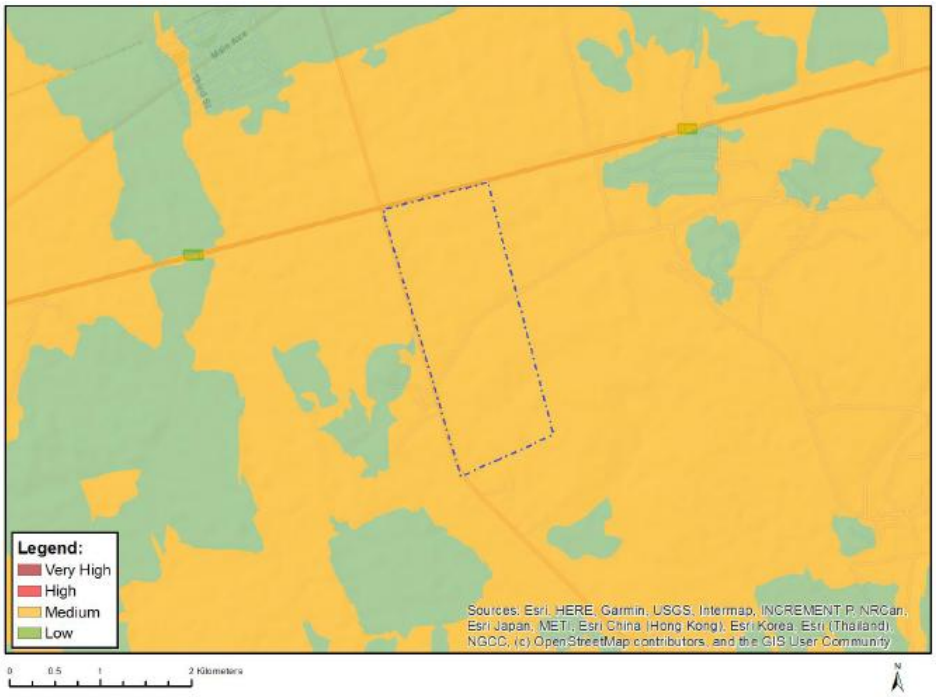

Figure 2-4: Environmental Screening Tool Plant Species Theme Sensitivity map for the proposed Carpe Diem North PV.

2.2 SITE SENSITIVITY VERIFICATION

Prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a site sensitivity verification. The purpose of this preliminary on-site inspection was to confirm the current use of the land and environmental sensitivities as identified by the screening tool.

Site verification was undertaken in October 2022 by a SACNASP registered zoologist and ecologist. The conditions during this period were considered sub-optimal. Based on the site visit, primary grassland was identified which confirmed the CBA status as per the provincial mapping.

No sensitive plant species was recorded on the study area, but suitable habitat was present. No other sensitive plant species could be confirmed, this could be due to a number of factors and does not necessarily exclude their presence from the study area.

The findings of the site verification, which included a site visit and desktop assessment, confirmed the **Very High** environmental sensitivity of the Terrestrial Biodiversity theme and **High** sensitivity for potential presence of Sensitive Plant Species. Accordingly full assessments were carried out for both themes.

2.3 MERAFONG MUNICIPAL INTEGRATED DEVELOPMENT PLAN AND SPATIAL DEVELOPMENT FRAMEWORK

The Merafong City Local Municipality (MCLM) is located in the western section of the West Rand District Municipality (WRDM). The WRDM's jurisdiction comprises three local municipalities (Mogale City, RandWest, and Merafong City) and a district management area, which comprises a portion of the cradle of humankind world heritage site.

Within Gauteng and the West Rand there are 2 important frameworks that guide spatial planning and land use management namely the Gauteng Environmental management Framework and the West Rand bioregional Plan. The GEMF replaces all other EMFs in Gauteng.

MCLM Strategic Objectives include Environmental Conservation:

- Investigate the possibility of legislating the GPEMF Control Zone 3 as a "Green Belt" to protect the natural environment from urban expansion;
- Protect sensitive areas such as ridges, wetlands and flood-prone areas;
- Rehabilitate degraded areas - in particular those mitigating the impacts of mining dumps and acid mine drainage on agriculture, tourism and human settlement.

3 METHODS

3.1 PRELIMINARY GIS

Existing data layers were incorporated into a GIS to establish how the proposed SEF layout and associated activities interact with important terrestrial entities. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018).
- 2011 Gauteng Conservation Plan Version 4 (C-Plan V4) (GDARD, 2011).
- Red List of Ecosystems (RLE) - Original extent and Remnants (SANBI, 2022[a] and 2022[b]).

- Protected and Conservation areas of South Africa (South Africa Protected Areas Database-SAPAD; South Africa Conservation Areas Database-SACAD)[2].

All mapping was performed using open-source GIS software (QGIS[3]).

3.2 DESKTOP AND LITERATURE REVIEW

3.2.1 Habitat mapping

Habitats were manually mapped within the PAOI and surrounding areas as structural units that would be utilised differently by herpetofauna / mammals or represent distinct habitats to flora (geology, watercourses, vegetation density) as determined from satellite imagery and on the ground verification. This mapping exercise was achieved through a combination of:

- the habitat characterisation performed on the ground during fieldwork;
- vegetation communities identified by botany fieldwork;
- the digital elevation model (obtained from Shuttle Radar Topography Mission); and
- the most recent satellite imagery (courtesy of Google Corporation).

3.2.2 Literature review

A literature review was conducted as part of the desktop study to identify the potential habitats and flora species of conservation concern (SCC) present within the study area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA) (SANBI, 2021[4]), to access distribution records on southern African plants[5]. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree grid cell (QDGC) resolution; however, the BODATSA database provides distribution data as point coordinates. The literature assessment, therefore, focussed on querying the database to generate species lists for the immediate study area and surroundings. A list of 504 species was generated for the below extent (WGS84 datum) in order to increase the likelihood of obtaining a representative species list for the proposed study area (Figure 3-1).

The Red List of South African Plants website (SANBI, 2021)[6] was utilised to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- Guide to grasses of southern Africa (Van Oudtshoorn, 2018);
- Field guide to succulents of southern Africa (Smith et al. 2017);
- Problem plants and alien weeds of South Africa (Bromilow, 2019);
- Field Guide to The Wild Flowers of The Highveld (Van Wyk & Malan, 1997);
- Field guide to trees of southern Africa (Van Wyk & Van Wyk, 2013).

2 http://dea.maps.arcgis.com/apps/MapTools/index.html?appid=2367540dd75148e8b6eaeab178a19d3a
3 http://qgis.osgeo.org/en/site/
4 http://newposa.sanbi.org/
5 Data are obtained from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH)
6 http://redlist.sanbi.org/

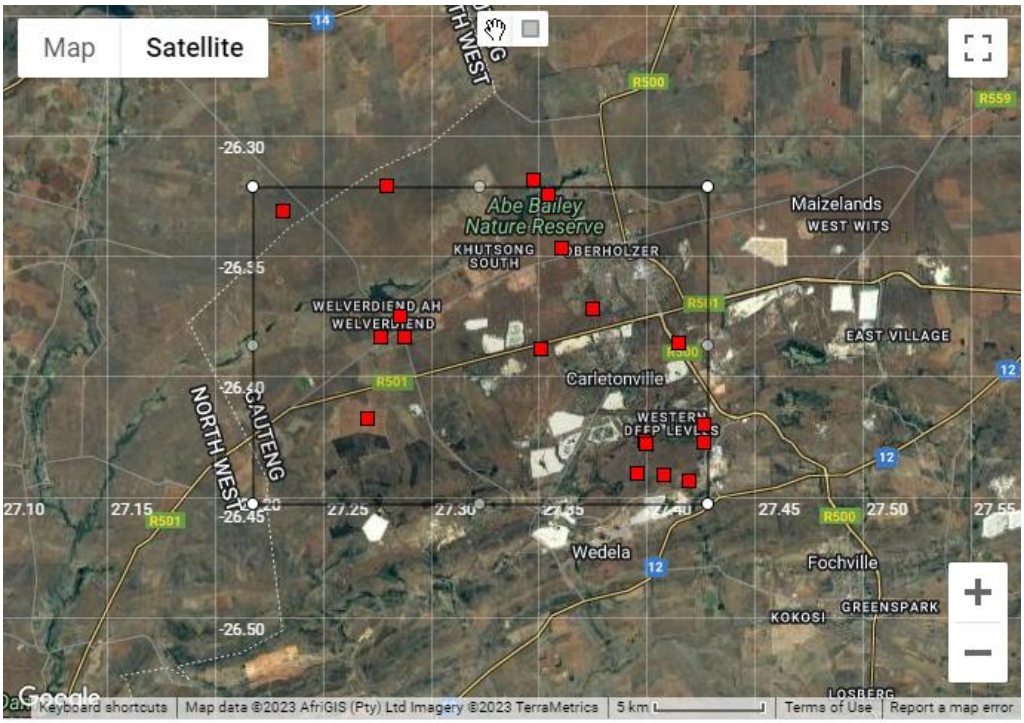

Figure 3-1: Generated plant species list from BODATSA database for proposed project.

Additional information regarding ecosystems, vegetation types, and SCC included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006 as amended); and
- Red List of South African Plants (Raimondo et al., 2009; SANBI, 2021).

3.3 SITE SURVEYS

An initial site survey was undertaken in October 2022 (early wet season) by Sam Laurence (SACNASP registered Zoologist and Ecologist), where the terrestrial biodiversity, floral and faunal aspects of the survey area were evaluated.

The full assessment survey was undertaken on 27 and 28 February 2023 by a SACNASP registered ecologist (Corné Niemandt) where the floral aspects of the survey area were evaluated. The timing of the survey represented wet season conditions in order to cover biophysical seasonal aspects. During the field surveys performed, the habitats were evaluated on foot and a series of georeferenced photographs were taken of the habitat attributes. The field surveys focused on a classification of the observed fauna and flora, habitats as well as the actual and potential presence of species of conservation concern (either classified as Threatened by the IUCN (2023), protected by NEMBA (2007, as amended) or indeed other legislations applicable provincially or nationally). An analysis of the diversity and ecological integrity of the habitats present on site was also performed.

3.4 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (http://www.iucnredlist.org/) provided the global conservation status of terrestrial fauna and flora. However, regional conservation status assessments performed for species of conservation concern (SCC) following the IUCN criteria were the most relevant and sourced from Red List of South African plants version 2021 and Raimondo *et al*. (2009).

The conservation status categories defined by the IUCN (Figure 3-2), which are considered here to represent species of conservation concern, are the "threatened" categories defined as follows.

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.

Other measures of conservation status include species listed under the following:

- Trade in Protected Species (TOPS; National)
- Convention on International Trade in Endangered Species (CITES; International).

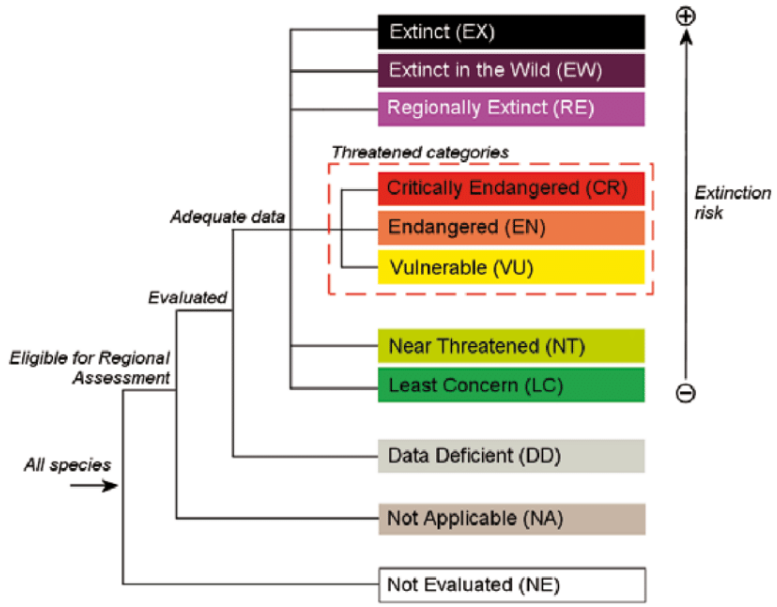

Figure 3-2: Schematic representation of the structure of the IUCN Red List Categories (IUCN 2012).

3.5 SITE ECOLOGICAL IMPORTANCE (SEI)

The Terrestrial Plant Species Protocol requires specialists to identify:

- the nature and the extent of the potential impact of the proposed development on SCC occurring on the proposed development site;
- the potential impact of the proposed development on the habitat of the SCC; and
- any alternative development footprints within the preferred development site which would be of 'low' sensitivity as identified by the screening tool and verified through the site sensitivity verification.

While most of the features that will be included in the conservation importance (CI) will be provided by the screening tool, it is important to note that CI is evaluated at a **much finer spatial scale** and based on fieldwork data collection and comprehensive desktop analyses performed by the specialist during the Environmental Authorisation (EA) process.

SEI is a function of the biodiversity importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and its resilience to impacts (receptor resilience [RR]) as follows: SEI = BI + RR

BI in turn is a function of CI and the functional integrity (FI) of the receptor as follows: BI = CI + FI

As BI is a function of CI and the FI of a receptor, BI can be derived from a simple matrix of CI and FI as follows:

Biodiversity importance		Conservation importance				
		Very high	High	Medium	Low	Very low
Functional integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

From the successful evaluation of both BI and RR as described above, it is possible to evaluate SEI from the final matrix as follows:

Site ecological importance		Biodiversity importance				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very high	Medium	Low	Very low	Very low	Very low

The SEI in relation to proposed development activities can be interpreted as follows:

- **Very High:** Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
- **High:** Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
- **Medium:** Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
- **Low:** Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
- **Very Low:** Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

For a full breakdown of the SEI methodology please refer to SANBI V3.1 (2020).

3.6 STUDY LIMITATIONS, ASSUMPTIONS AND NOTES

The following are applicable to this assessment:

- It is assumed that all third-party information acquired is correct (e.g. GIS data and scope of work).
- This report covers the Terrestrial Biodiversity and Sensitive Plant Species themes.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to time constraints, this was not possible for this study.
- Due to the nature of most biophysical studies, it is not always possible to cover every square metre of a given study area. Due to the large study area, it is possible that small and rare individual plant species of conservation concern (SCC) may have been overlooked even though care has been taken to search for specific SCC.
- Not all plants have the same growth and/or flowering period, and thus it is likely that the surveys could have occurred outside of the growth and/or flowering period of a specific species.
- Species of conservation concern (SCC) are generally uncommon and/or localised. Thus, locating such species can be challenging when attempted to locate such species outside its flowering season.

4 RESULTS

4.1 REGIONAL CONTEXT

4.1.1 Grassland Biome

Out of nine biomes occurring in the country, two biomes fall within the borders of the Gauteng Province, namely Savanna and Grassland Biome. The Savanna Biome is the southern extension of the largest Biome in Africa, whereas the Grassland Biome forms part of the cooler, elevated interior. The Grassland Biome is poorly represented elsewhere in Africa and is home to a wealth of fauna and flora species, limited to Southern Africa and covering almost one third of South Africa's landscape.

Grasslands serve as a water catchment (collection of rainwater, funnelling it into rivers, cleaning the water in wetlands) and carbon sequestration mechanism (storing carbon that would otherwise be released into the atmosphere). The Grassland Biome are one of South Africa's most biodiverse biomes (only second to the fynbos in terms of plant biodiversity) with 3 370 plant species of which only one in six are grasses; the rest are forbs (bulb, and herb-like wildflowers). Of South Africa's 856 bird species, 350 occur in the Grassland Biome.

Amongst the biomes that are most vulnerable to climate change is the Grassland Biome, which also offers resilience to climate change by the significant uptake of carbon from the atmosphere. For the Grassland Biome, significant change and loss of habitat is projected due to climate change. This is likely to be related to the high-altitude location of the biome and its susceptibility to warming effects, as well as the possible increase in tree cover. The invasion of woody plants (alien and indigenous) into the Grassland Biome has major implications for the delivery of ecosystem goods and services to people, notably water delivery from highland catchments and grazing. Such shifts have extremely important implications for

conservation and ecosystem service delivery, as well as ecosystem processes such as wildfire (*DEFF -Climate and Impacts Factsheet Series, Factsheet 7 of 7*).

Unfortunately, only 2.8% of the Grassland Biome is formally protected and 65% is already irreversibly transformed through agricultural production. Mining, industry and urban development have also destroyed large areas of intact grasslands. Livestock over-grazing and unnatural fire regimes (burning too often at the wrong time of year) also threaten the biome.

Dry Highveld Grassland prevails in the western regions of the Grassland Biome with a more temperate climate. These grasslands comprise of semi-arid sweetveld that is drought-adapted with the predominance of chloridoid grasses. The Carletonville Dolomite Grassland vegetation type is the only type of Dry Highveld Grassland that falls within Gauteng. The topography is flat to undulating, occasionally broken by small mountains. The major environmental factor controlling vegetation patterns and the recognition of different vegetation types is annual rainfall, which forms an east to west pattern of decreasing moisture across the Highveld.

4.1.2 Vegetation Types

The study site is situated within the Carletonville Dolomite Grassland and in the Gauteng Shale Mountain Bushveld (Mucina & Rutherford, 2006 – as amended) (Figure 4-1). Both are listed as Least Threatened. Since 2022, the Carletonville Dolomite Grassland is one of the three vegetation types where development in Gauteng has the greatest impact on.

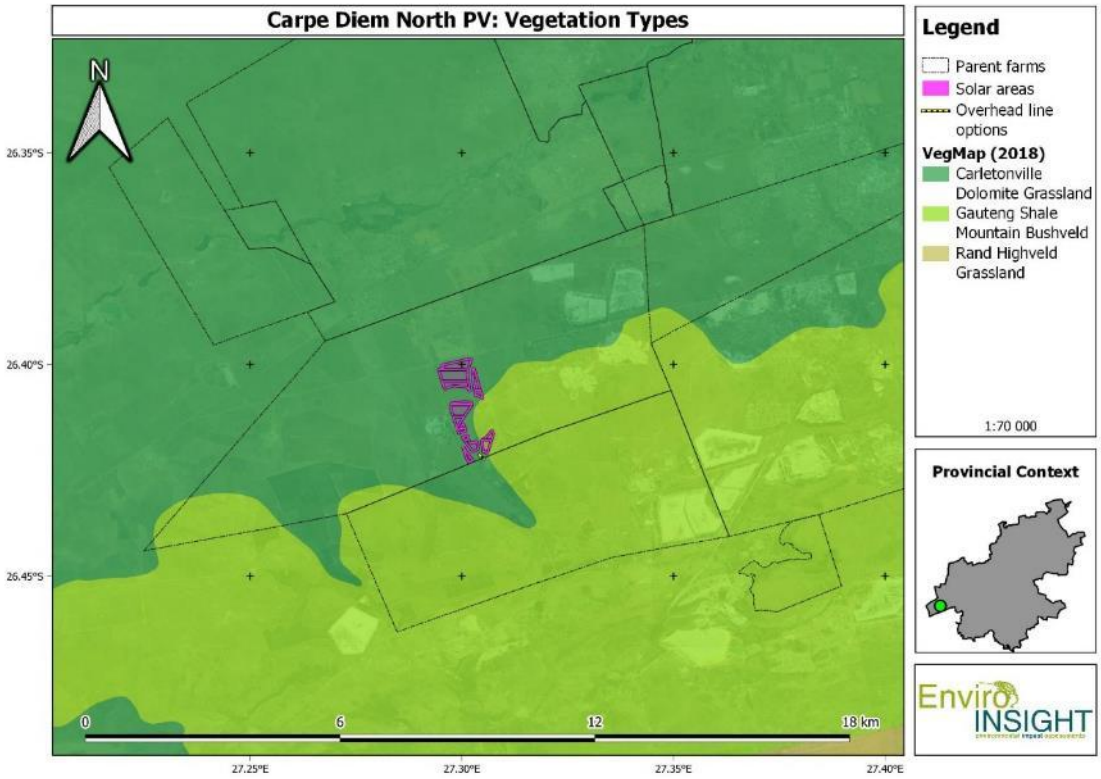

Figure 4-1: The proposed Carpe Diem North Solar PV in relation to vegetation types (SANBI 2018, as amended).

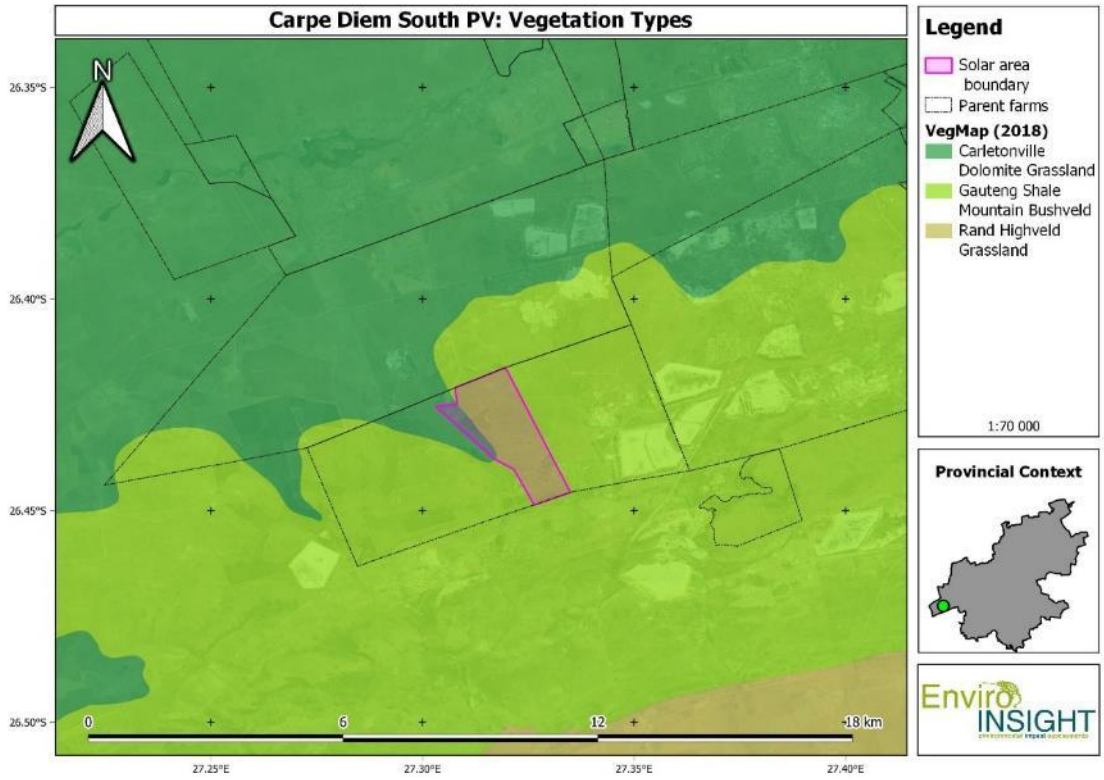

Figure 4-2: The proposed Carpe Diem South Solar PV in relation to vegetation types (SANBI 2018, as amended).

Carletonville Dolomite Grassland (Gh 15)

Distribution: Carletonville Dolomite Grasslands are predominantly found in the North West Province, in the regions round Potchefstroom, Ventersdorp and Carletonville.

Vegetation & Landscape features: Carletonville Dolomite Grassland is characterised by slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands forming a complex mosaic pattern dominated by many species but is mainly characterised by important taxa such as *Aristida congesta*, *Heteropogon contortus*, *Crabbea angustifolia*, and *Elephantorrhiza elephantina.* The geology is mostly dolomite and chert of the Malmani Subgroup.

Important Plant Taxa

- **Grasses**: *Aristida congesta, Brachiaria serrata, Cynodon dactylon, Digitaria tricholaenoides, Diheteropogon amplectens, Eragrostis chloromelas, E. racemosa, Heteropogon contortus, Loudetia simplex, Schizachyrium sanguineum, Setaria sphacelata, Themeda triandra* and *Alloteropsis semialata*.
- **Herbs**: *Acalypha angusta, Barleria macrostegia, Chamaecrista mimosoides, Chamaesyce inaequilatera, Crabbea angustifolia, Dianthus mooiensis, Dicoma anomala, Helichrysum caespititium, H. miconiifolium, H. nudifolium, Ipomoea ommaneyi, Kyphocarpa angustifolia* and *Senecio coronatus*.
- **Shrubs**: *Anthospermum rigidum, Indigofera comosa, Pygmaeothamnus zeyheri, Englerophytum magalismontana, Tylosema esculentum* and *Ziziphus zeyheriana*

Conservation: Only a small extent conserved in statutory reserves (Sterkfontein Caves—part of the Cradle of Humankind World Heritage Site, Oog Van Malmanie, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, Groenkloof)

and in at least six private conservation areas. Almost a quarter already transformed for cultivation, by urban sprawl. Erosion very low (84%) and low (15%).

Gauteng Shale Mountain Bushveld (SVcb 10)

Distribution: Gauteng Shale Mountain Bushveld occurs in a narrow band along a series of ridges from Carletonville-Westonaria-Lenasia.

Vegetation and Landscape Features: Gauteng Shale Mountain Bushveld occurs on low, rocky ridges of varying steepness. Vegetation is characterised by short, semi-open thicket consisting of a variety of fine- and broad-leaf woody species. The field layer is normally dominated by grasses (Mucina and Rutherford, 2006). The underlying geology comprises shale with some coarser clastic sediments and andesite from the Pretoria Group. Soils are shallow to deep Mispah.

Important Plant Taxa

Based on Mucina and Rutherford (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They recognise the following species as important taxa in Gauteng Shale Mountain Bushveld:

- **Trees**: *Dombeya rotundifolia, Celtis africana, Combretum molle, Cussonia spicata, Englerophytum magalismontanum, Protea caffra, Searsia leptodictya, Vangueria infausta, Vachellia caffra, V. karroo, Zanthoxylum capense* and *Ziziphus mucronata.*
- **Shrubs**: *Asparagus laricinus, Canthium gilfillanii, Chrysanthemoides monilifera, Dichrostachys cinerea, Diospyros austro-africana, Diospyros lycioides* subsp. *lycioides, Ehretia rigida* subsp. *rigida, Grewia occidentalis, Gymnosporia polyacantha* and *Olea europaea*.
- **Grasses**: *Hyparrhenia dregeana, Cymbopogon caesius, Digitaria eriantha* and *Eragrostis curvula*.
- **Herbs**: *Dicoma zeyheri, Helichrysum nudifolium, H. rugulosum, Hermannia lancifolia, Selaginella dregei, Senecio venosus, Vernonia natalensis, Vernonia oligocephala, Cheilanthes hirta, Pellaea calomelanos* and *Scadoxus puniceus*.

4.2 GAUTENG PROVINCIAL ENVIRONMENTAL MANAGEMENT FRAMEWORK, 2021

The Gauteng Provincial Environmental Management Framework (GPEMF) is a legal instrument in terms of the National Environmental Management Act. The objective of the tool is to assist environmental impact management, spatial planning and sustainable development. The GPEMF has a strong focus on the identification of Environmental Management Zones (EMZs) and the compatibility of development activities that can be permitted within each zone.

The objective of the GEMF is to guide sustainable land use management within Gauteng. It serves the following purposes:

- To provide a strategic and overall framework for environmental management in Gauteng.
- To align sustainable development initiatives with the environmental resources, developmental pressures as well as growth imperatives of Gauteng.
- Determine geographical areas where certain activities can be excluded from an EIA.

- Identify appropriate, inappropriate and conditionally compatible activities in various Environmental Management Zones in a manner that promotes proactive decision making.

The proposed Carpe Diem North and South SEFs and North BESS are located in Zone 3: High control zone (outside the urban development zone) and Zone 4: Normal control zone.

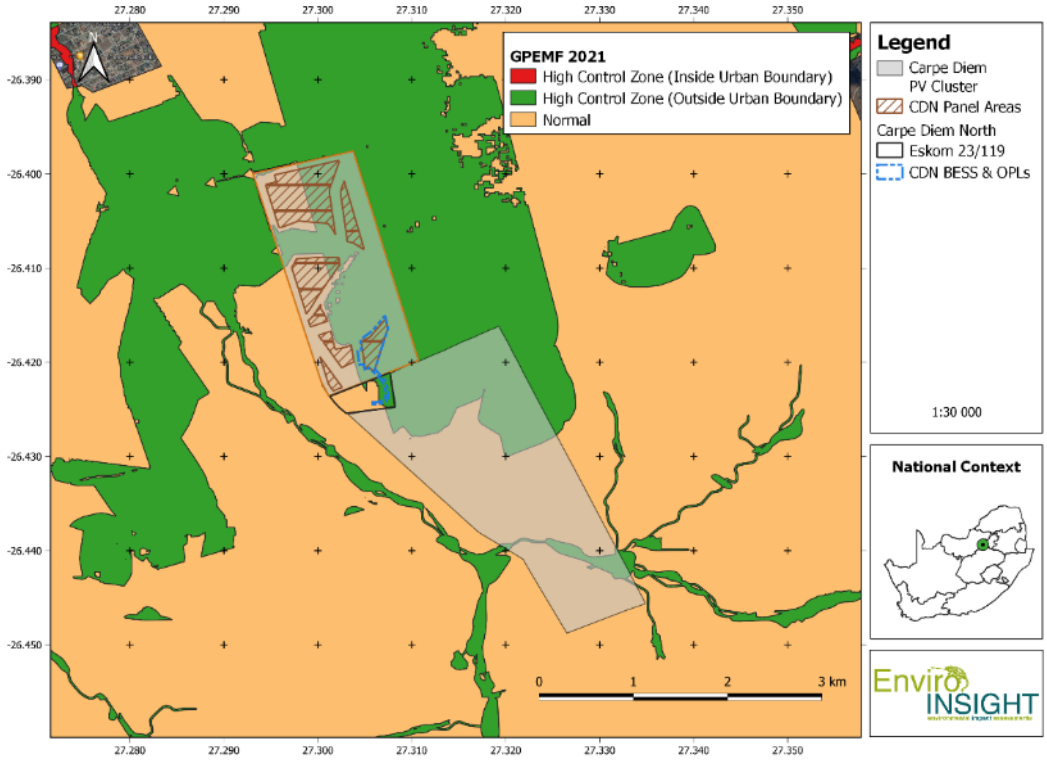

Figure 4-3: Proposed Carpe Diem North and South Solar developments in relation to the GPEMF.

Zone 3: High control zone (outside the urban development zone)

Special control zones are sensitive areas outside the urban development zone. These areas are sensitive to development activities and in several cases also have specific values that need to be protected. No listed activities may be excluded from environmental assessment requirements in this zone and further activities may be added where necessary to protect the environment in this zone.

The following areas have been identified in this zone:

- CBAs (Irreplaceable and Important areas) and ESAs outside the urban development zone as defined in C-Plan 3.3.
- Rivers (including a 32m buffer on each side) and currently undeveloped ridges that must be conserved.
- Areas that are sensitive (as determined in the sensitivity assessment).
- Protected areas.

The protection of Critical Biodiversity Areas and Ecological Support Areas is the primary objective in this zone and no new residential, retail, business, commercial, industrial, mining or any other land use, with the exception of unavoidable linear service infrastructure, may be allowed in this area, with the exception of tourism hospitality facilities that adhere to SuDS and green infrastructure principles. Land uses that are conditionally compatible with the intention of this zone include electricity network.

Zone 4: Normal control zone

This zone is dominated by agricultural uses outside the urban development zone as defined in the Gauteng Spatial Development Framework. No listed activities may be excluded from environmental assessment requirements in this zone. Land uses that are compatible with the intention of this zone include electricity network.

4.3 2024 GAUTENG C-PLAN V4

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. Biodiversity priority areas are described as follows:

- Critical biodiversity areas (CBA's) (very high level of importance) are areas of the landscape that need to be maintained in a natural or near- natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses. For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a population or habitat).
- Ecological support areas (ESA's) (high level of importance) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or delivery ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resources use in this specific ESA is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor result in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity). Spatial surrogates include dolomite, rivers, wetlands, pans, corridors for climate change and species migration and all untransformed ridges have a minimum category of ESA.
- Ridges are characterized by high spatial heterogeneity due to the range of differing aspects, slopes and altitudes all resulting in differing soil, temperature, elevation, light and hydrological conditions. This variation is an especially important predictor of biodiversity. Ridges are characterized by a particularly high biodiversity, and it follows that their protection will contribute significantly to the conservation of biodiversity in Gauteng. The ridges of Gauteng are vital habitat for many threatened plant species. 65% percent of Gauteng's threatened plant species and 71% of Gauteng's endemic plant species have been recorded growing on ridges. Just over 40% of these species are confined solely to this habitat type.

A map of the study in relation to the 2024 Gauteng C-Plan V4 is presented in Figure 4-4 for Carpe Diem North and Figure 4-5 for Carpe Diem South. The northern section of the study area is located in a CBA2 (Important) and sections in the middle and southwards in an ESA1 and ESA2. CBA2 are indicated based on Primary Grassland and potential orange list plant species. The ESA is mainly owing to Class 1 and 2 ridges, ecological corridors and secondary grassland. Several orange list plant species have been recorded, and some of the grassland patches are still natural and intact.

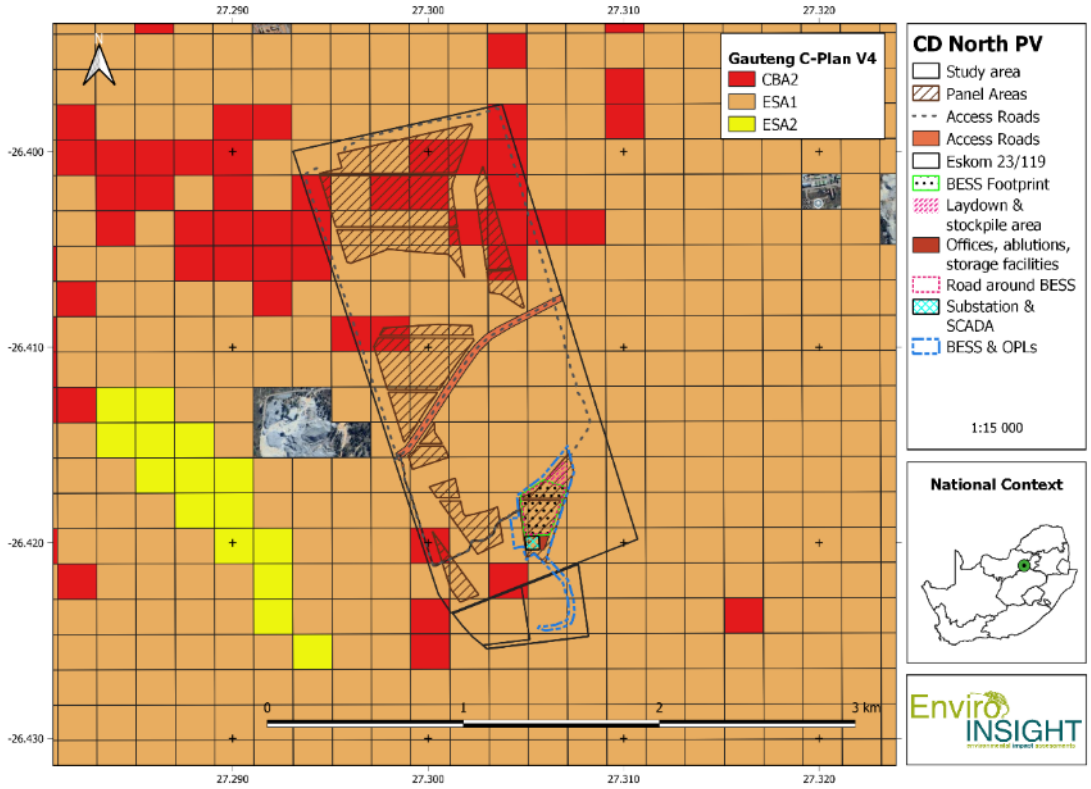

Figure 4-4: Location of the proposed Carpe Diem North PV in relation to the 2024 Gauteng C-Plan V4.

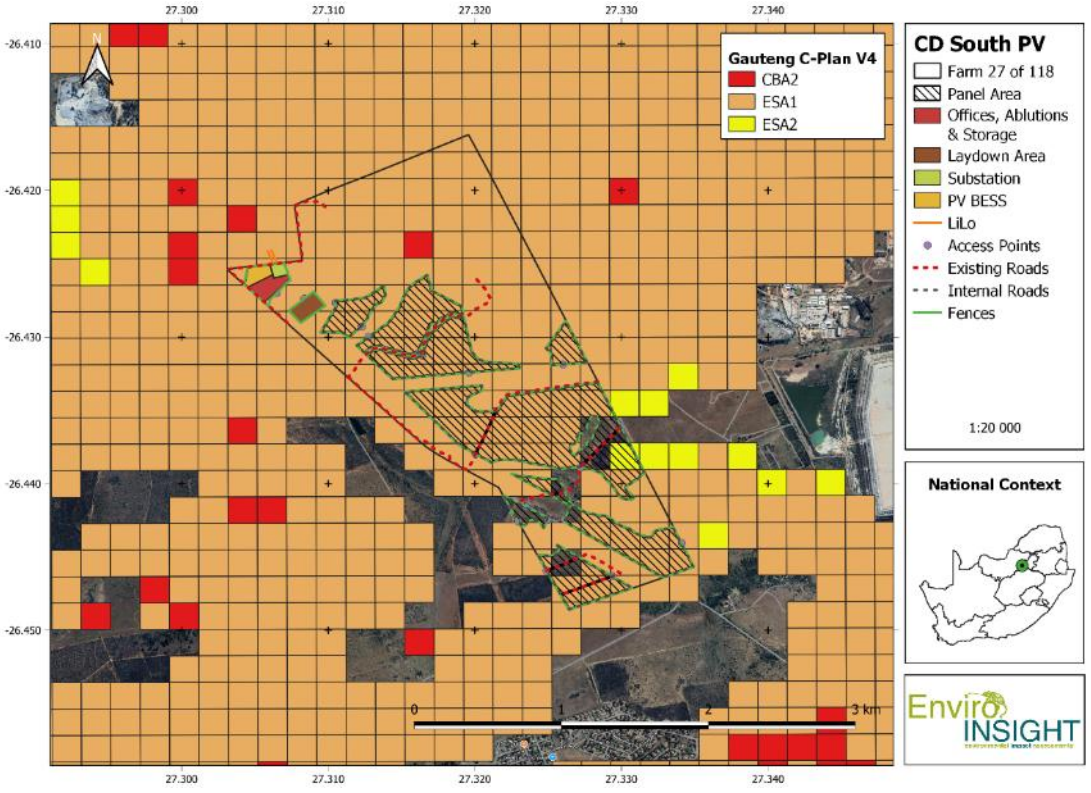

Figure 4-5: Location of the proposed Carpe Diem South PV in relation to the 2024 Gauteng C-Plan V4.

4.4 GAUTENG PROTECTED AREAS EXPANSION STRATEGY (GPAES)

Guided by the NPAES, the Gauteng Protected Areas Expansion Strategy (GPAES) was developed in 2011 and updated in 2013 and identifies 30,800 ha and 166,811 ha of habitat to be formally secured within Gauteng's protected area network, in five and 20 years, respectively. However, due to resource constrains within the GDARD to implement the GPAES, the PAE targets were subsequently revised to operational targets of adding 9,000 ha by 2019, 2,000 ha by 2020, and 1,000 ha each year until 2024.

The screening tool report indicated that the site is located in NPAES and accordingly it was investigated from a national and provincial perspective.

In addition to the C-Plan (see above), planning tools and sources consulted for the development of the GPAES included (it must be noted that there has been updated information available since 2013):

- The NPAES focus areas layer (2010), including fragments of land smaller than 5,000 ha.
- The draft Threatened Ecosystem layer (2011), showing the remaining extent of threatened ecosystems.
- The 2009 land cover layer, focussing on the largest remaining fragments of natural or near-natural habitat within each vegetation type.

The GPAES categorises priority areas for conservation into three levels:

- Level 1 – The largest intact areas in which the C-Plan Version 3 irreplaceability layer, NPAES spatial priority layer and threatened ecosystem layer overlap in areas of natural habitat.
- Level 2 – The largest intact areas in which two of the three layers overlap in areas of natural habitat.
- Level 3 – The largest intact areas within one of the three layers in areas of natural habitat.

MCLM has four areas of interest with regards to Level 1 to 3 GPAES prioritised areas. The proposed Carpe Diem North and South SEFs, including the Carpe Diem North BESS, intersects with the **Wonderfonteinspruit eco-corridor** (Figure 4-6). It contains mostly level 2 and some level 3 areas. MCLM indicated this area should be a local priority because it has massive expansion potential. It comprises more than 12 000 ha of land and is owned by a mining company willing to donate ecologically sensitive land for conservation purposes. This area is included as a major project for the municipality.

The **Gatsrand eco-corridor** is located just south of the proposed development. It includes some level 3 areas, however most of it fall out of the 3 categories. Although less important in terms of the GPAES agenda it will be relatively easy to expand in this area. MCLM indicated it should be considered for implementation in less than 5 years.

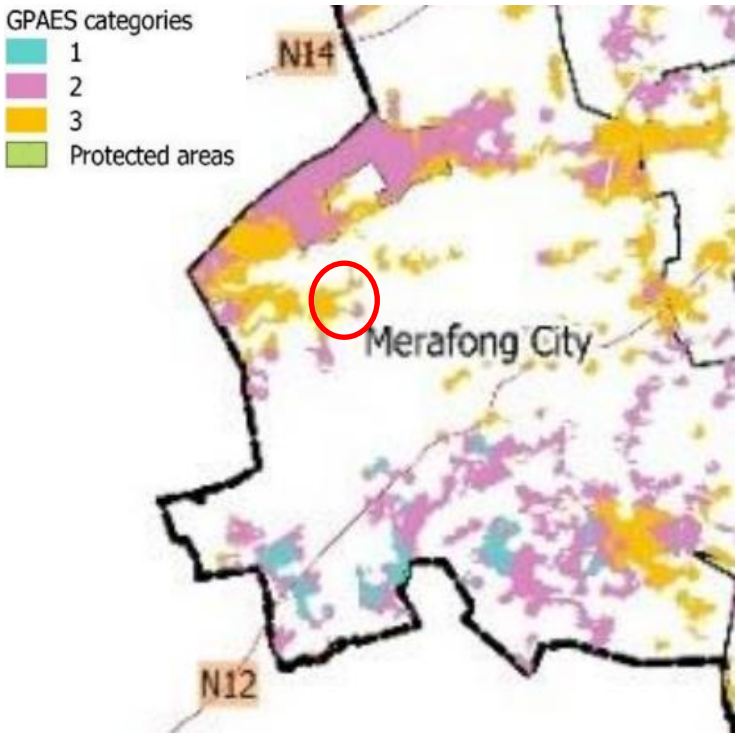

Figure 4-6: Project Area indicated with red circle in relation to the Gauteng Protected Areas Expansion Strategy (source: Gauteng Biodiversity Stewardship Programme.

4.5 ECOLOGICAL CORRIDORS

Ecological corridors are corridors of intact habitat (i.e. mostly good or fair ecological condition) that allow for a range of ecological processes to occur over time and space. They promote connectivity and linkages in the landscape, for example between core areas important for biodiversity, such as protected areas and CBAs.

To facilitate wildlife dispersal and species migration between biodiversity priority areas, which is particularly important in response to climate change, a corridor network was created to be included in the Ecological Support Areas. This is important to ensure the maintenance of ecological processes. Any remaining areas of the provincial-level biodiversity corridor network which could not be identified as CBA but where some remaining function needs to be retained.

An ecological corridor was generated based on a number of important biodiversity features which overlay with one another (refer to Figure 4-7), including CBA and ESA, Protected Areas Expansion (regionally and nationally), undeveloped ridges that must be conserved, and suitable habitat for both plant and animal SCC.

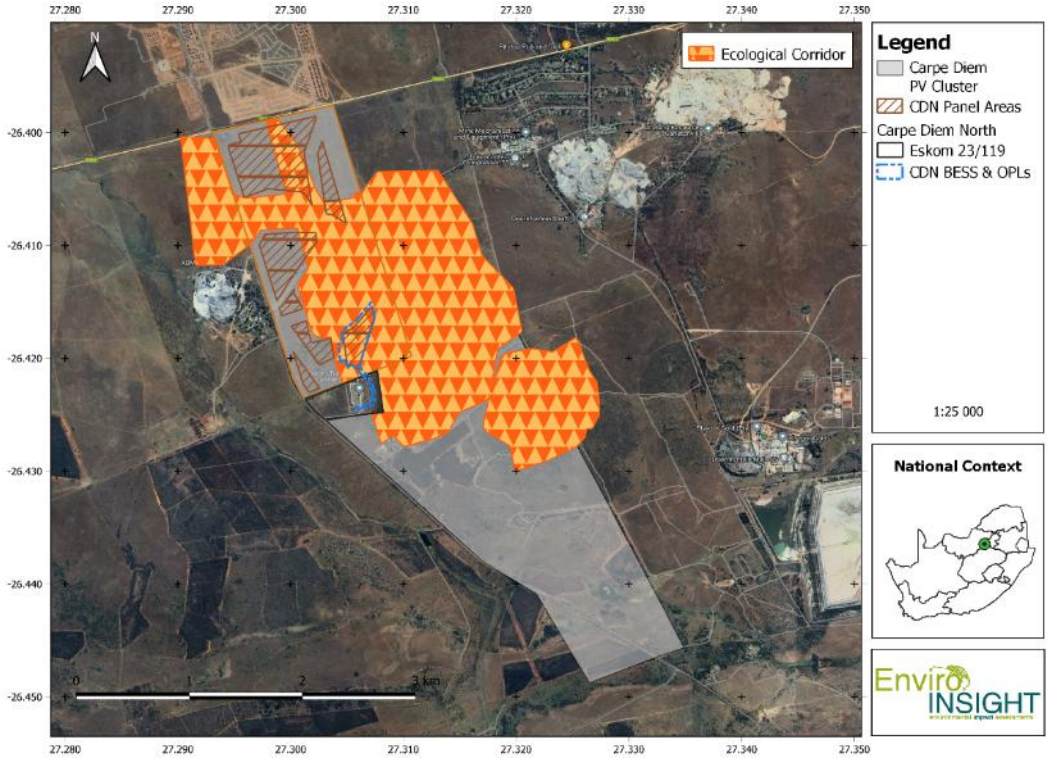

Figure 4-7: Ecological Corridor in relation to the study area.

4.6 GOOGLE EARTH HISTORICAL IMAGERY

The Carpe Diem sites have undergone multiple changes owing to historical and current impacts, mainly due to agricultural practices and the spreading of alien invasive species.

The earliest image found for the area is from 1986 (Figure 4-8), which indicates that the grassland in the northern section of Carpe Diem North was transformed into agricultural land. By 1994 (Figure 4-9), it seems that sections were no longer being utilised for cultivation and the land use was returning to secondary grassland where by 2008 (Figure 4-10), the land was no longer being used for cultivation and has returned completely to secondary grassland. This is evident from the burnt patches of grassland on the imagery. As indicated in Figure 4-11 for 2016, there are no signs of cultivation for Carpe Diem North. It is only by the current species composition and diversity that one can infer the secondary nature of the grassland, which has returned to a functioning system (refer to section 4.8 for more details).

Figure 4-8: Historical Imagery from 1986 for the Carpe Diem Solar Cluster (Source: Google Earth Pro). Area indicated in blue circle shows historical agricultural lands.

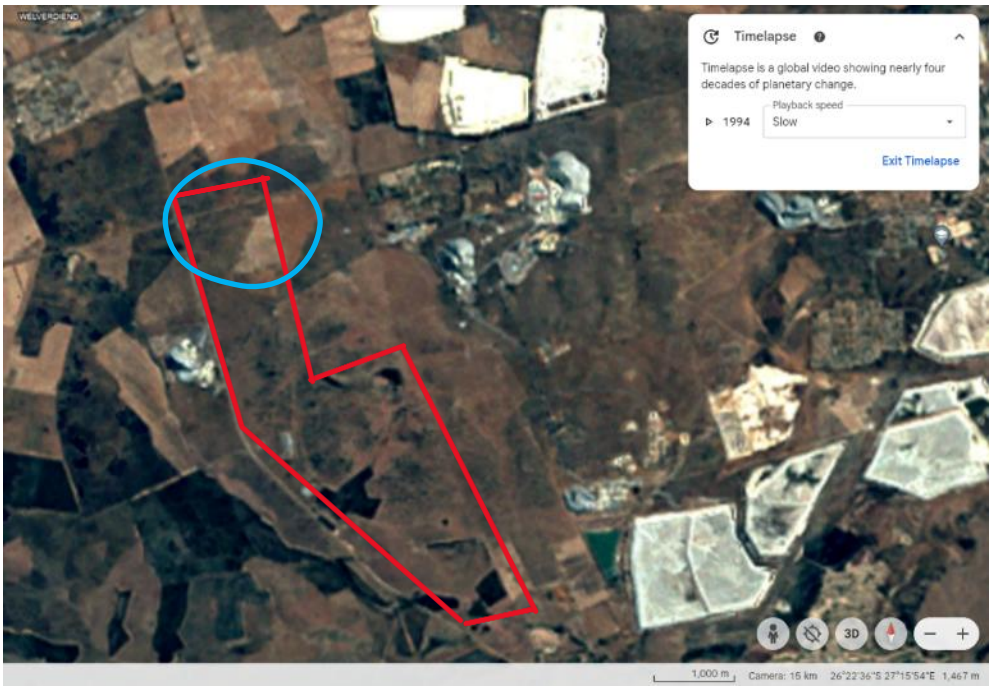

Figure 4-9: Historical Imagery from 1994 for the Carpe Diem Solar Cluster (Source: Google Earth Pro). Area indicated in blue circle shows historical agricultural lands.

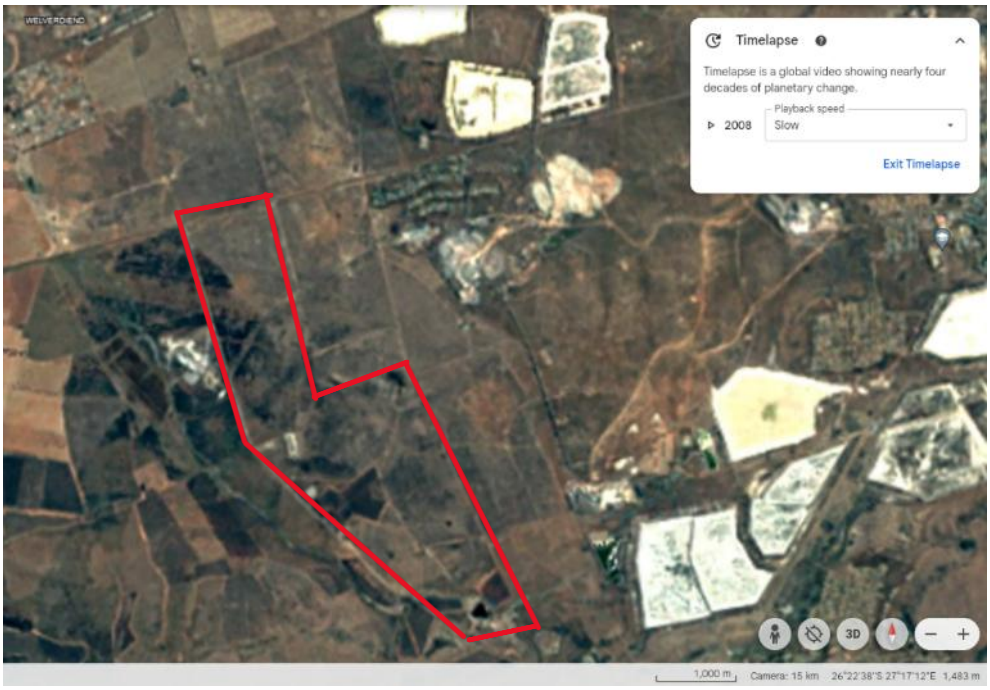

Figure 4-10: Historical Imagery from 2008 for the Carpe Diem Solar Cluster (Source: Google Earth Pro).

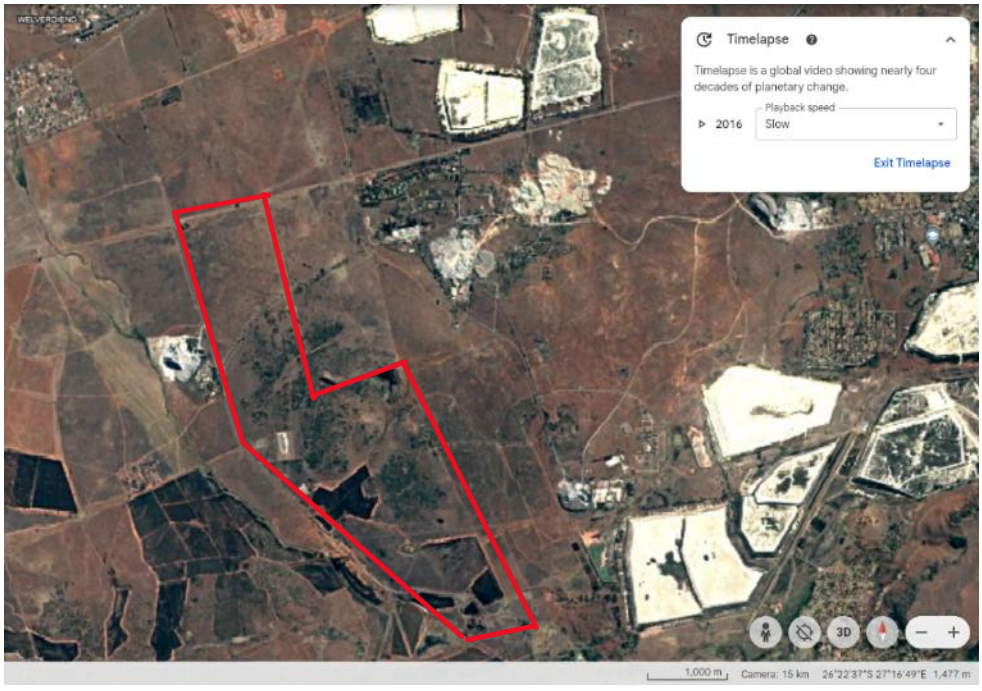

Figure 4-11: Historical Imagery from 2016 for the Carpe Diem Solar Cluster (Source: Google Earth Pro).

4.7 INATURALIST OBSERVATIONS

Since the fieldwork for this assessment took place in February 2023, new information has come to light for the larger area, specifically with regards to plant SCC (Figure 4-12). 45 out of a total of 50 SCC observations were made between March 2023 and August 2024. Within a 10 km radius from the study area, eight plant SCC have been recorded (Figure 4-13) of which one species listed as Vulnerable by the IUCN is Introduced (not native) in South Africa. Accordingly, of the remaining seven species, four species are listed as Vulnerable and two as Near Threatened by the Red List of South African Plants (SANBI). One species is listed as Least Concern nationally but listed as Vulnerable by the IUCN. Refer to Table 4-1 for more details on the Red List status of these species.

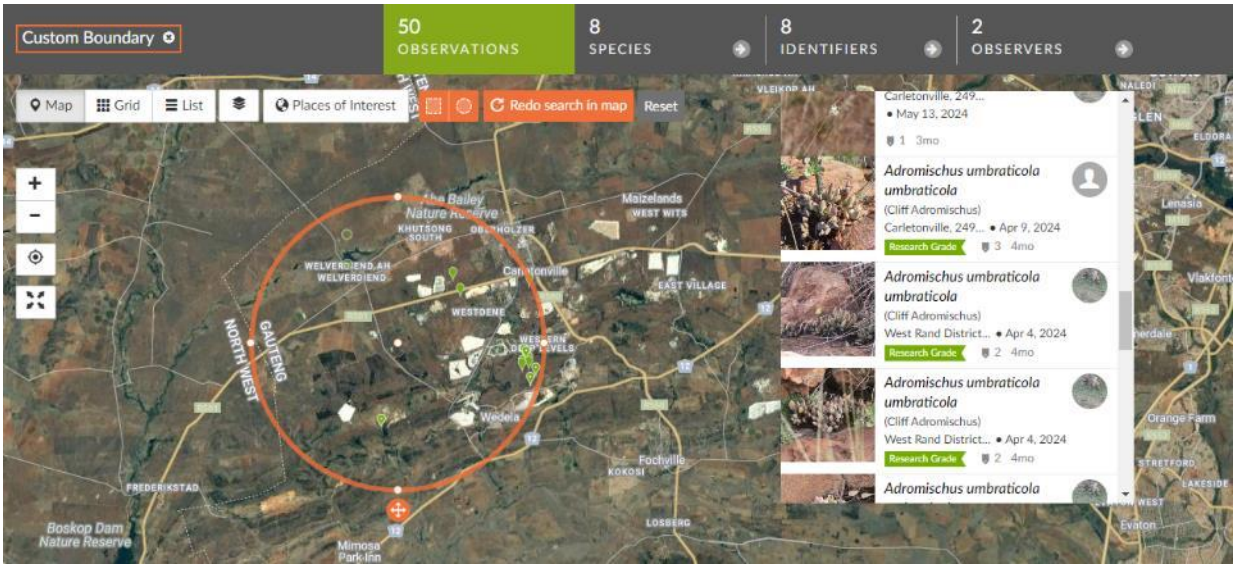

Figure 4-12: Observations of Threatened Plant Species within a 10km radius of the proposed Carpe Diem SEF Cluster (Source: iNaturalist).

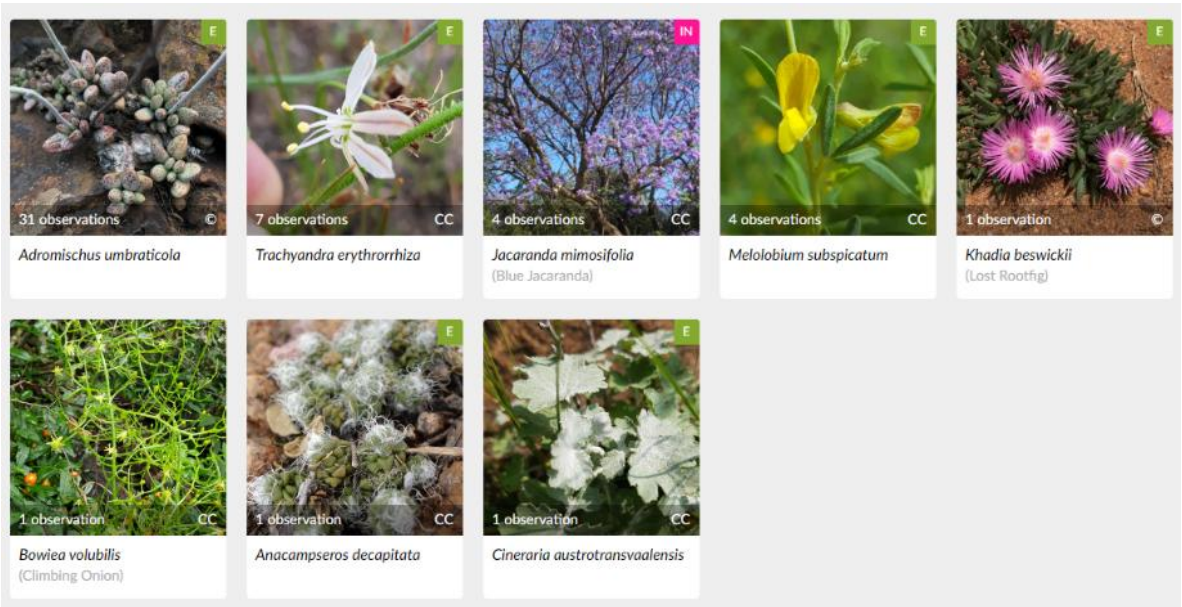

Figure 4-13: Eight Plant SCC recorded within a 10 km radius from the study area (Source: iNaturalist).

Table 4-1: Plant Species of Conservation Concern as observed on iNaturalist.

Species	SANBI Red List Status	IUCN Red List Status
Khadia beswickii	Vulnerable	Critically Endangered
Melolobium subspicatum	Vulnerable	Endangered
Bowiea volubilis ssp. volubilis	Vulnerable	Not Listed
Anacampseros decapitata	Vulnerable	Vulnerable
Adromischus umbraticola ssp. umbraticola	Near Threatened	Not Listed
Cineraria austrotransvaalensis	Near Threatened	Not Listed
Trachyandra erythrorrhiza	Least Concern	Vulnerable

4.8 HABITATS AND SPECIES COMPOSITIONS

The species diversity is generally moderate to high with diversity increasing in natural grassland and bushveld. Five main habitats were identified based on species composition and structure as well as transformed areas where no or limited vegetation remains. The habitats include Grassland, Disturbed Grassland, Watercourse, Bushveld and Alien Invasive Species stands.

Georeferenced photographs were taken to assist in both the site characterisation as well as the sensitivity analysis and provide lasting evidence for future queries. The specialist coverage (Figure 4-14) is considered optimal as every habitat was surveyed, taking into consideration the large study area. Furthermore, all areas of the study area were clearly visible, but not completely accessible due to the extent of the study area and road access limitations.

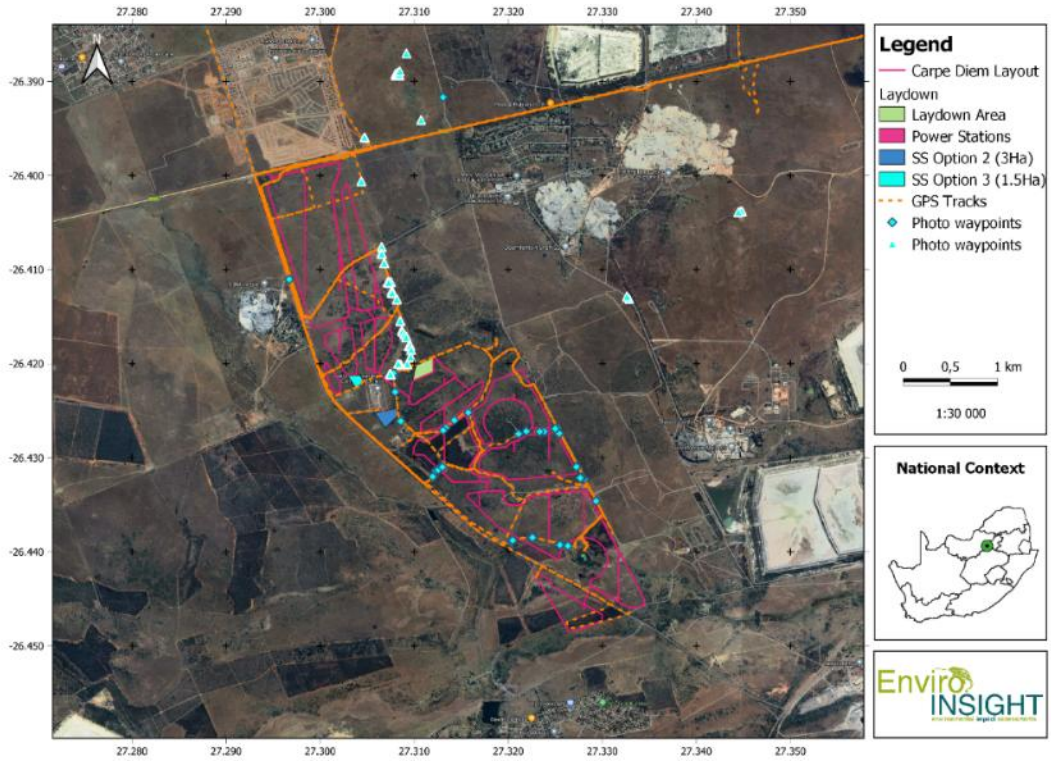

Figure 4-14: GPS tracks covering the study area.

4.8.1 Grassland

Grassland habitats include dry terrestrial grassland (more dominant at Carpe Diem North SEF) and moist grassland. Moist grassland habitats are mainly found along the unnamed non-perennial tributaries at Carpe Diem South SEF. The Grassland is secondary in nature owing to previous disturbances including ploughing and intensive grazing practices. However, numerous geophytes, including *Hypoxis* spp. and *Boophone disticha* as well as underground trees such as *Elephantorrhiza elephantina* are on site. Accordingly, the species diversity and composition can be considered moderate and the grassland shows signs of a functioning ecological system (Figure 4-15).

It must be noted that the grassland was burning during the February 2023 site visit and limited access was possible for Carpe Diem North. Accordingly, coverage for the habitat was considered suboptimal. The assessment for the Carpe Diem powerline corridor took place in February 2024 and the area was surveyed.

Figure 4-15: Vegetation and landscape features of the Grassland.

Species recorded during the survey (alien species indicated with *):

- Grasses: *Aristida congesta subsp. congesta, Eragrostis curvula, E. superba, Cynodon dactylon, Heteropogon contortus, Tristachya leucothrix, Eragrostis gummiflua, Hyparrhenia hirta, Pogonarthria squarrosa, Schizachyrium sanguineum, Tristachya rehmannii, Themeda triandra, Trachypogon spicatus*
- Forbs and Geophytes: *Albuca virens*, *Afroaster serrulatus, Bulbine abyssinica, Boophone disticha, Crabbea angustifolia, Commelina africana, Dicoma anomala subsp. anomala, Eriosema salignum, Gerbera viridifolia, G. piloselloides, Gladiolus crassifolius, Hilliardiella elaeagnoides, Hypoxis hemerocallidea, H. rigidula, Helichrysum nudifolium, H. rugulosum, Indigofera comosa, Ipomoea oblongata, Ledebouria luteola, Ocimum obovatum, Monsonia angustifolia, Hermannia transvaalensis, Senecio inaequidens*, *Chlorophytum saundersiae, Barleria macrostegia, Senecio coronatus, Solanum sisymbriifolium, Sphenostylis angustifolia, Tagetes minuta**, *Verbena* spp.*, and *Zinnia peruviana**.
- Small shrubs and trees: *Asparagus laricinus, Elephantorrhiza elephantina, Seriphium plumosum, Vachellia karroo*

The multi-stemmed shrub *Asparagus laricinus* and the smaller *Seriphium plumosum* are prevalent in some areas especially in heavily grazed areas in the past and continuing today. In terms of larger woody taxa, scattered *Vachellia karroo* trees are present throughout the drier grassland habitats. There is suitable habitat for two plant SCC. Some provincially important species include *Aloe greatheadii, Boophone disticha, Hypoxis hemerocallidea, Eucomis autumnalis.*

4.8.2 Disturbed Grassland

The Disturbed Grassland have been subject to historic overgrazing, alien species encroachment, and other forms of physical disturbances with numerous alien invasive plant species still present, dominating in some areas.

Alien invasive species, such as *Bidens pilosa, Verbena bonariensis, Seriphium plumosum, Erigeron bonariensis, Erigeron canadensis, Campuloclinium macrocephalum* and *Tagetes minuta* are common in areas that have been physically disturbed. Other alien invasive species include *Acacia dealbata, Eucalyptus camaldulensis and Lantana camara.* Indigenous species include *Themeda triandra, Hyparrhenia dregeana, Cymbopogon pospischilii, Melinis repens, Eragrostis curvula, Cynodon dactylon, Gomphocarphus fruticosus* and *Aristida congesta*. Some provincially important species include: *Boophone disticha, Hypoxis hemerocallidea.*

Figure 4-16: Vegetation and landscape features of the Disturbed Grassland.

4.8.3 Watercourse

This is specific to Carpe Diem South SEF as there is no watercourse on Carpe Diem North SEF. Portions of the river corridor are infested by the alien invasive *Eucalyptus* spp. and *Verbena brasiliensis* on the edges, and scattered *Populus x canescens,* and *Salix babylonica*. Remaining areas are characterised by fairly open, wetland habitat dominated by various Cyperaceae species (sedges), grasses/reeds like *Paspalum urvillei, Eragrostis gummiflua, Berkheya radula, Tulbaghia acutiloba* and *Phragmites australis*, and the rush *Typha capensis*. There is suitable habitat for two plant SCC at Carpe Diem South SEF.

Figure 4-17: Vegetation and landscape features of the Watercourse.

4.8.4 Bushveld

The Bushveld habitat is characteristic of the Gauteng Shale Mountain Bushveld characterised by short, semi-open thicket consisting of a variety of fine- and broad-leaf woody species and the field layer dominated by grasses. Bushveld comprise small pockets of indigenous and alien trees and shrubs. It can be described as undulating rocky and vegetated habitat with large extents of flat terrain. The Bushveld occurs mainly on a Class 2 ridge but also in the valleys between ridges.

Indigenous species present on site include (alien species indicated with *):

- Trees and Shrubs: *Acacia dealbata*, Acacia podalyriifolia*, Asparagus laricinus*, *Clutia pulchella, Eucalyptus camaldulensis*, Euclea crispa, Lopholaena coriifolia, Gymnosporia polyacantha, Cussonia spicata* (provincially protected), *C. paniculata sinuata* (provincially protected), *Pittosporum viridiflorum (*protected tree*), Diospyros lycioides, Protea caffra, Mundulea sericea, Ozoroa paniculosa, Vachellia karroo, Senegalia caffra, Searsia magalismontana, S. leptodictya*, *S. pyroides, Seriphium vulgaris, Solanum sisymbriifolium*, Vangueria sp., Ziziphus mucronata, Zanthoxylum capense*.
- Subshrubs / Suffrutex: *Pygmaeothamnus zeyheri, Parinari capensis*
- Grasses: *Aristida congesta, Pogonarthria squarrosa, Trachypogon spicatus, Triraphis andropogonoides*
- Forbs: *Albuca virens, Chlorophytum sp., Clematis villosa, Gerbera viridifolia, Helichrysum callicomum, H. setosum, Indigofera cf. comosa, Ipomoea oblongata, Ledebouria luteola, Nidorella hottentota, Ocimum obovatum, Pentarrhinum insipidum, Tagetes minuta*, Tritonia nelsonii*, *Thesium utile, Zinnia peruviana**
- Geophytes: *Boophone disticha, Hypoxis hemerocallidea, H. rigidula,*
- Ferns: *Pellaea calomelanos, Cheilanthes involuta*
- Succulents: *Crassula capitella, Crassula*

The protected tree *Pittosporum viridiflorum* occurs on the study area. A permit application from the relevant competent is required for its relocation prior to the commencement of construction activities.

Figure 4-18: Vegetation and landscape features of the Bushveld.

4.8.5 Alien Invasive Species stands

These stands located on Carpe Diem South SEF are mainly due to *Eucalyptus* spp. with some herbaceous species and grasses such as *Cymbopogon pospischilii, Campuloclinium macrocephalum, Tagetes minuta, Erigeron bonariensis* and *Erigeron canadensis.*

Figure 4-19: Vegetation and landscape features of the Alien Invasive Species stands.

4.9 EXISTING IMPACTS

The following existing impacts were observed during the surveys:

- Alien invasive plants.
- Existing Powerlines.
- Infrastructure such as internal roads and houses.
- Wildlife fencing.
- Cattle Grazing.
- Fire management in grasslands.

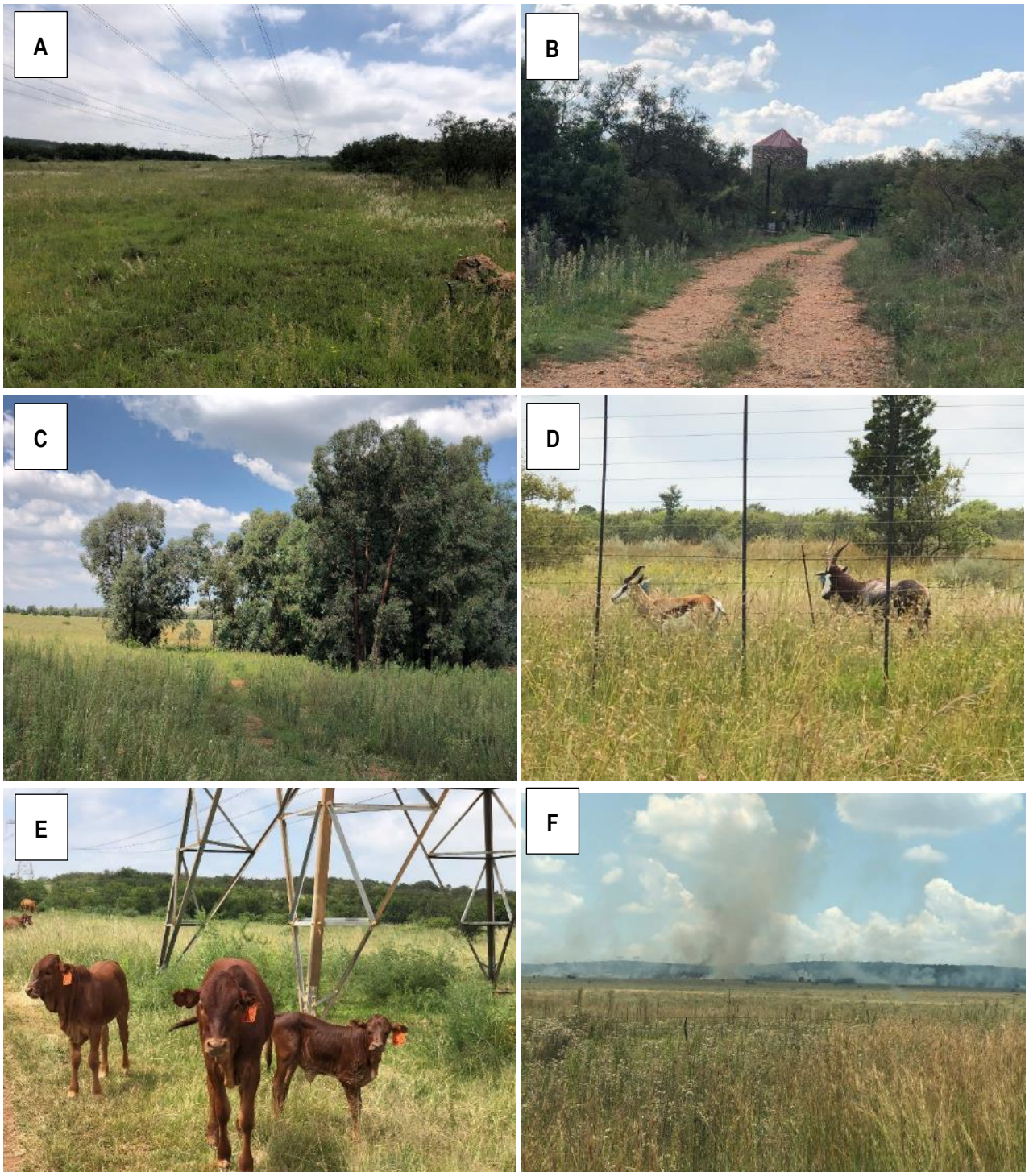

Figure 4-20: Current impacts of the site. A = Powerlines, B = Infrastructure, C = Alien Invasive Species, D = Wildlife fencing, E = Cattle grazing, F = Fire management.

4.10 PLANT SPECIES OF CONSERVATION CONCERN

The plant species Red List gets reviewed every ~ 5 years by South African National Biodiversity Institute (SANBI), with the latest assessment being done in 2024.

As per the screening report, three sensitive species are likely to occur in the study area (all indicated as medium sensitivity). None were recorded during the survey; however suitable habitat is present for several species as indicated in Table 4-2. Additional species were added to the list based on records from iNaturalist within the surrounding area and suitable habitat.

A search of the BODATSA (2024) indicates that 505 plant species have been recorded in the broader Carletonville region. Of these 13 species are on the national Red List (see list below).

Table 4-2: Expected and Observed list of Sensitive Plant Species for the proposed renewable energy facility.

Species name	Family	Red List Status	Provincially Protected / Endemic	Recorded / Suitable Habitat / POO[7]
Sensitive species 1147	ORCHIDACEAE	Endangered C2a(i); D	Yes	**Specific to Carpe Diem North SEF** Suitable habitat: Suboptimal POO: Moderate Occur in Carletonville Dolomite Grassland in open grassland on dolomite or in black, sandy soil.
Delosperma purpureum	AIZOACEAE	Endangered B1ab(iii)+2ab(iii)	Yes	Suitable habitat: Optimal POO: Moderate to **High** Occur on south-facing slopes, in shallow soils among crystalline or conglomerate quartzitic rocks, in sun or in partial shade (rarely in shade) in grassland with some trees.
Sensitive species 1248	HYACINTHACEAE	Vulnerable A2cd		Suitable habitat: **Present** POO: **High** Occur in Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld. In Gauteng, it is often found in open woodland or on steep rocky hills usually in well-shaded situations.
Khadia beswickii	AIZOACEAE	Vulnerable B1ab(iii,v)+2ab(iii,v)	Yes	Suitable habitat: **Present** POO: **High** – occur in Carletonville

[7] POO – Probability of Occurrence

				Dolomite Grassland and Gauteng Shale Mountain Bushveld in open shallow soil over rocks in grassland. Recorded within an 8km radius from the study area.
Ceropegia decidua subsp. pretoriensis	APOCYNACEAE	Vulnerable D1+2	Endemic	**Specific to Carpe Diem North SEF** Suitable habitat: Suboptimal POO: Moderate – occur in Carletonville Dolomite Grassland. Associated with ridges and quartzitic rocky outcrops in pockets of soil among rocks in direct sunshine or shaded areas.
Melolobium subspicatum	FABACEAE	Vulnerable D2	Endemic	**Specific to Carpe Diem North SEF** Suitable habitat: Present POO: Moderate – occur in Carletonville Dolomite Grassland. Species was recorded within a 10km radius of the study area.
Cineraria austrotransvaalensis	ASTERACEAE	Near Threatened B1ab(iii)	Endemic	**Specific to Carpe Diem South SEF** Suitable habitat: **Present** POO: **High** Amongst rocks on steep hills and ridges, at the edge of thick bush or under trees on a range of rock types: quartzite, dolomite and shale
Delosperma leendertziae	AIZOACEAE	Near Threatened B1ab(iii)+2ab(iii)		**Specific to Carpe Diem South SEF** Suitable habitat: **Present** POO: **High** Occurs in Gauteng Shale Mountain Bushveld on steep, south-facing slopes of quartzite in mountain grassland.
Gnaphalium nelsonii	ASTERACEAE	Near Threatened B1ab(iii)	Yes	**Specific to Carpe Diem South SEF** Suitable habitat: **Present** POO: **High** Occurs in seasonally wet places in grassland and savanna, and along dry watercourses.

Ceropegia turricula	APOCYNACEAE	Near Threatened A2c		Suitable habitat: **Present** POO: **High** Occurs on grassland slopes.
Leobordea adpressa subsp. leptantha	FABACEAE	Data Deficient	Endemic	Suitable habitat: Present POO: Moderate
Myrothamnus flabellifolius	Myrothamnaceae	Data Deficient		POO: Moderate
Acalypha caperonioides var. caperonioides	Euphorbiaceae	Data Deficient		Suitable habitat: **Present** POO: **High**

Delosperma purpureum is listed as EN according to the Red List of South African Plants (SANBI, 2024). It occurs on south-facing slopes, in shallow soils among crystalline or conglomerate quartzitic rocks, in sun or in partial shade (rarely in shade) in grassland with some trees. Major threats include habitat loss and degradation as a result of urban expansion and alien plant invasion at four known locations.

Khadia beswickii is listed as VU according to the Red List of South African Plants (SANBI, 2024) and can be found in Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld preferring open shallow soil over rocks in grassland. It is known from 10 locations where it is declining due to habitat loss to urban and infrastructure development, alien plant invasion, mining and collecting for the specialist succulent horticultural trade.

Sensitive species 1248 is listed as VU according to the Red List of South African Plants (SANBI, 2024) and can be found in Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld growing along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes. In Gauteng Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. It tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.

Melolobium subspicatum is listed as VU according to the Red List of South African Plants (SANBI, 2024) and can be found in Carletonville Dolomite Grassland. Very small pockets of suitable habitat remain within the Gauteng province (AOO estimated <20 km²). Development is currently prohibited on any locations where it occurs, and although most of the habitat has already been lost, there is no continuing decline. Habitat fragmentation has however resulted in an altered fire regime (fires occur either too frequently or not at all), which may potentially affect the remaining subpopulations. Major threats to these species include habitat loss and degradation (Victor et al., 2005).

Delosperma leendertziae is listed as NT according to the Red List of South African Plants (SANBI, 2024) and can be found in the Gauteng Shale Mountain Bushveld on steep, south-facing slopes of quartzite in mountain grassland. Major threats are due to declining habitat quality at more than 10 existing locations owing to soil erosion, alien plant invasion and inappropriate fire management (Victor et al., 2005).

4.11 SITE ECOLOGICAL IMPORTANCE (SEI)

The results of the SEI are indicated in the Tables below for each habitat. While most of the features that will be included in the conservation importance (CI) will be provided by the screening tool, it is important to note that CI is evaluated at a much finer spatial scale and based on fieldwork data collection and comprehensive desktop analyses performed by the specialist during the Environmental Authorisation (EA) process. The reasons indicated below are based on the criteria in the guidelines selected for each relevant habitat.

Conservation Importance (CI)

Habitat	Criteria	CI
Grassland	High likelihood occurrence of several EN and VU species. Presence of range-restricted and endemic species. > 50% of receptor contains natural habitat with potential to support SCC.	High
Disturbed Grassland	Confirmed or highly likely occurrence of populations of NT species. > 50% of receptor contains natural habitat with potential to support SCC.	Medium
Watercourse	High likelihood occurrence of VU and NT species. Suitable habitat for rare species. > 50% of receptor contains natural habitat with potential to support SCC.	High
Bushveld	High likelihood occurrence of several EN and VU species. Presence of range-restricted and endemic species.	High

Functional integrity (FI)

Habitat	Criteria	FI
Grassland	Medium semi-intact area for any conservation status of ecosystem type. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	Medium
Disturbed Grassland	Mostly minor current negative ecological impacts with some major impacts (established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. Several minor and major current negative ecological impacts.	Low
Watercourse	Medium semi-intact area for any conservation status of ecosystem type. Good habitat connectivity with potentially functional ecological corridors – fragmentation minor. Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance and good rehabilitation potential.	High
Bushveld	Medium semi-intact area for any conservation status of ecosystem type. Good habitat connectivity with potentially functional ecological corridors. Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance	Medium

Receptor Resilience (RR)

Habitat	Criteria	RR
Grassland	The grasslands natural resilience to infestation by invasive alien species, reduced sunlight and change in species structure and composition is reduced, which can ultimately lead to a complete modification of the grassland. It will require active management after decommissioning and restoration attempts are not always successful. Flora endemic to this habitat is unlikely to adapt to major change, even after a long period.	Low
Disturbed Grassland	The habitat has the potential to be restored over time, particularly the areas that have been invaded by alien invasive species and cattle grazing.	Medium
Watercourse	Habitat and ecological systems that are unlikely to be able to recover fully after a relatively long period (> 15 years required) to restore < 50% of the original species composition and functionality of the receptor functionality.	Low
Bushveld	Will recover slowly (> 10 years) to restore > 60% of the original species composition and functionality of the receptor functionality.	Low

Table 4-3: Determination of Site Ecological Importance (SEI).

Habitat	CI	FI	BI = CI + FI	RR	SEI = BI + RR
Grassland	High	Medium	Medium	Low	High
Disturbed Grassland	Medium	Low	Low	Medium	Low
Watercourse	High	High	High	Low	Very High
Bushveld	High	Medium	Medium	Low	High

It is very important to note that SEI is specific to the proposed development activities and cannot be meaningfully compared between different proposed projects with different associated activities on the same spatial location.

Summary of the SEI:

- In general, the Grassland has **High** sensitivity regarding Terrestrial Biodiversity and Plant SCC. However, taking past and current disturbances as well as important biodiversity areas including ecological corridors into account, several patches are considered **Medium** sensitivity.
- Limited destructive development activities should be considered in High sensitive areas. Avoidance mitigation wherever possible for destructive development activities. Development activities of low to moderate impacts are acceptable. PV panels located in CBA: Optimal and ESA local corridor and ridges must be avoided as far as possible and all permanent transformation for BESS, O&M, laydown area, roads etc. must occur in moderate to low sensitivity areas.
- Grasslands, in some form, can still exist underneath PV panels and might require some form of active intervention to recreate is to grasslands that are functional. As far as possible, the species composition and structure must be representative of the Carletonville Dolomite Grassland. It is anticipated that limited soil disturbance will take place

as bulldozing will be limited, which will protect the seedbank. Other species including geophytes, succulents and forbs could be removed from site prior to construction and replanted after construction.

- Watercourse has **Very High** sensitivity regarding Terrestrial Biodiversity and Plant SCC. No development is allowed within 15m of the edge of a watercourse. Additional buffers and mitigation measures as described by the Aquatic Specialist must be taken into account.
- The Bushveld has **High** sensitivity regarding Terrestrial Biodiversity and Plant SCC. This is mainly due to ridges that provide vital habitat for many threatened and endemic plant species. Ecological corridors must be maintained and intact bushveld on ridges must be excluded from development.
- The Disturbed Grassland overall is considered to have **medium to low** sensitivity regarding Terrestrial Biodiversity and Plant SCC. Development activities including placement of PV panels and permanent infrastructure such as BESS, roads, laydown areas etc. are acceptable.

5 IMPACT ASSESSMENT

5.1 IDENTIFICATION OF POTENTIAL IMPACTS/RISKS

The potential impacts identified during the EIA are listed below and apply to the PV Facilities.

Construction Phase

Potential impact 1: Loss of habitat and sensitive features.

- The solar arrays will be positioned ~ 5m above ground. The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west, or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun. Groundworks is anticipated to be high for the installation as approximately 105 ha will be transformed. Post-construction, vegetation cover will return underneath the PV arrays, albeit at a lower species composition and structure.
- The access road will comprise of a new road, as well as the expansion of sections of the existing farm road. The access roads as well as internal roads will range from 5 -8m in width. It is estimated that approximately 6 ha will be cleared for internal roads. This will result in loss of vegetation and will increase habitat fragmentation as small islands of vegetation will remain. The functionality of these vegetation patches will be reduced.
- The construction camp and laydown area will further transform approximately 5 ha. This must be located in medium to low sensitivity areas.
- The Watercourse and Bushveld habitat were identified as high sensitivity features. The Watercourse should be avoided by the development as well as the Bushveld which intersects with the Ridges.
- Sections of the Grassland habitat was identified as high sensitivity features. Appropriate mitigation measures and active rehabilitation can reduce the impact to the Grassland to moderate. Maintaining ecological corridors could be beneficial for the persistence of the grassland.

Potential impact 2: Loss of protected species.

- No species of conservation concern were recorded during the survey but based on the latest information, several species could likely occur on site owing to suitable habitat.

- Several provincially protected species occur on site which must either be relocated prior to construction or alternative measures made (depending on comments received from the provincial authority). A permit application is required from the provincial department where the development footprint impact on these species.
- The protected tree, *Pittosporum viridiflorum,* was recorded on site. A permit application is required from the competent authority where the development footprint impact on the species. Should relocation be suggested, this must be done prior to commencement of construction activities.

Potential impact 3: Introduction and spread of alien invasive species (AIS).

- AIS are more likely to establish in disturbed areas due to construction activities.
- Alien invasive species density and distribution is high in certain areas, especially where existing infrastructure are located, such as homesteads, roads, dumping sites and mining activities. The spread of these species must be controlled, and all species mentioned in this report must be eradicated.
- Vehicles can also transport seeds from other areas and introduce new species previously unknown to the area.

Potential impact 4: Increased erosion and soil compaction.

- Erosion is likely to occur where vegetation has been cleared.
- Heavy machinery and vehicles operated during the construction phase will lead to soil compaction. Plants cannot readily establish in compacted soil, since the soil is too hard for root penetration.
- Water infiltration is less in compacted areas and the runoff is higher, which could lead to increased erosion.
- Where internal routes cross watercourses, this may result in damage to the habitat, including changes in flow patterns, functionality and erosion.
- Erosion increases the sediment load in the watercourses, resulting in increased sedimentation downstream of the disturbance. Sedimentation may cause a blockage and alter the characteristics of the watercourse.

Potential impact 5: Littering and General Pollution.

- The site camp and construction activities are potential sources of pollution, including hydrocarbons, construction material, domestic waste and sewage.
- Pollution may inhibit plant growth.
- It can cause soil and water pollution if not managed appropriately.
- Pollution will be localised to the site, but several pollutants may spread due to water runoff.

Operational Phase

Potential impact 1: Increase in alien invasive species.

- After construction, alien invasive species could have established in optimal conditions.
- If not managed, these species can spread and reduce plant species diversity and could alter species composition.

Potential impact 2: Loss of species composition and diversity.

- The shading effect from solar panels is likely to affect the species composition and diversity and may result in some bare patches. Numerous shrubs will be removed, where only the herbaceous and grass layers remain.

- Emerging seedlings of protected species may also be affected by the shading. Sensitive species may therefore not regenerate in the developed area.

Potential impact 3: Littering and General Pollution

- The most likely type of pollutants are hydrocarbons spilled when refuelling vehicles, leakages from poorly maintained vehicles, spillage from maintaining machinery on site and littering at the site office or security gate.

Decommissioning Phase

Potential impact 1: Alien invasive species management

- During this phase, machinery can disturb the soil which can create optimal conditions for seeds to sprout.
- Vehicles can also transport seeds from other areas and introduce new species previously unknown to the area.

Potential impact 2: Loss of habitat

- Some vegetation may be destroyed during decommissioning, which may result in loss of species composition and diversity. Decommissioned areas must be rehabilitated to restore the habitats.

Cumulative Impacts

Cumulative impacts including other approved Wind and Solar projects within a 30 km radius are considered.

Cumulative impact 1: Habitat loss and fragmentation

- The vegetation types are not considered threatened, but sensitive features still exist within these vegetation types and on the study area.
- The total developable area for all PV facilities and associated infrastructure is about 650 ha, but the entire site will not be cleared of vegetation. The basal layer will still maintain the grass and herbaceous layer, but trees and shrubs will be removed which will alter the vegetation structure and species composition. In addition, additional loss will be due to internal road network.
- Grassland, Ridges and Watercourse habitats remain important ecological features in terms of ecosystem functioning, climate refugia, landscape corridors and harbouring endemic species. Avoiding these habitats as indicated, will reduce the total sensitive areas for development which in turn will reduce the overall cumulative impacts.

5.2 IMPACT ASSESSMENT

5.2.1 Potential Impacts during the Construction Phase

Impact	Impact Criteria and Significance Pre-Mitigation		Potential mitigation measures	Impact Criteria and Significance Post-Mitigation	
CONSTRUCTION PHASE					
Habitat loss and fragmentation (especially primary grassland, watercourses and ridge / bushveld habitat)	Status	Negative	• No new development should take place within High sensitivity areas or buffer zones. This is specific to the Watercourse, Bushveld (intersecting with Ridges) and specific Grassland patches - existing roads and fencing may be upgraded. • Placement of permanent infrastructure which causes irreversible transformation of the system within High Sensitivity areas must be avoided as far as possible. • The Grassland and bushveld should be avoided where possible, but with appropriate mitigation and significant rehabilitation the limited impacts can be reduced. • No construction related activities, such as the site camp, storage of materials, temporary roads or ablution facilities may be located in the high sensitivity areas. • Linear infrastructure such as roads and overhead powerlines can cross the Watercourse habitat as delineated and mapped by the Aquatic specialist, but it is advised to construct pylons outside the buffer areas, where possible. • The topsoil must not be disturbed, and heavy machinery must only be utilised to only drill holes for the erection of the PV panels, approximately 2m above ground. • Approximately 105 ha, including grassland will be transformed. Should CBA grassland be transformed, a biodiversity offset agreement must be put into place prior to the commencement of development activities. • A rehabilitation management plan must be in place prior to commencement of construction activities. • It is advised that the developer undertake an agreement with the landowner to assist with active eradication of alien invasive species in the surrounding grasslands and watercourses, as well as rehabilitating secondary grasslands and/or old agricultural fields. • Restoring species composition and structure post construction, includes removing species such as geophytes, succulents and forbs from site prior to construction and replant them after construction. The species can be kept in a nursery on site or similar in order to protect them during the construction period • Rehabilitate disturbed areas that are no longer required by the operational phase of the development immediately after construction is completed for a PV facility. Inadequate rehabilitation could result in limited revegetation of	Status	Negative
	Spatial Extent	2		Spatial Extent	1
	Duration	4		Duration	4
	Intensity	8		Intensity	6
	Probability	5		Probability	4
	Reversibility	4		Reversibility	3
	Irreplaceability	4		Irreplaceability	2
	SP	110 High		SP	64 Moderate

Impact	Impact Criteria and Significance Pre-Mitigation		Potential mitigation measures	Impact Criteria and Significance Post-Mitigation	
			indigenous species and/or an invasion of alien vegetation which will result in long term ecological degradation and damage. • Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna. • An Environmental Control Officer (ECO) must be appointed to monitor the clearing of vegetation within demarcated areas and oversee the implementation of the rehabilitation management plan.		
Loss of species of conservation concern	Status	Negative	• Avoidance is the best measure. • The Grassland, Bushveld and Watercourse habitats where suitable habitat is present has been indicated as high sensitivity, and a 15m buffer has been applied. • *P. viridiflorum* (cheesewood) occurs in the bushveld habitat, especially rocky outcrops. • Some species must be protected in situ and cannot be removed with a species permit. • A comprehensive Plant Search and Rescue Operation must be undertaken by a suitably qualified botanical specialist prior to vegetation clearance during the construction phase, specifically related to permit applications (provincially and protected trees) and locating all individuals of SCC within the development footprint. • All relevant plant permits must be obtained from the provincial authority prior to the removal or relocation of SCC, including provincially protected species and protected tree. • Replanting of protected SCC as part of rehabilitation efforts post-construction, where applicable. • A walkdown of the approved layout in terms of the National Forest Act (Act 84 of 1998) is required where individuals are enumerated and recorded with a GPS. For the purposes of the EIA process, the EMPr must include the species and the requirement to do a walkdown of the approved development footprint within the bushveld habitat to comply with the NFA regulations. • Where the approved layout designs impact on individuals, permit applications are required for either the relocation or destruction of provincially protected species and protected trees.	Status	Negative
	Spatial Extent	2		Spatial Extent	1
	Duration	4		Duration	4
	Intensity	8		Intensity	4
	Probability	5		Probability	3
	Reversibility	5		Reversibility	3
	Irreplaceability	5		Irreplaceability	3
	SP	120 High		SP	45 Moderate
Increased alien invasive species	Status	Negative	• A site-specific Alien Invasive Species (AIS) Management Plan must be compiled prior to the commencement of construction activities and implemented during the construction phase and continued monitoring and eradication needs to take place throughout the life of the project. • Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site. • The development footprints and immediate surroundings should be monitored for the growth/regrowth of alien vegetation throughout the construction and operation phases of the project	Status	Negative
	Spatial Extent	2		Spatial Extent	2
	Duration	4		Duration	4
	Intensity	6		Intensity	4
	Probability	4		Probability	3

Impact	Impact Criteria and Significance Pre-Mitigation		Potential mitigation measures	Impact Criteria and Significance Post-Mitigation	
	Reversibility	3		Reversibility	2
	Irreplaceability	3		Irreplaceability	2
	SP	72 Moderate - High		SP	42 Moderate
Increased erosion and soil compaction	Status	Negative	• Utilise existing access routes as far as possible. • Confine the movement of vehicles to the access routes to and from the site and to the construction and operation areas. • Do not drive in the natural veld. • Rehabilitate new vehicle tracks and areas where the soil has been compacted as soon as possible. • Monitor the entire site for signs of erosion throughout the construction, operational and decommissioning phases of the project. • Refer to Aquatic Report mitigation measures relevant to watercourse crossings and development close to watercourses.	Status	Negative
	Spatial Extent	2		Spatial Extent	1
	Duration	4		Duration	4
	Intensity	6		Intensity	4
	Probability	4		Probability	3
	Reversibility	4		Reversibility	3
	Irreplaceability	3		Irreplaceability	2
	SP	76 Moderate - High		SP	42 Moderate
Littering and general pollution	Status	Negative	• The site camp must not be located in very high sensitivity areas and their buffer zones. • Dangerous goods may not be stored within 100 m of a watercourse. • Hydrocarbon fuels must be stored in a secure, bunded area. • Sufficient waste disposal bins must be available on site and clearly marked. Skip bins may be required during the construction phase which must be emptied on a regular basis. • Ablution facilities must be located outside sensitive areas and their buffer zones. • Portable ablution facilities must be regularly cleaned and maintained in good working condition. • Any spillage from ablution facilities must be cleaned up immediately and disposed of in an appropriate manner.	Status	Negative
	Spatial Extent	2		Spatial Extent	1
	Duration	4		Duration	4
	Intensity	3		Intensity	2
	Probability	4		Probability	3

Impact	Impact Criteria and Significance Pre-Mitigation		Potential mitigation measures	Impact Criteria and Significance Post-Mitigation	
	Reversibility	3	• Vehicles must be in good working condition, with no oil, water or fuel leaks. Vehicles must be regularly inspected and any problems corrected. • Refuelling may only take place in an appropriate, bunded area. Refuelling may not take place in sensitive areas. • Hydrocarbon spills must be contained and cleaned up immediately. Spill kits must be available on site in case of accidental spillage.	Reversibility	2
	Irreplaceability	3		Irreplaceability	2
	SP	60 Moderate		SP	33 Low

5.2.2 Potential Impacts during the Operational Phase

Impact	Impact Criteria and Significance Pre-Mitigation		Potential mitigation measures	Impact Criteria and Significance Post-Mitigation	
OPERATIONAL PHASE					
Loss of species composition and diversity	Status	Negative	• The loss of species composition and diversity cannot be mitigated due to a permanent structure which will change microclimatic conditions for the life of the facility operation. • Maintain plant composition and structure below overhead power line based on continuous maintenance as per the management plan. • A rehabilitation plan is required to restore each habitat to a natural state that is representative of the respective vegetation type after decommissioning. This is not possible for primary grasslands, which should be avoided as far as possible.	Status	Negative
	Spatial Extent	1		Spatial Extent	1
	Duration	4		Duration	4
	Intensity	6		Intensity	4
	Probability	3		Probability	3
	Reversibility	4		Reversibility	3
	Irreplaceability	3		Irreplaceability	2
	SP	54 Moderate		SP	42 Moderate
Increased alien	Status	Negative	• Implement an AIS Management Plan in terms of National Environmental Management:	Status	Negative

Impact	Impact Criteria and Significance Pre-Mitigation		Potential mitigation measures	Impact Criteria and Significance Post-Mitigation	
invasive species	Spatial Extent	2	Biodiversity Act (Act 10 of 2004, as amended) (NEMBA). • The site-specific AIS Management Plan must be implemented for the first year of the operational phase. Thereafter, alien vegetation must continue to be monitored and eradicated annually throughout the life of the project. • Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem species are already present in the area and are likely to increase rapidly if not controlled. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. • Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.	Spatial Extent	1
	Duration	4		Duration	4
	Intensity	4		Intensity	2
	Probability	3		Probability	3
	Reversibility	3		Reversibility	2
	Irreplaceability	2		Irreplaceability	2
	SP	45 Moderate		SP	33 Low
Littering and general pollution	Status	Negative	• Vehicles must be in good working condition, with no oil, water or fuel leaks. • Vehicles must be regularly inspected and any problems corrected. • Refuelling may only take place in an appropriate, designated bunded area. • Any spillages must be reported immediately and dealt with appropriately. • Spill kits must be available on site in case of accidental spillage. • Sufficient waste disposal bins must be available on site and clearly marked.	Status	Negative
	Spatial Extent	1		Spatial Extent	1
	Duration	4		Duration	4
	Intensity	4		Intensity	2
	Probability	3		Probability	2
	Reversibility	3		Reversibility	2
	Irreplaceability	2		Irreplaceability	2
	SP	42 Moderate		SP	22 Low

5.2.3 Potential Impacts during the Decommissioning Phase

Impact	Impact Criteria		Potential mitigation measures	Significance and Ranking (Post-Mitigation)	
DECOMMISSIONING PHASE					
Loss of habitat	Status	Negative	• The loss of vegetation is unavoidable within the approved layout development footprint, but sensitive areas must be avoided when dismantling of infrastructure. • The ecological impacts will be similar to those listed in the construction phase and the associated mitigations measures must be updated based on the findings of the operational phase monitoring and implemented to reduce potential adverse impacts. • The dismantling of the project will eventually contribute to the removal of all the implemented structures and the necessary rehabilitation needs to take place to return the land use and vegetation back to a functioning system.	Status	Negative
	Spatial Extent	1		Spatial Extent	1
	Duration	3		Duration	2
	Intensity	6		Intensity	2
	Probability	3		Probability	2
	Reversibility	3		Reversibility	2
	Irreplaceability	2		Irreplaceability	1
	SP	45 Moderate		SP	16 Low
Increased alien invasive species	Status	Negative	• Implement an AIS Management Plan in terms of National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) (NEMBA) for the dismantling of infrastructure and as part of rehabilitation. • The site-specific AIS Management Plan must be implemented for the first year after decommissioning and must be monitored until satisfactory eradication and control has been reached and impacts are low.	Status	Negative
	Spatial Extent	2		Spatial Extent	1
	Duration	3		Duration	2
	Intensity	6		Intensity	4
	Probability	3		Probability	3
	Reversibility	3		Reversibility	2
	Irreplaceability	2		Irreplaceability	1
	SP	48 Moderate		SP	30 Low

5.3 CUMULATIVE IMPACTS

The PV development is not located in a REDZ. Approximately four solar PV development projects are located within a 30km radius from the proposed Carpe Diem PV SEF. Many more renewable energy projects are anticipated owing to the proximity of the Carmel Substation.

Table 5-1: Cumulative impacts that may arise should the development be approved in relation to other renewable energy facilities.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
Loss of vegetation during the construction phase	*Status*	*Negative*	*Moderate*	*Transformation is considered low for this vegetation type but increased renewable developments could change this.*	*Moderate*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Permanent*				
	Consequence	*Substantial*				
	Probability	*Very Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Moderate*				

6 SITE SENSITIVITY

This section details the evaluation of habitat sensitivity with regard to potential construction, operational and decommissioning phase impacts. A sensitivity map was generated for Carpe Diem North (Figure 6-1) and Carpe Diem South (Figure 6-2), where low sensitivity is considered ideal for development and very high sensitivity areas must be avoided (no-go areas). After the draft report went out for public review, the Applicant was requested to avoid all sensitive areas, especially CBA: Optimal. The finalized infrastructure layouts presented in the report for Carpe Diem North and South avoid new development in all high sensitivity areas and their associated no-go buffer zones. The sensitivity map is based on the CBA verification, untransformed ridges, primary vegetation, sensitive features including plant SCC and their respective buffers, and ecological corridors. The following sensitivity levels are applicable for the terrestrial biodiversity features:

- **High** sensitivity features:
  - Watercourses (including wetlands) on Carpe Diem South SEF are recognised to be important owing to the vital role they play in ecosystems, especially since they are critically important for maintaining the quantity and quality of water entering downstream rivers, streams and aquifers and support high level of biodiversity. Two plant SCC could occur along the embankments. Accordingly, the Watercourse is rated as having a high sensitivity to proposed impacts of development and a 15m buffer has been included to protect it.

- Grassland including rocky areas within Grasslands are recognised to be important owing to remnants of Carletonville Dolomite Grassland and CBA Important Areas as well as suitable habitat for SCC. GDARD (2014) indicates: "*All good condition natural vegetation must be designated as ecologically sensitive. The location and extent of all primary grassland (even if it is in a poor/degraded condition) must be mapped and designated as ecologically sensitive*." The development footprint must be reduced where possible. As per Figure 6-1, no permanent transformation activities allowed such as construction of BESS, O&M building, laydown area and PV panels in areas indicated as High including a 15m buffer area.
- Bushveld habitat specifically occurring on ridges provide vital habitat for many threatened and endemic plant species. Ecological corridors must be maintained and intact bushveld on ridges must be excluded from all development activities.

- **Medium** sensitive areas: Disturbed grasslands outside CBA2. These Grasslands are included as ecological corridors and support areas for biodiversity. Development should be reduced as far as possible.

All other areas not indicated on the map are considered low sensitivity as they are either highly degraded or transformed. The presence and abundance of alien invasive species are high with several other impacts including roads, alien invasive species stands, agricultural land, and previously ploughed land.

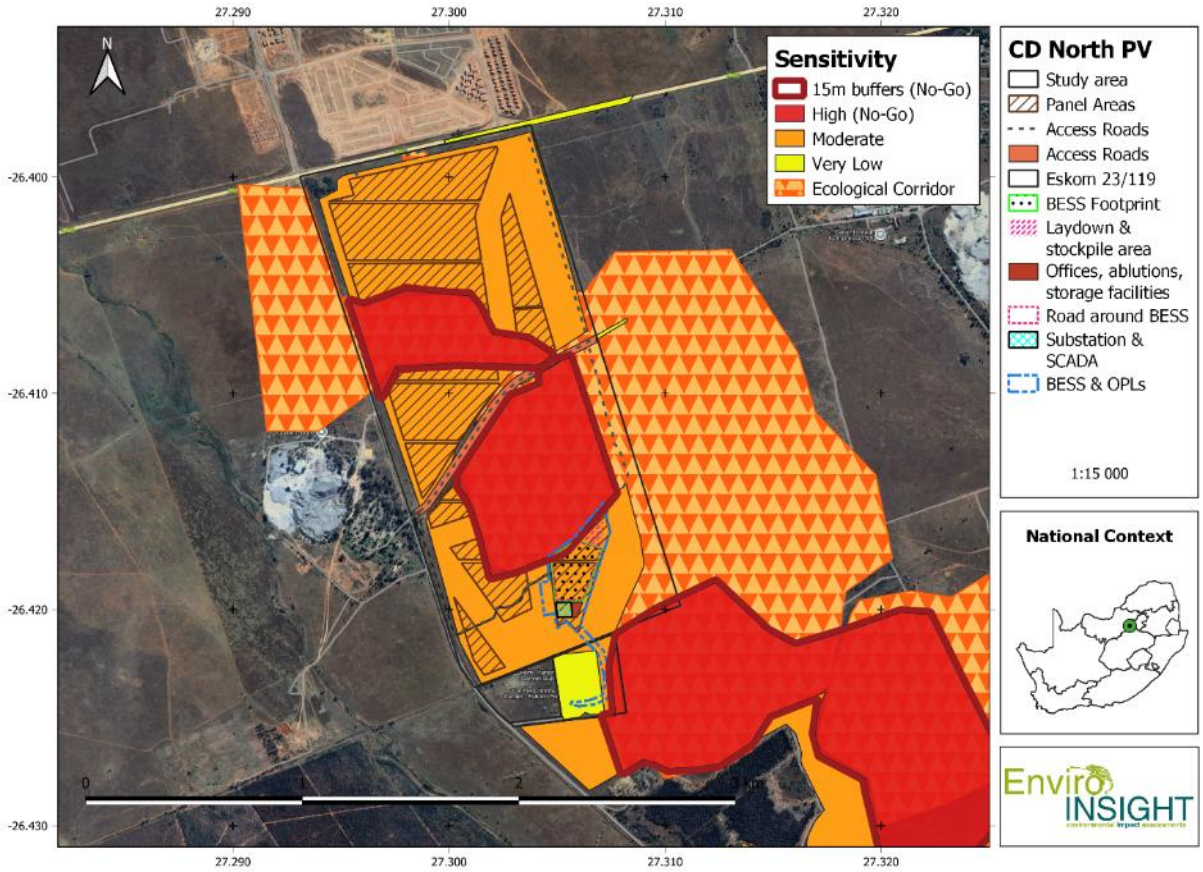

Figure 6-1: Sensitivity map for the proposed Carpe Diem North Solar PV project.

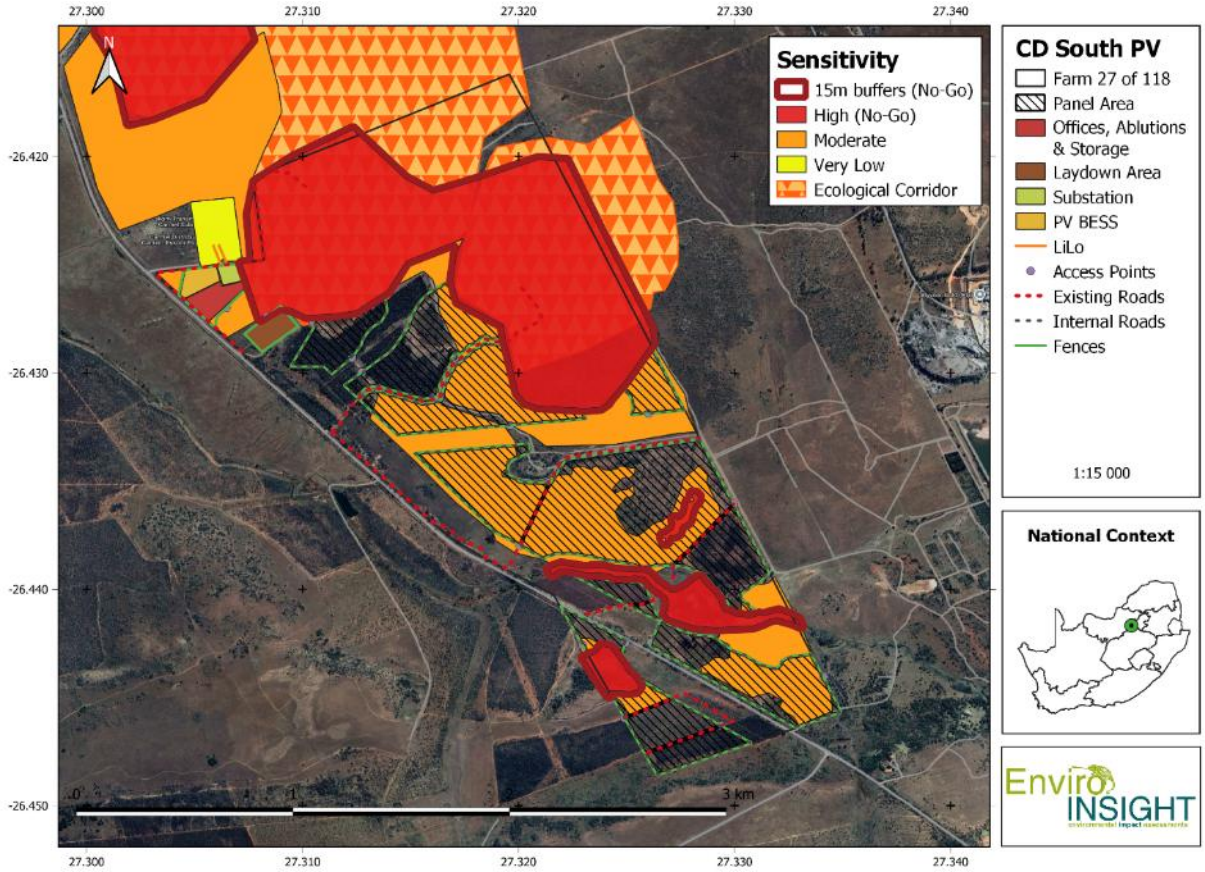

Figure 6-2: Sensitivity map for the proposed Carpe Diem South Solar PV project.

7 CONCLUSION AND PROFESSIONAL OPINION

The proposed Carpe Diem North and South PV projects are situated within a regional area dominated by anthropogenic activities including mining, industrial structures and residential development. The regional landscape is considered highly modified and fragmented, with patches of remaining grassland and bushveld habitat on important ridges. The study area is located in the Carletonville Dolomite Grassland and the Gauteng Shale Mountain Bushveld, both listed as least concern. The proposed Carpe Diem North and South PV projects also intersects CBA2 (Optimal) and ESA1 and ESA2, mainly owing to the remaining primary grassland and potential red list birds and orange list plants, of which three species, namely *Boophone disticha, Eucomis autumnalis* and *Hypoxis hemerocallidea* have been recorded and suitable habitat for several plant SCC are present. Furthermore, the high sensitivities on site are due to the site being located on a Class 1 and 2 ridge, GPEMF high control zone outside urban development zone, NPAES priority focus area including provincial PAES and important ecological corridors.

The protected tree, *Pittosporum viridiflorum,* occurs in the Bushveld habitat. A walkdown of the approved layout in terms of the National Forest Act (Act 84 of 1998) is required where individuals are enumerated and recorded with a GPS. For the purposes of this EIA process, the EMPr must include the species and the requirement to do a walkdown of the approved development footprint within the bushveld habitat to comply with the NFA regulations. Where the approved layout designs impact on individuals, permit applications are required for either the relocation or destruction of provincially protected species and protected trees.

The loss of topsoil and fragmentation of natural habitats that is virtually unavoidable with any type of development, has a negative impact on the regional ecosystem as it disrupts the natural flow of ecosystem services and affects all fauna and flora that are dependent on those habitats. The impact of clearing of the vegetation is High Negative, especially for the construction of permanent infrastructure such as internal roads and other associated infrastructure, and temporary infrastructure (including construction camp and laydown area) during the construction phase. Permanent clearance of indigenous vegetation is estimated to be about 105 ha. Accordingly, the Grassland, Bushveld and Watercourse as indicated in Figure 6-1 and Figure 6-2 must be excluded from these activities where no meaningful rehabilitation and mitigation measures are possible.

An effective rehabilitation and management plan needs to be drafted to ensure the continuous functionality of the grassland system especially where development will take place, taking the construction phase impacts into account, avoidance of highly sensitive areas as well as the possible risk of fires. Over time, dominant species characteristic of the regional vegetation could reduce due to the absence of fire, and other species will dominate the vegetation layer underneath the PV panels. As little is known about the impacts of solar panels on vegetation in South Africa, it is unclear whether there would be a significant change to the system, and whether additional rehabilitation efforts and the extent of success will be required post-operational phase of the facilities.

In conclusion, the terrestrial biodiversity specialist confirms that:

- The current layout is supported from a terrestrial biodiversity perspective and adheres to the relevant recommendations.
- No biodiversity offsets relevant to the terrestrial biodiversity aspects discussed above are required for the current layout.
- No further terrestrial biodiversity specialist studies are required.

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APPENDIX A: SACNASP PROFESSIONAL CERTIFICATE

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Corné Niemandt

Registration Number: 116598

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **13 December 2018** Expires **31 March 2026**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

APPENDIX B: ANIMAL COMPLIANCE STATEMENT

Scoping and Environmental Impact Assessment for the Proposed Carpe Diem Solar PV Facility located on Portion 5 of Farm Varkenslaagte No. 119 and Portion 27 of Farm Doornfontein No. 118, Gauteng Province

August 2024

For

Legacy EMC

Kim Pontac

Vivienne Thomson

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by

Enviro-Insight CC

Samuel Laurence - *Pr. Sci. Nat. Zoologist*

Corné Niemandt - *Pr. Sci. Nat. Ecologist*

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Specialist details

Specialists	Contact details	SACNASP registration	Experience
Samuel David Laurence	sam@enviro-insight.co.za	Zoological and Ecological Sciences - 400450/13	18
Corné Niemandt	corne@enviro-insight.co.za	Ecological Science - 116598	10

Statement of independence

We, Samuel David Laurence and Corné Niemandt, as the appointed animal specialists, hereby declare/affirm the correctness of the information provided in this compliance statement, and that we:

- meet the general requirements to be independent and have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
- are aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).

Samuel Laurence

Corné Niemandt

Site Inspection Details

A site visit was undertaken by Mr Sam Laurence and Mr Corné Niemandt to verify the medium sensitivity for animal species (excluding avifauna), and to assess whether the proposed development will have any significant impact on Animal Species of Conservation Concern (SCC).

Date of Site Visit	October 2022 & February 2023
Duration	Two days (±16 hours)
Season	Wet season
Season Relevance	Conditions were optimal

Methodology

Desktop Study

Relevant databases, field guides and texts were consulted for the literature study which included the following:

- The online Virtual Museum (VM) facility of the Animal Demography Unit (ADU) of the University of Cape Town (http://vmus.adu.org.za) was queried for the presence of mammal (MammalMAP, 2023) and reptile (ReptileMAP, 2023) SCC within the quarter degree grid cell (QDGC) in which the proposed development resides;
- Mammal SCC information was obtained from Child *et al.,* (2016);
- Skinner & Chimimba (2005) and Stuart & Stuart (1998) were consulted in order to provide baseline ecological information to inform the conclusions regarding SCC.
- Reptile SCC information was obtained from Bates *et al.,* (2014); and
- The IUCN[8] and SANBI[9] was utilised to provide the most current account of the conservation status of invertebrates.

Species nomenclature follows the aforementioned references throughout this document except for herpetofauna where nomenclature for reptiles follows ReptileMAP (2023) as new distribution data and taxonomic changes have already occurred since publication of Bates *et al.,* (2014). The use of these online facilities is justified as it not only includes the latest verified publicly contributed data but also a complete record of the museum material in South Africa.

Study Approach

- The Spotted-necked Otter (*Hydrictis maculicollis*; IUCN Vulnerable) is associated with aquatic habitats (Ponsonby et al. 2016).
- Uvarov's Clonia (*Clonia uvarovi*, IUCN Vulnerable) occurs in tall, woodland savannah (Bazelet & Naskrecki, 2014).
- Potchefstroom Blue (*Lepidochrysops procera*, Regionally Rare) is endemic to South Africa, occurring over a large area (EOO 93,799 km^2). However, it occupies a very small portion of this area.
- Highveld Blue (*Lepidochrysops praeterita*, IUCN Endangered) is a range-restricted endemic species of the Free

[8] https://www.iucnredlist.org/
[9] https://speciesstatus.sanbi.org/taxa/lineage/188/

State, Gauteng and North West Provinces in South Africa.

- The Maquassie Musk Shrew (*Crocidura maquassiensis*; IUCN Vulnerable) is strongly associated with wetlands (Taylor et al. 2016). The species is extremely difficult to locate/ sample making the likelihood of successfully detecting them during a rapid faunal survey very low. Under such conditions the precautionary principle should be applied where it is assumed that the species is present in its preferred habitat and therefore, all suitable habitat within the study area would need to be buffered. As described below, this precautionary buffering has been applied.
- If a fieldwork exercise involving trapping were to take place and the species was detected on site in the preferred habitat, the recommended mitigation measure would be to buffer their preferred habitat which is in no way different from applying the precautionary approach described above. Consequently, the specialists evaluated that there would be no value in performing a costly fieldwork assessment as the outcome would not differ from applying the precautionary approach and assuming that the species are present on site in their preferred habitat.
- In summary, it was concluded that conducting fieldwork in order to appropriately assess and mitigate anticipated impacts from the proposed development on mammal species of conservation concern (SCC) was unnecessary, as long as the precautionary approach was applied, and the SCC were assumed to be present on site in their preferred habitat.

Habitat Characterisation & Mapping

Habitat suitability was confirmed from the habitat descriptions and photographs collected during the survey by Samuel Laurence. Vegetation units, mostly botanical delineations, were converted to more structural habitat units of relevance for mammals, by the combination of certain vegetation units into a single macro-habitat. This process resulted in the identification of five structural habitat types, each of which are expected to have specific (albeit possibly overlapping) mammal communities.

Field survey

- The specialist investigated the study area on foot and by vehicle over two days.
- The study area was investigated for animal signs and sightings.
- Five SCC (excluding avifauna) were flagged by the screening report.
- The habitats were characterised, photographs were taken and the likelihood of any SCC being present were assessed.
- All fauna observed during the site survey were photographed (where possible).

Assumptions and limitations

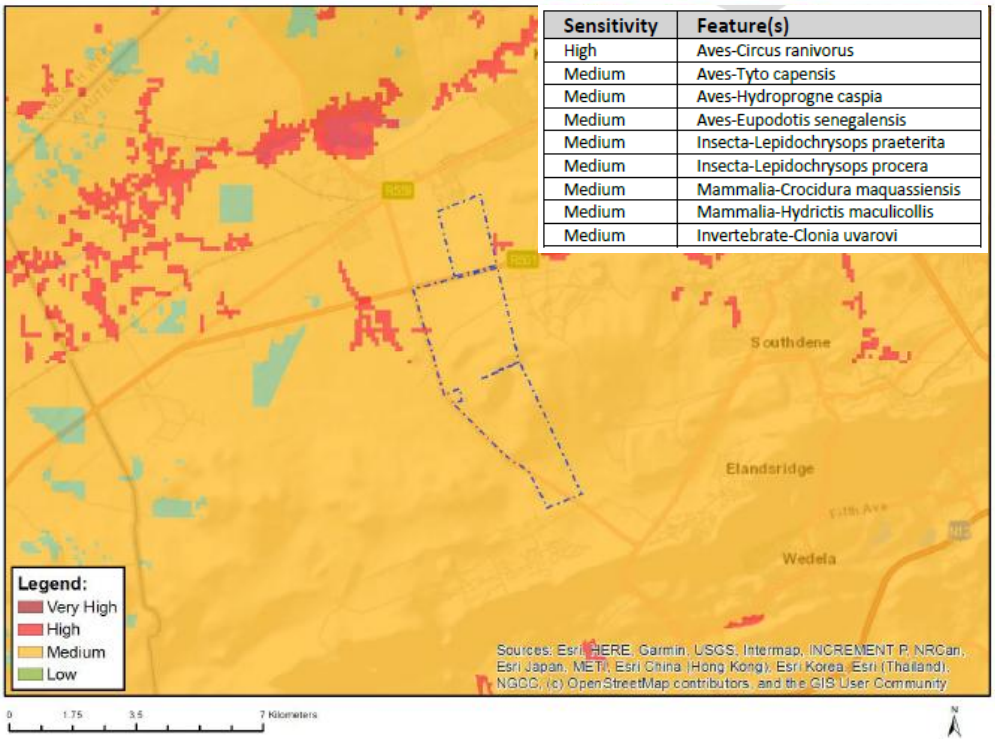
- It is assumed that all third-party information used (e.g. GIS data and satellite imagery) is correct at the time of generating this report.
- The survey was restricted to a single wet summer season which represented optimal conditions.
- The Avifauna assessment is not part of this report and is dealt with under the relevant theme and presented in a separate report.

Results

Screening Report

Based on the environmental screening tool reports generated for the project, the Animal Combined Sensitivity Theme is indicated as a combination of Medium and High (low surface area) sensitivity in areas that are said to contain the following Sensitivity Feature(s).

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Sensitivity	Feature(s)
High	Aves-Circus ranivorus
Medium	Aves-Tyto capensis
Medium	Aves-Hydroprogne caspia
Medium	Aves-Eupodotis senegalensis
Medium	Insecta-Lepidochrysops praeterita
Medium	Insecta-Lepidochrysops procera
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Hydrictis maculicollis
Medium	Invertebrate-Clonia uvarovi

Figure B-1: Screening Tool Report on the Animal Species Theme

Sampling

The results must be related to the delineated habitat analysis as shown as Figure B-2. This provides ecological weight and proof to the species-specific conclusions rendered below.

Maquassie Musk Shrew (*Crocidura maquassiensis*; IUCN Vulnerable B2ab(ii,iii,iv))

This species has an extensive global distribution with an estimated extent of occurrence of 721,746 km^2 spanning South Africa, Swaziland and Zimbabwe (Cassola 2016). Although tolerant of a range of different habitats, this species is dependent on moist habitats such as montane grasslands, coastal forests and riparian or wetland areas. Consequently, Taylor et al. (2016) used wetlands as a proxy for suitable habitat when conducting the Red List assessment for this species. It follows therefore that such wetland habitat is likely to represent ideal conditions for this species and should be protected from degradation as indicated in Taylor et al. (2016).

This species is extremely difficult to trap/ sample (Taylor et al. 2016) rendering short term trapping exercises redundant and since this study area falls within the global range of the species, the precautionary principle is applied, and it is assumed that the species is present in the wetland habitats within **the Project Area of Influence** but not within the affected

development footprint. Therefore, the species is all but absolved from any further impact analysis.

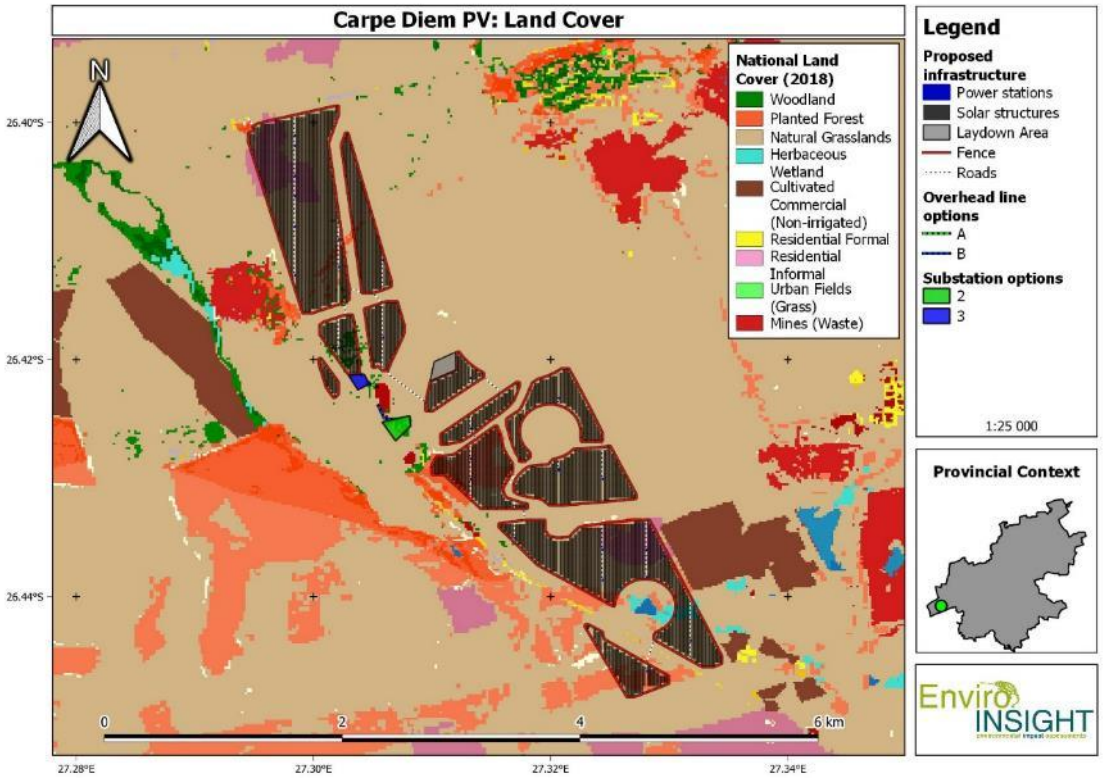


Figure B-2: Animal Habitats for the Carpe Diem PVSEF.

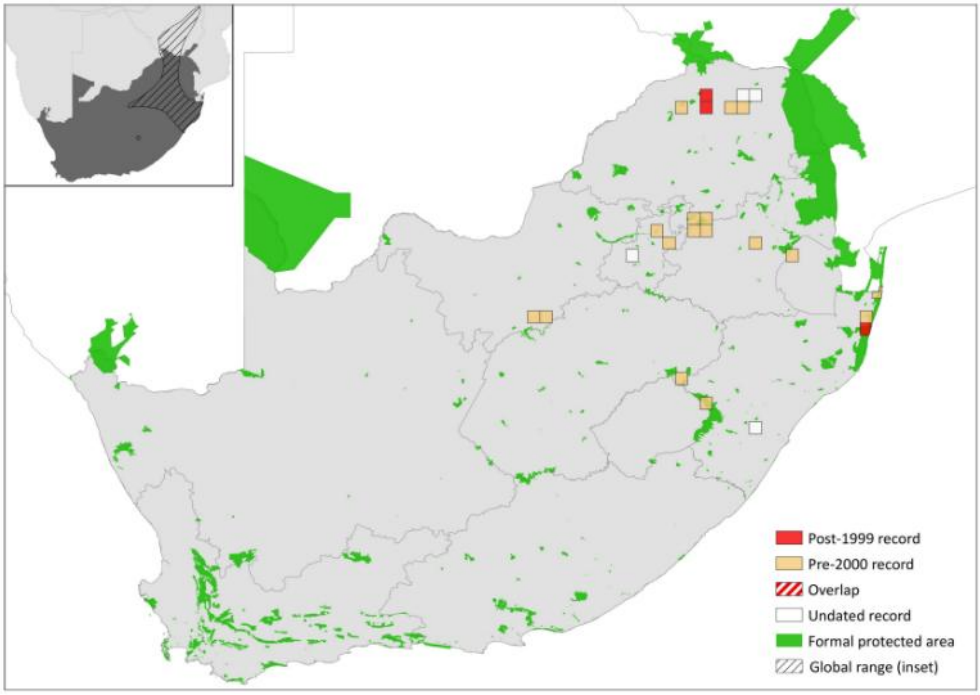


Figure B-3: Distribution records in South Africa for Maquassie Musk Shrew (Crocidura maquassiensis) and global range [reproduced from Taylor et al. 2016].

Spotted-necked Otter (H*ydrictis maculicollis*; IUCN Vulnerable B2ab(ii,iii,iv))

Although these otters have a large extent of occurrence, they are restricted to areas of permanent fresh water, offering good shoreline cover and an abundant prey base, which means the area of occupancy is substantially smaller and difficult to quantify (Reed-Smith et al. 2015). Overall, the population may be declining as river habitat is lost to development and infestations of alien species in riparian areas, and riverside vegetation degradation from overgrazing. Habitat loss and degradation is exacerbated by human disturbance, including both direct and indirect persecution and/or hunting, reduction of denning sites and diminishment of the species (Ponsonby et al. 2016).

Adequate riparian vegetation, in the form of long grass, reeds, or bushes, is also essential to provide cover (Perrin & d'Inzillo Carranza 2000b), especially during periods of inactivity (Perrin & d'Inzillo Carranza 2000a). Spotted-necked Otters are thought to inhabit freshwater habitats where water is not silt-laden, and is unpolluted, and rich in small fishes (Perrin & Carugati 2000a; d'Inzillo Carranza & Rowe-Rowe 2013). However, anecdotal observations suggest they can occur, and can be common, in relatively polluted rivers, such as the Braamfonteinspruit, Jukskei River and Blesbokspruit, Gauteng Province (Ponsonby, thesis, in prep.) and the Vaal River (Power 2014). More surveys are needed to determine at what threshold of water quality otter densities decline. Limited suitable habitat (riparian vegetation) is present for the species, and the watercourses have been excluded from the proposed development footprint.

Uvarov's Clonia (*Clonia uvarovi*, IUCN Vulnerable B1ab(i,iii))

The threat status of Uvarov's Clonia is Vulnerable under criterion B1. Its extent of occurrence is relatively small (~5,000 km^2), it has only been recorded in five locations, and the area, extent and quality of its habitat are expected to be in decline due to grazing pressure, cultivation, urban development, invasive alien plants and climate change. Furthermore, this species is not known to occur in any protected areas. The species inhabits tall woodland savannah and is endemic to the highveld region of South Africa and has only been recorded from Gauteng and North-West Provinces.

This species occurs in tall, woodland savannah in areas which are under intensive grazing pressure by livestock and wildlife, cultivation with non-timber crops, urban development, and invasion by alien plant species such as *Lantana* spp., bugweed (*S. mauritianum*) and other non-native weed species. Furthermore, climate change is already causing increasingly frequent extreme weather events in these regions, which is liable to drastically effect the distribution of grasses, the katydid's food plant.

It may be present in the Bushveld habitat, and accordingly development within this area should be reduced. As per the Terrestrial Biodiversity assessment, the proposed solar development should avoid the bushveld (ridge) habitat. Active rehabilitation of the habitat post-construction is required to promote and enhance the bushveld habitat. This includes removal of alien invasive species and limiting cattle grazing.

Potchefstroom Blue (*Lepidochrysops procera*, Regionally Rare)

This species is endemic to South Africa, occurring over a large area (Extent of Occurrence 93,799 km^2). However, it occupies a very small portion of this area. The taxon is a rare habitat specialist with relatively few known locations, several of which are under some degree of threat. However, such threats are not thought to be significant currently and the taxon is listed as Least Concern (IUCN).

It occurs in rocky areas in grassland (and grassy areas in savanna), where its larval host plant, *Ocimum obovatum*, occurs. The early stages are unrecorded, but the presence of the host ant (probably a *Camponotus* species) will be an additional requisite.

Highveld Blue (*Lepidochrysops praeterita* – IUCN Endangered B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v))

This is a range-restricted endemic species of the Free State, Gauteng and North West Provinces in South Africa (Extent of Occurrence 1,336 km^2, Area of Occupancy 44 km^2). There are currently estimated to be four locations, occurring from Potchefstroom in the west to Walkerville in the east, in the highveld region. The taxon inhabits an area with dense human habitation and intensive land use. Its range has shrunk significantly over the last 20 years, and the number of specimens recorded during its flight period has reduced alarmingly in recent years. The quality and extent of habitat is declining at a fairly rapid rate, due to extended residential construction and associated infrastructure, agricultural development and overgrazing by nomadic herds of cattle. The taxon thus qualifies globally under the IUCN criteria as Endangered under criterion B.

The species has been recorded between Carletonville and Fochville (Figure B-4), as well as in the vicinity of Westonaria. Since it is a rare habitat specialist, and the presence of the host plant is required, the presence of the species is difficult to confirm. The proposed OHPL will however have minimal impacts on the species habitat, and active rehabilitation and planting of *B. obovatum* could enhance the species habitat, if present in the area.

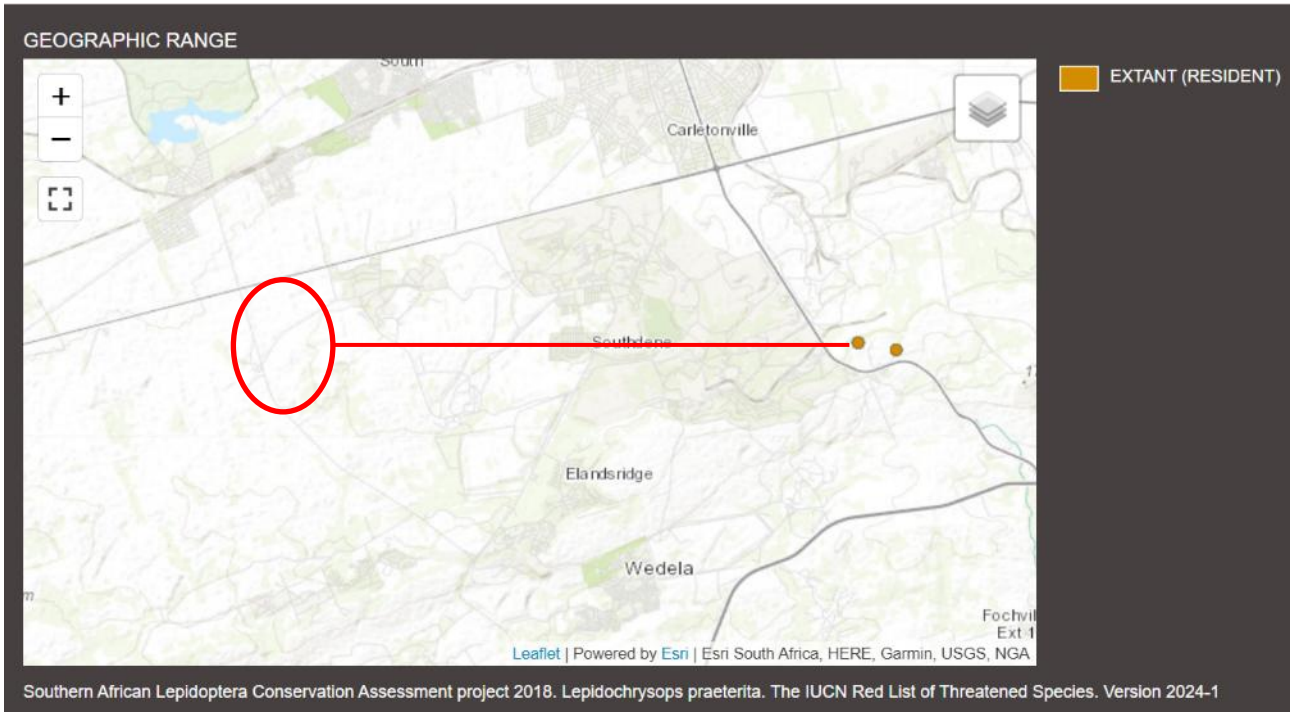


Figure B-4: Geographic range of Southern African Lepidoptera Conservation Assessment project 2018. Lepidochrysops praeterita. The IUCN Red List of Threatened Species. Version 2023-1.

APPENDIX C: IMPACT METHODOLOGY

The assessment of the potential environmental and social impacts was based on the project team's professional judgement, field observations and desk-top analysis.

The standard Legacy EMC impact/risk rating method has been adopted to enable the author to determine the overall impact of the proposed activities by collating the information at hand into a uniform rating matrix.

The following methodology has been applied to the prediction and assessment of impacts. Potential impacts have been rated in terms of the direct, indirect and cumulative nature of the impact:

- **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 – of an activity 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 significance of each potential impact, with and without the implementation of the proposed mitigation measures, will be assessed based on the following variables (evaluation components):

- Spatial extent – The size of the area that will be affected by the impact;
- Intensity – The anticipated severity of the impact;
- Duration – The timeframe during which the impact will be experienced;
- Probability – The probability of the impact occurring;
- Reversibility – The "reversibility" of the environmental impacts of the proposed development after project cessation or decommissioning; and
- Irreplaceability – The "irreplaceability" of natural characteristics in the area that may be impacted upon by the proposed development.

Using the criteria above, the impacts will further be assessed with the use of quantifiable values as described below:

Table 2-C: Evaluation of criteria by means of quantitative ratings and descriptions.

Criteria	Description	Quantitative Rating
Duration	Temporary (less than a year)	1
	Short term (1 to 6 years)	2
	Medium term (6 to 15 years)	3
	Long term (the impact will cease after the operational life of the activity)	4
	Permanent (mitigation will not occur in such a way or in such a time span than the impact can be considered transient)	5
Spatial extent	Site specific	1
	Local (less than 2 km from the site);	2
	Regional (within 30 km of the site)	3
	National (beyond Provincial boundaries and within National boundaries)	4

Criteria	Description	Quantitative Rating
	International / Transboundary (Beyond National boundaries)	5
Intensity / Magnitude Applicable to Negative Impacts (at indicated spatial extent)	None (Biophysical and/or social functions and/or processes will remain unaltered)	0
	Very Low (Biophysical and/or social functions and/or processes might be negligibly altered)	2
	Low (Biophysical and/or social functions and/or processes might be slightly altered)	4
	Medium (Biophysical and/or social functions and/or processes might be notably altered)	6
	High (Biophysical and/or social functions and/or processes might be considerably altered)	8
	Very High (Biophysical and/or social functions and/or processes might be severely altered)	10
Intensity / Magnitude Applicable to Positive Impacts (at indicated spatial extent)	None (Biophysical and/or social functions and/or processes will remain unaltered)	0
	Very Low (Biophysical and/or social functions and/or processes might be negligibly enhanced)	2
	Low (Biophysical and/or social functions and/or processes might be slightly enhanced)	4
	Medium (Biophysical and/or social functions and/or processes might be notably enhanced)	6
	High (Biophysical and/or social functions and/or processes might be considerably enhanced)	8
	Very High (Biophysical and/or social functions and/or processes might be substantially enhanced)	10
Probability	Improbable (5% to no chance of occurring)	1
	Probable (5% - 25% chance of occurring)	2
	Medium Probability (25% - 75% chance of occurring)	3
	Highly probable (75% - 95% chance of occurring)	4
	Definite (greater than 95% chance of occurring)	5
Reversibility	No impact	0
	Impact will be reversible	1
	High potential that impact might be reversed	2
	Moderate potential that impact might be reversed	3
	Low potential that impact might be reversed	4
	Impact cannot be reversed	5
Irreplaceability	None	0
	Very low potential for loss of irreplaceable resources	1
	Low potential for loss of irreplaceable resources	2
	Moderate potential for loss of irreplaceable resources	3
	High potential for loss of irreplaceable resources.	4
	Definite loss of irreplaceable resources	5
CUMULATIVE impact	**High**: The activity is one of several similar pasts, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.	
	Medium: The activity is one of a few similar pasts, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.	
	Low: The activity is localised and might have a negligible cumulative impact.	
	None: No cumulative impact on the environment.	

Once the evaluation components have been ranked for each impact, the significance of the potential impact is assessed (or calculated) using the following formula: **SP (significance points) = (intensity + duration + spatial extent + irreplaceable + reversibility) x probability.**

The maximum value is 150 SP (significance points). The unmitigated and mitigated scenarios for each environmental impact should be rated as per the table below (Table 2-C).

Table 3 -C: Definition of significance ratings (positive and negative)

Significance Points	Environmental Significance	Description
125 – 150	Very high (VH)	An impact of high or very high significance could influence a decision about whether or not to proceed with the proposed Project, regardless of available mitigation options. **Cumulative Impacts:** The activity is one of several similar pasts, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
100 – 124	High (H)	
75 – 99	Moderate-High (MH)	If left unmanaged, an impact of moderate-high significance could influence a decision about whether or not to proceed with the proposed Project. Mitigation options should be re-evaluated.
40 – 74	Moderate (M)	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with the proposed Project. **Cumulative Impacts:** The activity is one of a few similar pasts, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.
<40	Low (L)	An impact of low significance is likely to contribute to positive decisions about whether or not to proceed with the proposed Project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation. **Cumulative Impacts:** The activity is localised and might have a negligible cumulative impact.
+	Positive impact (+)	A positive impact is likely to result in a positive consequence/effect and is likely to contribute to positive decisions about whether or not to proceed with the proposed Project.