ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED ENAMANDLA SOLAR ENERGY FACILITY (PV 4) AND ASSOCIATED INFRASTRUCTURE:

FAUNA & FLORA SPECIALIST SCOPING STUDY

PRODUCED FOR WSP

ON BEHALF OF BIOTHERM ENERGY (PTY) LTD

BY

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1 INTRODUCTION

BioTherm Energy (Pty) Ltd is proposing to develop five PV facilities with associated infrastructure and two CSP facilities on Hartebeest Vlei 86, situated approximately 18 km south of Aggeneys in the Northern Cape Province. The CSP facilities will be known as Letsoai CSP Site 1 and Letsoai CSP Site 2; and the PV facilities are referred to as Enamandla PV Site 1, Enamandla PV Site 2, Enamandla PV Site 3, Enamandla PV Site 4 and Enamandla PV Site 5 respectively. Each of these PV and CSP facilities will be assessed through a separate EIA process.

This Specialist Ecological Scoping Report forms part of the required EIA process for the Letsoai and Enamandla solar facility developments and details the ecological features of the proposed site and provides a preliminary assessment of the ecological sensitivity of the affected areas and identifies the likely impacts that may be associated with the development of solar energy facilities at the site.

A site visit as well as desktop review of the available ecological information for the area was conducted in order to identify and characterize the ecological features of the sites and develop a draft ecological sensitivity map for the sites. The information and sensitivity map provides an ecological baseline that can be used in the planning phase of the development to ensure that the potential negative ecological impacts associated with the development can be minimized going into the EIA phase. Furthermore, the study defines the terms of reference for the EIA phase of the project, provides a preliminary assessment of potential impacts and outlines a plan of study for the EIA which will follow the Scoping Study. The full scope of study is detailed in Section 2.3 below.

2 STUDY APPROACH

2.1 SCOPE OF STUDY

The specific terms of reference for the scoping study includes the following:

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- Direct, indirect and cumulative impacts of the identified issues are evaluated within the Scoping Report in terms of the following criteria:
    - the nature, which includes a description of what causes the effect, what will be affected and how it will be affected;
    - the extent, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international;

- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;
- Identification of potentially significant impacts to be assessed within the EIA phase and the details of the methodology to be adopted in assessing these impacts. This should be detailed enough to include within the Plan of Study for EIA and include a description of the proposed method of assessing the potential environmental impacts associated with the project.

2.2 ASSESSMENT APPROACH & PHILOSOPHY

The assessment will be conducted according to the EIA Regulations, published by the Department of Environmental Affairs (2014) as well as within the best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005).

This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

- Demonstrate how the proponent intends complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should:

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

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:
The study will include data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:

- A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

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

Community and ecosystem level

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

Species level

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

Fauna

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

Other pattern issues

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

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

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

2.3 RELEVANT ASPECTS OF THE DEVELOPMENT

The proposed Enamandla PV site 4 solar energy facility will comprise the following components:

- Solar PV panels, which will be either fixed axis mounting or single axis tracking solutions, and will be either crystalline silicon or thin film technology. DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22-33kV (medium voltage) in the transformers;
- The medium voltage collector system will comprise of cables (1kV up to and including 33kV) that will be run underground, except where a technical assessment suggest that overhead lines are applicable;
- An onsite 132kV powerline connecting the facility to the onsite substation;
- An onsite 132/400kV Substation, with the transformers for voltage step up from medium voltage to high voltage. The Substation will occupy an area of 150m x 150m;

- A laydown area for the temporary storage of materials during the construction activities;
- Access roads and internal roads;
- Sewage disposal facility and septic tanks;
- Construction of a car park and fencing; and
- Administration, control and warehouse buildings.

One EIA will be undertaken for the transmission integration of all the solar projects. There are four powerline alternatives and two alternatives for the water pipeline (western and eastern corridors).

Table 1. List of EIAs that will be undertaken for the various proposed facilities at the site.

Letsoai (2 EIAs)	**EIA 1** – Site 1 - 1 x CSP 150 MW power station including internal power lines, access road and water pipeline (774 ha)	Northern Cape – near Aggeneys
	EIA 2 – Site 2 - 1 x CSP 150 MW power station including internal power lines and access road (779 ha)	
Enamandla (5 EIAs)	**EIA 1** – Site 1 - 1 x PV 75MW including internal power lines and access road (354 ha)	Northern Cape – near Aggeneys (Immediately adjacent to Letsoai)
	EIA 2 – Site 2 - 1 x PV 75MW including internal power lines and access road (491 ha)	
	EIA 3 – Site 3 - 1 x PV 75MW including internal power lines and access road (725 ha)	
	EIA 4 – Site 4 - 1 x PV 75MW including internal power lines and access road (337 ha)	
	EIA 5 – Site 5 - 1 x PV 75MW including internal power lines and access road (325 ha)	
Letsoai and Enamandla integrated linear infrastructure (1 EIA)	EIA 1 – 400 kV Power Line Alternatives (1-4), 2 water pipeline routes (Alternative 1 and 2)	

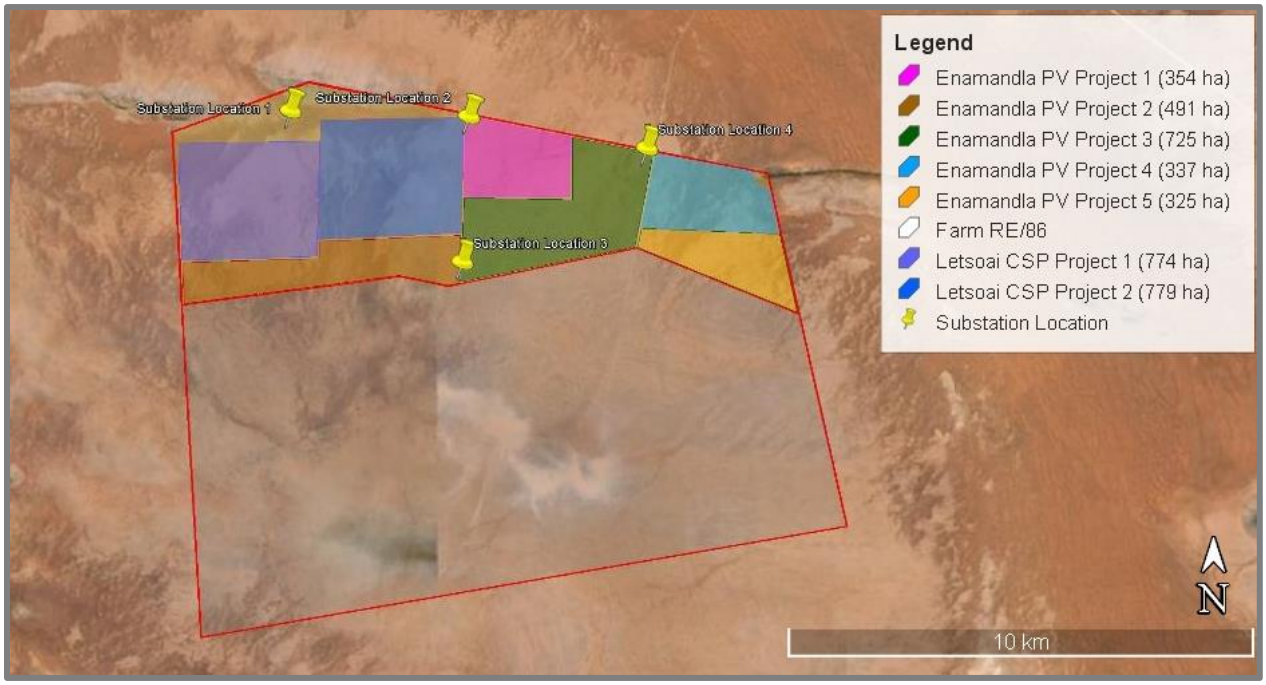

Figure 1. Satellite image showing the boundaries of the two Letsoai CSP sites and five Enamandla PV sites. Substation options are indicated by the yellow markers.

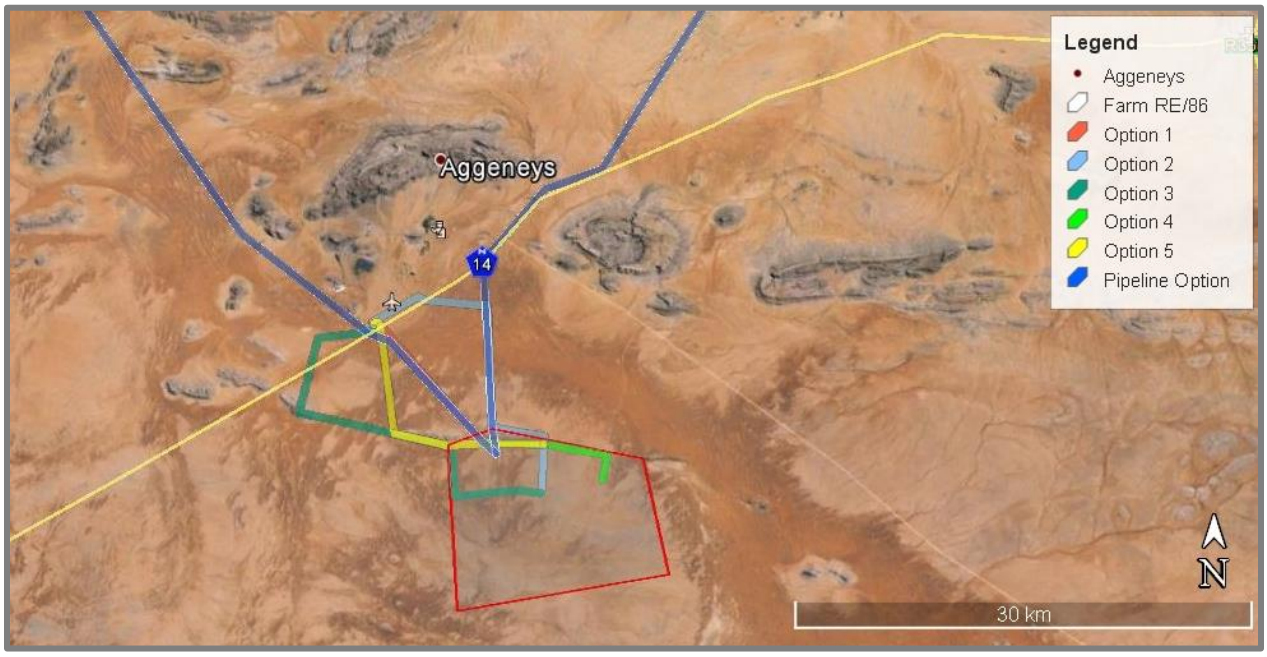

Figure 2. Satellite image showing the powerline corridor options for the integrated electrical infrastructure for the two Letsoai CSP sites and five Enamandla PV sites. Water pipeline corridor options are indicated in blue.

2.4 LIMITATIONS & ASSUMPTIONS

The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species sampled at the time of the site visit should be critically evaluated.

The main site visit for the current study took place in April 2016 which is usually the end of the wet season in the area. The wet season had however been relatively poor and it was relatively dry over most parts of the site. There had however been some rains preceding the site visit and some parts of the site, especially areas of deeper sands were relatively wet with a high abundance of annuals and geophytes. Even within the drier parts of the site the shrubs and grasses present were green or had flowered and could be identified. As a result, the results of the site visit are considered reliable and additional fieldwork at the site would be unlikely to change the assessed sensitivity of the site. The desktop study imposes some limitations on the study as the available maps and databases do not have a high resolution and many areas have not been well sampled in the past. As a result, these databases may underestimate the diversity of the site. This is to some extent countered in the current study by previous experience of the specialist in the immediate area and knowledge of the nature and distribution of sensitive features in the area.

The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

3 METHODOLOGY

3.1 DATA SOURCING AND REVIEW

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

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas for the site and surroundings were extracted from the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 2918 was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a

conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.

- The IUCN conservation status (Figure 3) of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2013).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011). This includes rivers, wetlands and catchments defined under the study.
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna:

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria 2015 (See Figure 3) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. To address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

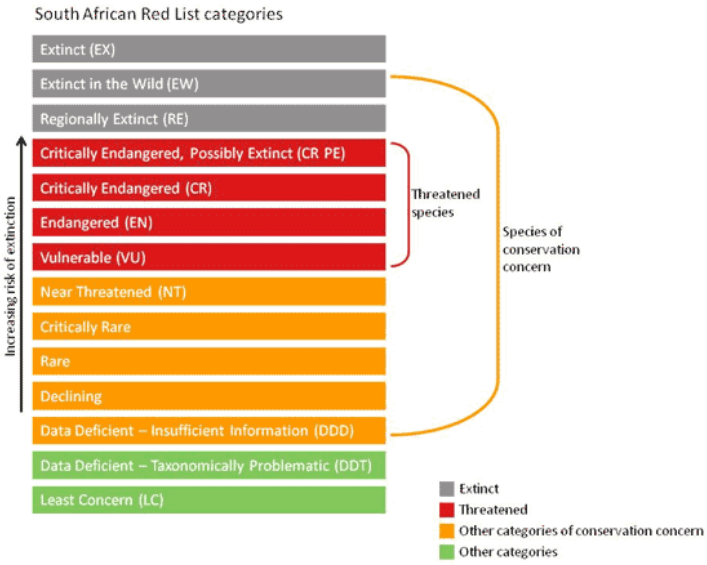

Figure 3. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

3.2 SITE VISIT

The site was visited on 1st and 2nd of April 2016. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Specific features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. This included features such as any pans and rocky outcrops that were not visible from the access roads of the site and might have otherwise been missed. Walk-through-surveys were conducted within representative areas across the different habitats units identified and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

3.3 SENSITIVITY MAPPING & ASSESSMENT

A draft ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This includes delineating the different habitat units identified in the field and assigning sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern.
The purpose of this map is to provide a guide to development at the site and ensure that areas that are intrinsically sensitive or vulnerable to disturbance could be accommodated at the planning stage within the layout as much as possible.

The ecological sensitivity of the different units identified in the mapping procedure for the broad-scale sensitivity map was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact may occur due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is generally undesirable and should proceed with caution as additional specific mitigation and avoidance is usually required to reduce impacts within these areas to acceptable levels. High sensitivity areas are also usually more sensitive to cumulative impact and the footprint within these areas should be kept low.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided. However, in case of linear features such as drainage lines, it may be necessary for access roads and other infrastructure to traverse such features. However no infrastructure should be located within such areas and other disturbance should be minimized. Excessive disturbance or impact to such areas may be considered to constitute a fatal flaw of the development and as such should be avoided and minimized as much as possible.
- In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories.

4 BASELINE DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map (Mucina & Rutherford 2006), (Figure 4) the 5 PV sites and 2 CSP sites are all restricted to the Bushmanland Arid Grassland vegetation type. The powerline corridor options and water pipeline options, however, in some places traverse Bushmanland Sandy Grassland, Bushmanland Inselberg Shrubland, Eastern Gariep Rocky Desert and Eastern Gariep Plains Desert.

Bushmanland Arid Grassland vegetation type is an extensive vegetation type and is the second most extensive vegetation type in South Africa and occupies an area of 45 478 km^2. It extends from the

study area around Aggeneys in the east to Prieska in the west. It is associated largely with red-yellow apedal (without structure), freely drained soils, with a high base status and mostly less than 300mm deep. Due the arid nature of the unit which receives between 70 and 200 mm annual rainfall, it has not been significantly impacted by intensive agriculture and more than 99% of the original extent of the vegetation type is still intact. Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is a relatively low number given the extensive nature of the vegetation type.

Bushmanland Sandy Grassland occurs in the surrounds of Aggeneys and the largest intact patch of this vegetation type fills the shadow valley of the intermittent Koa river southeast and west of Aggeneys (Mucina & Rutherford 2006), in close proximity to the current site. The vegetation consists of dense, sandy grassland with dominant white grasses (*Stipagrostis*, *Schmidtia*) and abundant drought-resistant shrubs. The geology consists of mostly Quarternary sediments (sand, calcrete). Typically the surface is covered by red sands >300mm deep, forming dunes in places (Mucina & Rutherford 2006). The vegetation is Least Threatened with a target for conservation of 21% (Mucina & Rutherford 2006).

Bushmanland Inselberg Shrubland is associated with the hills and inselbergs in northern Bushmanland in the Aggeneys and Pofadder areas at altitudes ranging from 600 to 1120m. This vegetation type does not occur within any of the PV or CSP development sites, but the water pipelines and some of the electrical infrastructure do traverse this vegetation type. It consists of fairly azonal vegetation - shrubland with both succulent (*Aizoaceae*, *Asphodelaceae*, *Crassulaceae*, *Didiereaceae*, *Euphorbiaceae, Zygophyllaceae*) as well as nonsucculent (mainly *Asteraceae*) elements, with sparse grassy undergrowth (*Aristida*, *Eragrostis*, *Stipagrostis*) on steep slopes. The geology consists of inselbergs of high-grade metamorphic rocks on a broad alluvial plain. This vegetation type is threatened by mining (although not immediately) and has a target of 34%. None of it is statutorily conserved (Mucina & Rutherford 2006). In general this is considered to be a sensitive vegetation and habitat type as the diversity is high and it contains a high abundance of listed and endemic plant species. Development within these areas should be reduced as much as possible.

The Eastern Gariep Plains Desert consists of sloping plains of typical wash vegetation, occurring in a broad east-west band between the mountains to the north that fringe or are close to the Orange river and the more broken east-west line of hills and mountains to the south (Annakoppies, Grootberg, Witberg, Heramoebberge, Bantamerg). The grassland is dominated by ‘white’ grasses, some of which are spinescent (*Stipagrostis* spp) with additional shrubs and herbs in the drainage lines and on the gravely or loamy soil next to the mountains (Mucina & Rutherford 2006). The geology and soils consist of Quarternary sheet-wash alluvial deposits, sands, deep in places, whilst in the south soils are red-yellow apedal, freely drained soils. None of this vegetation type is contained in statutory conservation areas with few intact areas left due to overgrazing and climate and its conservation target is 34% (Mucina & Rutherford 2006). In the east this vegetation unit is transitional to Bushmanland Arid Grassland to the south.

Eastern Gariep Rocky Desert vegetation occurs on all rocky desert areas along the Orange River and smaller mountains between Pella and Vioolsdrif. The vegetation occurs on hills and mountains (up to 650m of relative altitude from their base), mostly with bare outcrops and covered with sparse shrubby vegetation in crevices. This vegetation unit is usually separated by broad sheet-wash plains and habitats are mostly controlled by topography, aspect, local climate and lithology (Mucina & Rutherford 2006). It is a very rocky substrate with little to no soil. The southernmost mapped mountains are transitional to Bushmanland Inselberg Shrubland. None of this unit occurs in statutory conservation areas (Mucina & Rutherford 2006) and it has a conservation target of 34%.

There are no wetlands within the PV and CSP sites but there is a wetland within the corridor of Powerline Corridor (option) 3, one in close proximity to Powerline Corridor 1 and a couple in close proximity to the Waterpipe Corridor Option 2.

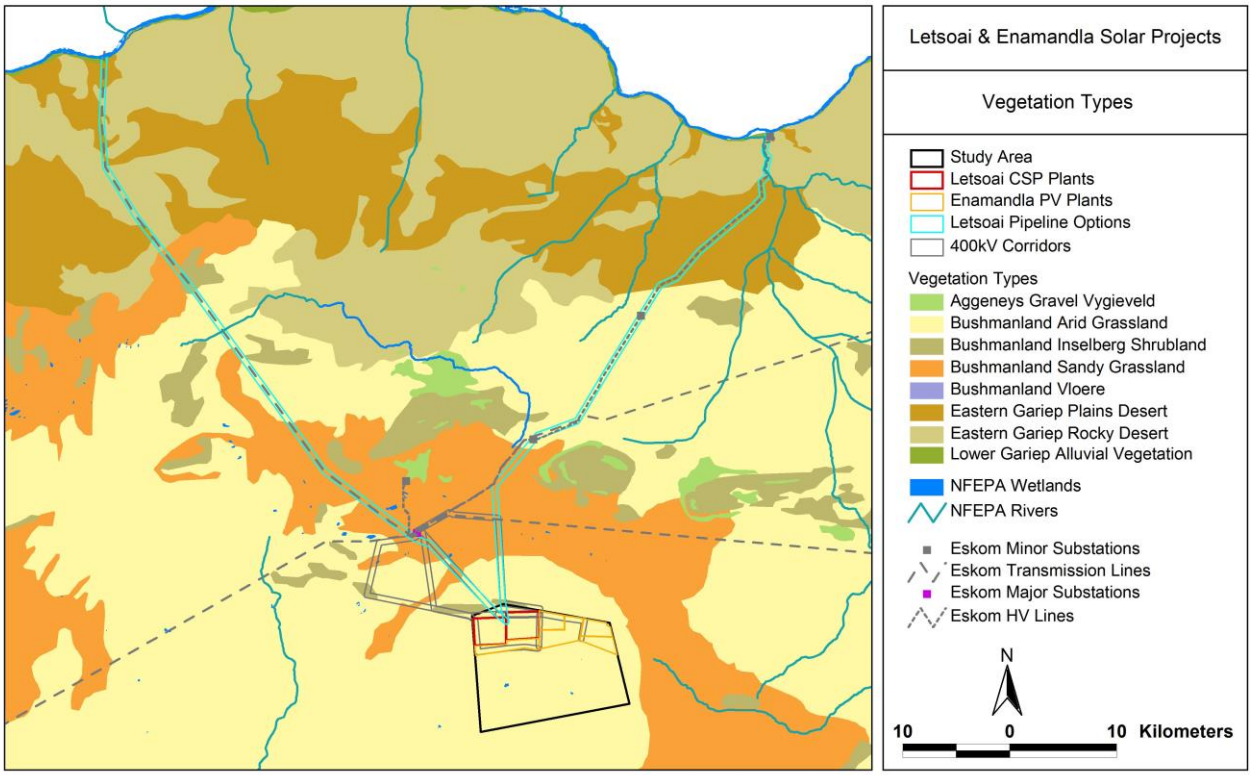

Figure 4. Broad-scale overview of the vegetation in and around the Letsoai and Enamandla solar sites, powerline and waterpipe corridor options. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011).

4.2 LISTED AND PROTECTED PLANT SPECIES

According to the SANBI SIBIS database, 309 indigenous plant species have been recorded from the quarter degree squares 2918 AB, BA, AD and BC. This includes 11 species of conservation concern as listed below in Table 2. Only *Hoodia gordonii* can be confirmed present at the site and it is not likely that any of the other listed species are present at the site or within the development footprint of the PV 4 facility. There are some *Boscia albitrunca* trees present on the hills of the area, which is a nationally protected species but would not be affected by the development. There are also some species protected under the Northern Cape Nature Conservation Act of 2009, which are present in the area including *Boscia foetida* subsp. *foetida* and all species within the *Mesembryanthemaceae*, *Euphorbiaceae*, *Oxalidaceae*, *Iridaceae* and all species within the genera *Nemesia* and *Jamesbrittenia*.

Table 2. Listed species known from the broad area around the site.

Family	Species	Status
CRASSULACEAE	*Crassula decumbens var. brachyphylla*	NT
MESEMBRYANTHEMACEAE	*Conophytum limpidum*	NT
CRASSULACEAE	*Crassula exilis subsp. exilis*	Rare
FABACEAE	*Crotalaria pearsonii*	Rare
HYACINTHACEAE	*Lachenalia polypodantha*	Rare
MESEMBRYANTHEMACEAE	*Conophytum tantillum subsp. eenkokerense*	Rare
OXALIDACEAE	*Oxalis inconspicua*	Rare
ASTERACEAE	*Othonna euphorbioides*	Thr*
HYACINTHACEAE	*Daubenya namaquensis*	Thr*
MESEMBRYANTHEMACEAE	*Cheiridopsis rostrata*	VU
APOCYNACEAE	*Hoodia gordonii*	DDD
AMARYLLIDACEAE	*Brunsvigia namaquana*	DDT
ASTERACEAE	*Senecio glutinarius*	DDT
MESEMBRYANTHEMACEAE	*Drosanthemum breve*	DDT
AMARYLLIDACEAE	*Boophone disticha*	Declining

4.3 ALIEN PLANT SPECIES ABUNDANCE

Alien species abundance at the site is generally low, which can be ascribed to the very arid nature of the area. However, with disturbance and increased runoff from the facility, alien species may become more prevalent. The most conspicuous alien on the site is *Prosopis glandulosa* which has been planted to provide shade for livestock, but it has not spread and is not currently invading the site. The only other alien observed was Salsola kali which was present near to some of the watering points. It was however relatively dry at the time of sampling and additional species are likely to appear after rains. Overall, the site can currently be considered very lightly to free of alien plant species and has not been significantly impacted by aliens in any way.

4.4 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

The site falls within the planning domain of the Namakwa Biodiversity Sector Plan (Desmet & Marsh 2008). This biodiversity assessment identifies Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. When incorporated into municipal SDFs and bioregional plans, such fine-scale plans are recognized under NEMA and the various activities listed under the act.

The site does not occur within a CBA area, although there are small CBAs to the immediate north of the site. These CBA patches are sensitive small rocky outcrops covered with Bushmanland Inselberg Shrubland vegetation or localized calcrete patches with endemic species.

The site falls within a NPAES focus area, meaning that the area has been identified as a large currently intact area which has high biodiversity potential and is not currently well represented within the existing protected area network. The major concern in this regard is the availability of other similar habitat in the area. While the broader landscape contains several features and vegetation types of concern, these are outside of the study area; the typical Bushmanland grassy plains habitat within the site is very widely available in the area and the development of the site would not be likely to affect the availability of this habitat in the broader area. Therefore it is not likely that the development of the sites would significantly affect the Focus Area or the ability to meet conservation targets for the affected habitat types.

Of greater concern, would be the potential cumulative impacts of renewable energy development in the area as depicted by Figure 6 showing all the renewable energy applications registered with the DEA as at April 2016. There are a number of developments in the area and in the longer term, an east-west corridor of development is developing along the N14 from Springbok to Pofadder and threatens to disrupt landscape connectivity in a north-south direction to and from the Orange River. However, the DEA map does not indicate the actual footprint of the facilities which are in most cases much smaller than the cadastral units indicated. Therefore, there are still large undeveloped gaps between the different projects. Furthermore, the map does not indicate preferred bidders and so not all of the applications would actually get built.

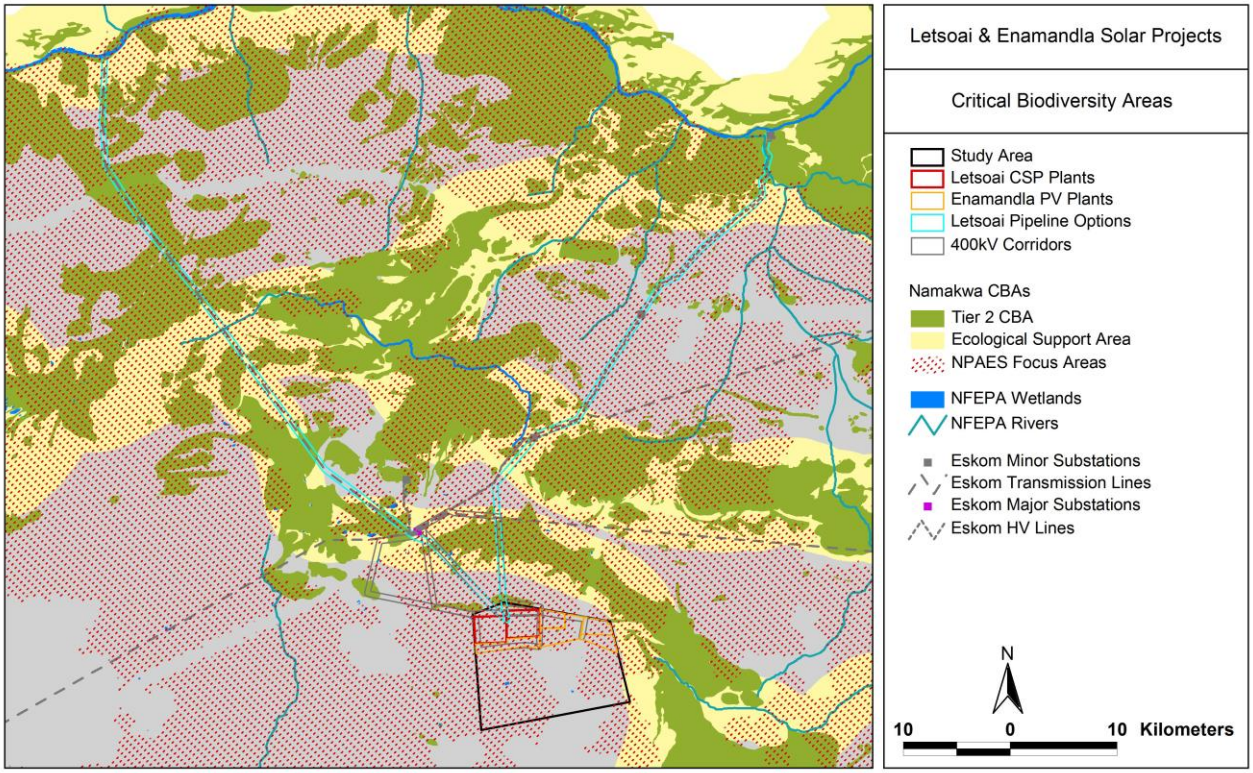

Figure 5. Critical Biodiversity Areas map of the area around the Letsoai and Enamandla sites and electrical infrastructure, showing that the PV and CSP project sites are not within a CBA or ESA, except for a small area on Enamandla PV Site 3. The electrical infrastructure and water pipelines do cross over an ESA and several small CBAs. The majority of the entire development site is within an NPAES Focus Area.

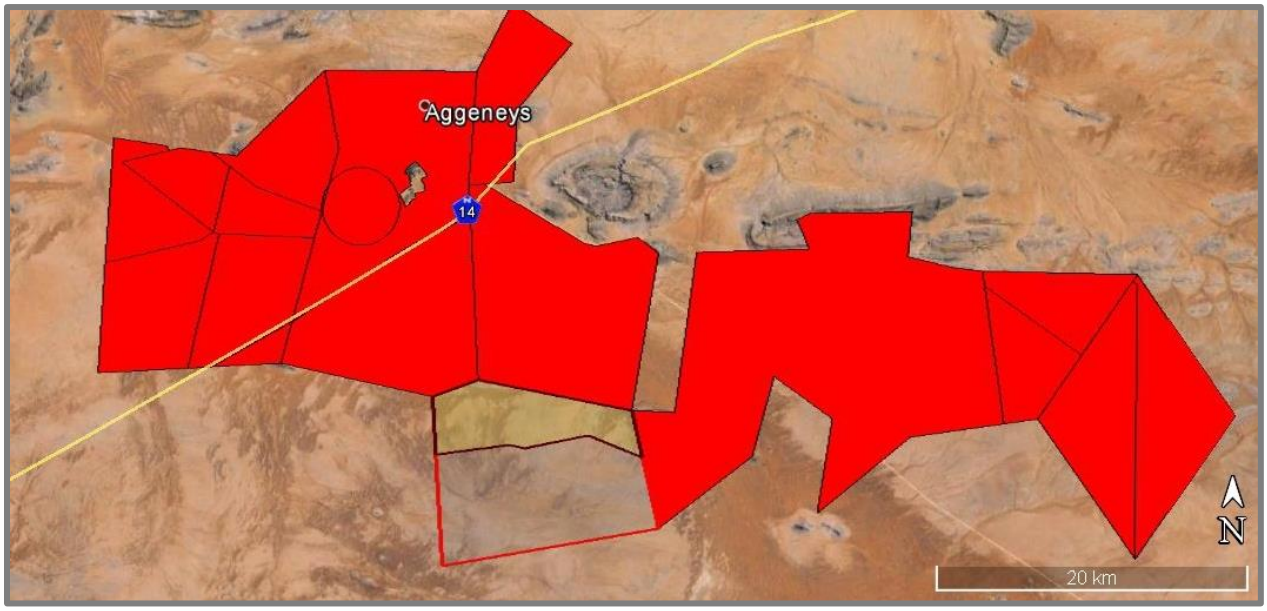

Figure 6. Map of DEA registered renewable energy applications as at April 2016. Red are cadastral units with solar projects, and the Enamandla and Letsoai site is indicated in black outline and yellow fill. Available at: https://dea.maps.arcgis.com/apps/webappviewer/index.html?id=b8452ef22aeb4522953f1fb10e6dc79e

4.5 SITE DESCRIPTION

Enamandla PV 4

Deep sands within the Enamandla PV 4 site, dominated by *Stipagrostis brevifolia* left and *Stipagrostis ciliata* right. Some parts of the deep sands are considered high sensitivity as they are vulnerable to wind erosion and it would be difficult to develop these areas without significant disturbance as vehicles cannot easily pass on the loose sands and some areas would also need to be levelled for construction. However, the open flat areas are considered potentially more suitable for development.

4.6 FAUNAL COMMUNITIES

Mammals

The site falls within the distribution range of 46 terrestrial mammals, although only around 20 are recorded in the area on a regular basis based on records from the MammalMap database. Species that can be confirmed present in the area based on previous site visits to the area include Black-backed Jackal, African Wildcat, Cape Fox, Rock Hyrax, South African Ground Squirrel, Steenbok, Springbok, Gemsbok, Cape Porcupine, Yellow Mongoose, Cape Hare, Aardvark and Round-eared Elephant Shrew.

Species associated with the rocky outcrops of the area include Rock Hyrax *Procavia capensis*, Klipspringer *Oreotragus oreotragus*, Pygmy Rock Mouse *Petromyscus collinus*, Namaqua Rock Mouse *Aethomys namaquensis* and Western Rock Elephant Shrew *Elephantulus rupestris*. The open plains which characterise the development areas are likely to be dominated by species associated with open hard or sandy ground such as various gerbils including the Hairy-footed Gerbil *Gerbillurus paeba*. There were also many burrows of Ground Squirrels and Yellow Mongoose at the site and these appear to be the most common fauna within the development area. There are no areas of particular significance for mammals at the site as the habitat is repetitive and broadly homogenous.

Two listed species may occur in the area, the Black-footed cat Felis nigripes (Vulnerable) and Leopard *Panthera pardus* (Near Threatened). Given the extremely low cover at the site it is not likely that Leopard are present in the study area. The habitat is however suitable for the Black-footed Cat which favours a mix of open and more densely vegetated areas. However this species is widely distributed across the arid and semi-arid areas of South Africa, and the development would not amount to a significant amount of habitat loss for this species, although some cumulative impact in the area is a developing threat.

The major impact associated with the development of the sites for mammals would be habitat loss for resident species and potentially some disruption of the broad-scale connectivity of the landscape.

Reptiles

Although reptile diversity in the broader area is high with as many as 60 species known from the area, only a fraction of this is likely to be present within the development study area. A large proportion of the reptiles of the area consist of species associated with the inselbergs and rocky hills along the Orange River and would not occur on the open plains characteristic of the site. More typical plains species are likely to dominate the study area and is likely to include Verrox's

Tent Tortoise *Psammobates tentorius verroxii*, Namaqua Sand Lizard *Pedioplanis namaquensis*, Spotted Desert Lizard *Meroles suborbitalis*, Southern Rock Agama *Agama atra* and Plain Sand Lizard *Pedioplanis inornata*.

As with mammals, there are not likely to be any highly significant impacts on reptiles outside of some habitat loss resulting from the development. Some species such as geckos will probably increase within the development on account of the increased vertical structure and shelter provided by the panels and their supports.

Amphibians

Only eight frog species are known from the area around the site and even this is a gross overestimate of the number of amphibian species likely to be present within the site. There are few freshwater features present and only species able to live independently of water will be present at the site. As such the only species likely to be present within the site would be the Karoo Toad *Vandijkophrynus gariepensis*. Given the very low likely abundance of amphibians at the site, impacts on amphibians are likely to be local in extent and of low significance.

5 SITE SENSITIVITY ASSESSMENT

The sensitivity of the site is indicated below in Figure 7 and shows that most of the development areas are within areas that are considered medium-low to medium sensitivity. Enamandla PV 4 is largely within an area considered to be Medium-High sensitivity and is the only site that is considered largely unsuitable for development. This area consists of deep loose sands that would be vulnerable to disturbance and wind erosion and as the soils are loose, it would be difficult for vehicles to access this area without creating a lot of additional disturbance.

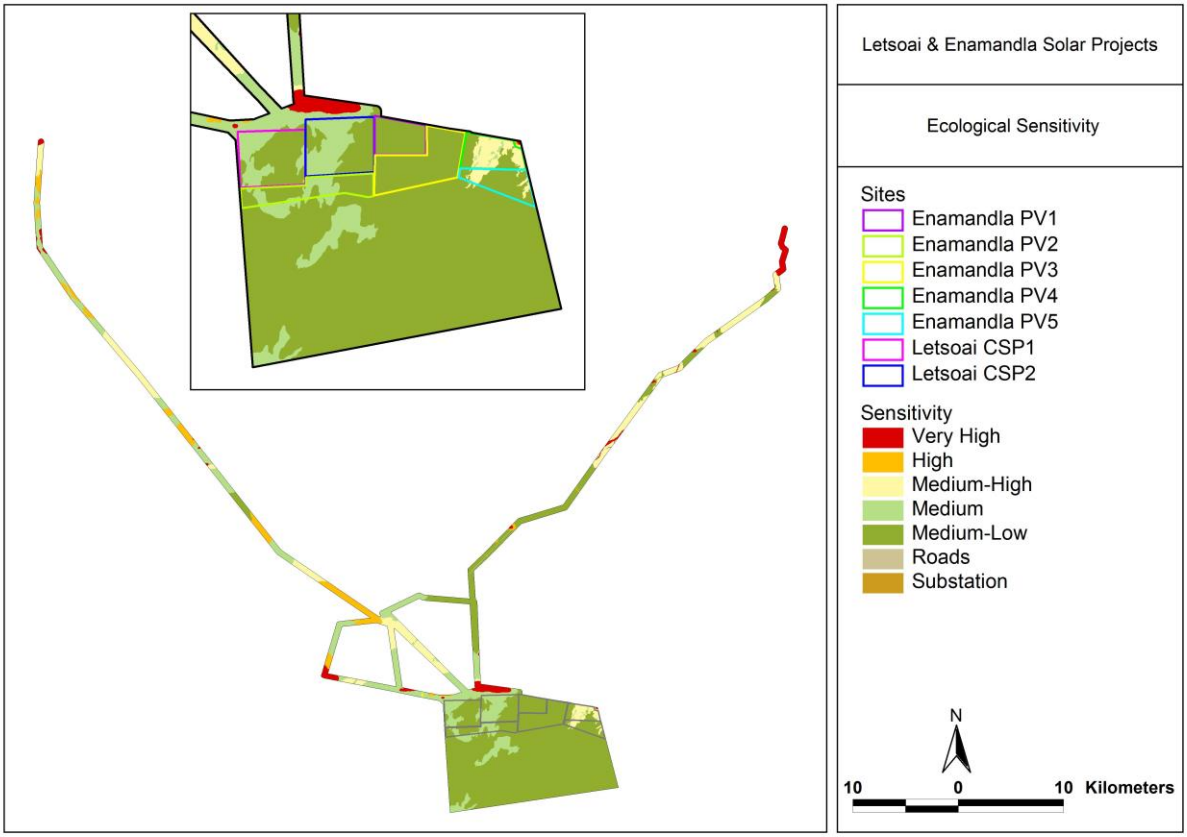

Figure 7. Ecological sensitivity map of the site, power line corridors and pipeline routes, showing that most of the development areas are on medium-low sensitivity areas.

6 *IMPACTS AND ISSUES IDENTIFICATION*

6.1 IDENTIFICATION OF POTENTIAL IMPACTS

The likely impacts on the terrestrial ecology of the site resulting from the development of the Enamandla PV 4 site are identified and discussed below with reference to the characteristics and features of the site. The development of the site is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as PV arrays, roads, operations buildings etc. The following impacts were identified during this scoping phase as the major impacts that are likely to be associated with the development, for the preconstruction, construction and operational phases of the development. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarized below before the impacts are assessed.

Impacts on vegetation and protected plant species

It is confirmed that some protected plant species occur within the site and it is highly likely that these will be impacted on by the development. Depending on the number of the affected species, impacts on such species are likely to be of moderate to low significance. However, as the abundance of such species is low, the major impact would be on vegetation loss in a general sense and not on any particular species.

Direct Faunal impacts

Construction and operational phase noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals or reptiles such as tortoises would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present.

Increased alien plant invasion

Alien plants are likely to invade the site as a result of the large amounts of disturbance created during operation. However as the construction phase would be less than 2 years, this is not long enough for significant alien problems to develop and the major impact and required mitigation measures would be expressed in the Operational phase. Current levels of plant invasion at the site is low. Alien species such as *Prosopis* are however present and would potentially invade the site along with other typical weedy species such as *Salsola kali*.

Impacts on Broad-Scale Ecological Processes and Loss of Landscape Connectivity

As there are several other renewable energy developments in the area, the development of the sites will contribute towards cumulative impacts, particularly the loss of landscape connectivity. The site is likely to be fenced and the cleared parts of the site are also likely to be hostile to many smaller fauna which will prevent or impede their movement across the landscape. The significance of this impact will need to be evaluated at the landscape level with consideration of the location and configuration of the other developments in the area.

Reduced ability to meet conservation obligations & targets

The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets. The receiving vegetation types in the study area are classified as Least Threatened and they are extensive vegetation types that are still more than 99% intact. The development of the sites would result in the loss of up to ~450-500ha of intact habitat which on its own is not considered highly significant, but as there is an array of other developments in the area, the possibility for significant cumulative impact on the affected vegetation types or on more localised plant communities is a potential concern, especially given the NPAES status of the site.

7 SCOPING PHASE PRELIMINARY IMPACT ASSESSMENT

The assessment methodology will be in accordance with the recent revised 2014 EIA regulations and based on the assessment approach recommended by Hacking (2001). An impact screening tool has been developed to assess the significance of identified impacts. The screening tool is based on two criteria, namely probability and severity. The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the severity of such an impact occurring before and after implementation of proposed mitigation measures. The mitigation measures are those intended for the planning phase and mitigation measures to be included in the EMPr will be described in the EIA report.

The Enamandla PV 4 site is assessed individually and summarized results presented in the table below:

7.1 PLANNING & CONSTRUCTION PHASE IMPACTS

Enamandla PV 4 Project

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
IMPACT: Impacts on vegetation and listed plant species:		
Enamandla PV Project 4	High	High
IMPACT: Faunal impacts due to construction activities		
Enamandla PV Project 4	Medium	Very Low

Summary of impacts:

- **Vegetation**: Impacts on vegetation and protected plant species will occur due to vegetation clearing and disturbance associated with the construction of the facility. The development would also be certain to impact vegetation within the footprint. Enamandla PV Project 4 does however have sensitive dunes habitat (Medium-High Sensitivity) covering a large proportion of the site which increases the impact to **High**, both before and after mitigation.
- **Fauna**: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. There are fauna resident within the site and these will be impacted during construction of the facility. However, faunal diversity and density within the site is medium and post mitigation impacts are likely to be **Very Low** and of local significance only. Large amounts of noise and disturbance at the site during construction is largely unavoidable but all personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises, and owls which are often persecuted out of superstition.

7.2 OPERATIONAL PHASE IMPACTS

Enamandla PV Project 4

Phase & Impact	Before Mitigation	After Mitigation
Operational Phase Impacts		
IMPACT: Increased alien plant invasion:		
Enamandla PV Project 4	Low	Very Low
IMPACT: Faunal impacts due to construction activities		
Enamandla PV Project 4	Low	Very Low
IMPACT: Cumulative habitat loss and impacts on broad-scale ecological processes and loss of landscape connectivity		
Enamandla PV Project 4	Medium	Low
IMPACT: Reduced ability to meet conservation obligations & targets.		
Enamandla PV Project 4	Medium	Low

Summary of impacts:

- **Alien invasive plants**: Alien plants are likely to invade the site as a result of the large amounts of disturbance created during operation. However as the construction phase would be less than 2 years, this is not long enough for significant alien problems to develop, provided required mitigation measures are instigated in the construction phase. Alien plant invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impact from alien species would not be significant in any of the sites during the operational phase.
- **Fauna:** The operation and presence of the facility may lead to disturbance or persecution of fauna. It is likely that some fauna including Ground Squirrels, Yellow Mongoose and Gerbils are likely to increase or settle within the PV 4 site development area. These should be tolerated and allowed to move about the facility. In addition if the facility is to be fenced with electrical fencing, this should be on the inside and not the outside of the facility.
- **Cumulative impact**: As there are several other renewable energy developments in the area, the operation of the site will contribute towards the loss of landscape connectivity. The facility will prevent fauna from moving through the area and decrease landscape connectivity. The loss of ecosystem services associated with Enamandla Site 4 on the sensitive dunes has been rated as **Medium** Impact before mitigation and **Low** after mitigation.
- **Conservation targets**: The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' future ability to meet its conservation targets. The area has been identified as an NPAES focus area and development within this area may compromise the value of the area for future conservation area expansion. However, the Bushmanland Arid Grassland vegetation type is extensive and the extent of habitat loss from the development would not significantly impact the remaining extent of this vegetation type. The Enamandla PV Project

site 4 has Medium impact before mitigation. Consequently the impact of the development on the future conservation potential of the area is considered Low after mitigation.

7.3 DECOMMISSIONING PHASE IMPACTS

Enamandla PV Project 4

Phase & Impact	Before Mitigation	After Mitigation
Decommissioning Phase Impacts		
IMPACT: Increased alien plant invasion following decommissioning:		
Enamandla PV Project 4	Low	Very Low
IMPACT: Faunal impacts during decommissioning		
Enamandla PV Project 4	Low	Very Low

Summary of impacts:

- **Fauna**: Disturbance or persecution of fauna during the decommissioning phase may occur. The operation of heavy machinery and human presence at the site during decommissioning would impact fauna. Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. There is fauna resident within the site and these will be impacted during decommissioning of the facility. However, faunal diversity and density within the site is low and post mitigation impacts are likely to be **Very Low** and of local significance only.
- **Invasive Alien Plants**: Alien plants are likely to invade the sites as a result of disturbance created during decommissioning. This impact would be likely to persist from several years after decommissioning until such time as a cover of indigenous species recovered. The area is however very arid and this limits which species would potentially invade the site and provided an Alien Management Plan is implemented, the impacts would be of Very Low Significance.

8 PROPOSED ACTIVITIES FOR THE EIA PHASE

The current study is based on a site visit, a desktop assessment of the study area as well as prior knowledge of the wider area resulting from previous work in the area. Additional work that will be conducted for the EIA phase of the development includes the following:

- Identification and quantification of the abundance and distribution of species of conservation concern within the site and especially within the development footprint.
- Evaluate the possible impact of the development on landscape connectivity in the field based on the likely use of the area as a corridor for movement by fauna as well as any local impacts on faunal communities. This should include the identification of any corridors that should be kept clear of development at the site and any buffers required around such features.

- Identify sensitive faunal habitats that should be avoided and measures that should be implemented to reduce impacts on fauna in general.
- Consider the potential impact of the development on CBAs and broad-scale ecological processes at the site. This should consider the habitats affected by the current development, including a detailed characterization of the small CBA patches within the sites and which the powerlines transverse, as well as the overall impact of renewable energy development in the area at a broader scale.
- Assess the contribution of the current development to cumulative habitat loss within the NPAES Focus Area and the potential impact of this on future conservation options in the area.
- Evaluate, based on the site attributes, what the most applicable mitigation measures to reduce the impact of the development on the site would be and if there are any areas where specific precautions or mitigation measures should be implemented.
- Assess the impacts identified above in light of the site-specific findings and the final layout to be provided by the developer.

9 CONCLUSIONS & RECOMMENDATIONS

Within the affected habitat types there are few listed or protected plant species present and the significance of impacts on vegetation within these areas would be low. Enamandla PV Project 4 does however have sensitive dunes habitat (Medium-High Sensitivity) covering a large proportion of the site which increases the impact to High, both before and after mitigation.

The Enamandla PV 4 site falls within a NPAES focus area, but the typical Bushmanland grassy plains habitat within the site is very widely available in the area and the development of the site would not be likely to affect the availability of this habitat in the broader area. As the density of renewable energy development in the area is high, cumulative impacts are a significant concern. There are a number of approved and planned facilities in the area and these will ultimately result in significant habitat loss in the area. However, currently, the location of these facilities is within lower sensitivity areas and the important features of the area have not been significantly impacted to date. Due to the arid nature of the area, it is important that the mobility of fauna in the area is not impacted as many arid fauna respond to the unpredictability of these systems by moving extensively across the landscape. These impacts can be reduced by ensuring that fauna are still able to move about the landscape and are not impeded by extensive tracts of electrified fencing or similar impenetrable obstacles.

The likely impacts associated with the development of the Enamandla Solar Energy PV 4 Facility and associated infrastructure are summarized in Section 7. While there are few impacts associated with the development that are likely to remain high after mitigation, Enamandla PV

Site 4 is located largely within a sensitive dune area where it would be difficult to mitigate all impacts.

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11 ANNEX 1. LIST OF MAMMALS

List of mammals which are likely to occur in the vicinity of the Enamandla site PV 4. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2015 and South African Red Data Book for Mammals (Friedmann & Daly 2004).

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus rupestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	Low
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Low
Lagomorpha (Hares and Rabbits):				
Pronolagus rupestris	Smith's Red Rock Rabbit	LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	Low
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	High
Rodentia (Rodents):				
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Petromus typicus	Dassie Rat	LC	Mountainous regions and inselbergs, where they are confined to rocky outcrops and live in crevices or piles of boulders	High
Xerus inauris	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	Confirmed
Graphiurus platyops	Rock Dormouse	LC	Rocky terrain, under the exfoliation on granite bosses, and in piles of boulders	High
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Thallomys paedulcus	Acacia Tree Rat	LC	Associated with stands of Acacia woodland	Low
Thallomys nigricauda	Black-tailed Tree Rat	LC	Associated with stands of Acacia woodland	Low

Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	Low
Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Gerbillurus tytonis	Dune Hairy-footed Gerbil	LC	Hot dry areas on shifting red sand dunes	Moderate
Gerbilliscus leucogaster	Bushveld Gerbil	LC	Predominantly associated with light sandy soils or sandy alluvium	Moderate
Gerbilliscus brantsii	Higheld Gerbil	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland	Moderate
Saccostomus campestris	Pouched Mouse	LC	Catholic habitat requirements, commoner in areas where there is a sandy substrate.	High
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Petromyscus collinus	Pygmy Rock Mouse	LC	Arid areas on rocky outcrops or koppies with a high rock cover	High
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
Cercopithecus mitis	Vervet Monkey	LC	Most abundant in and near riparian vegetation of savannahs	Low
Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High

Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Panthera pardus	Leopard	NT	Wide habitat tolerance, associated with areas of rocky koppies and hills, mountain ranges and forest	Low
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Confirmed
Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Herpestes pulverulentus	Cape Grey Mongoose	LC	Wide habitat tolerance	High
Atilax paludinosus	Marsh Mongoose	LC	Associated with well-watered terrain, living in close association with rivers, streams, marshes, etc.	Low
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	High
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	High
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	High
Aonyx capensis	African Clawless Otter	LC	Predominantly aquatic and do not occur far from permanenet water	Low
Ictonyx striatus	Striped Polecat	LC	Widely distributed throughout the sub-region	High
Rumanantia (Antelope):				
Tragelaphus strepsiceros	Greater Kudu	LC	Broken, rocky terrain with a cover of woodland and a nearby water supply.	Low
Oryx gazella	Gemsbok	LC	Open arid country	High
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	High
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed
Oreotragus oreotragus	Klipspringer	LC	Closely confined to rocky habitat.	High
Chiroptera (Bats)				
Sauromys petrophilus	Flat-headed free-tailed bat	LC	Rocky areas and the availability of narrow rock fissures essential requirements	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	In arid areas. often associated with water sources	High
Nycteris thebaica	Egyptian Slit-faced Bat	LC	Wide habitat tolerance	High

Cistugo seabrae	Angolan hairy bat	NT	From areas with annual rainfall of less than 100 mm, usually near open water	High
Eptesicus hottentotus	Long-talied serotine bat	LC	Wide habitat tolerance	High
Rhinolophus clivosus	Geoffroy's horsehoe bat	LC	Wide habitat tolerance but Roost in caves	Low
Rhinolophus capensis	Cape horseshoe bat	LC	Many records from coastal caves	Low
Rhinolophus darlingi	Darling's Horsehoe Bat	LC	Savanna woodland species but requires caves	High

12 ANNEX 2. LIST OF REPTILES

List of reptiles which are likely to occur at the Enamandla site PV 4, based on the SARCA database. Conservation status is from Bates et al. (2014).

Family	Genus	Species	Subspecies	Common name	Red list category	No. records
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern	2
Agamidae	*Agama*	*knobeli*		Knobel's Rock Agama	Not listed	1
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern	2
Colubridae	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern	3
Colubridae	*Telescopus*	*beetzii*		Beetz's Tiger Snake	Least Concern	2
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern	2
Cordylidae	*Platysaurus*	*capensis*		Namaqua Flat Lizard	Least Concern	1
Elapidae	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not listed	6
Elapidae	*Naja*	*nigricincta*	*woodi*	Black Spitting Cobra	Least Concern	1
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern	2
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern	4
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern	7
Gekkonidae	*Goggia*	*lineata*		Striped Pygmy Gecko	Least Concern	4
Gekkonidae	*Pachydactylus*	*goodi*		Good's Gecko	Vulnerable	1
Gekkonidae	*Pachydactylus*	*latirostris*		Quartz Gecko	Least Concern	8
Gekkonidae	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern	1
Gerrhosauridae	*Cordylosaurus*	*subtessellatus*		Dwarf Plated Lizard	Least Concern	1

Lacertidae	*Meroles*	*suborbitalis*		Spotted Desert Lizard	Least Concern	7
Lacertidae	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern	1
Lacertidae	*Pedioplanis*	*lineoocellata*	*lineoocellata*	Spotted Sand Lizard	Least Concern	1
Lacertidae	*Pedioplanis*	*namaquensis*		Namaqua Sand Lizard	Least Concern	8
Lamprophiidae	*Boaedon*	*capensis*		Brown House Snake	Least Concern	3
Lamprophiidae	*Psammophis*	*namibensis*		Namib Sand Snake	Least Concern	1
Lamprophiidae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern	1
Lamprophiidae	*Pseudaspis*	*cana*		Mole Snake	Least Concern	1
Scincidae	*Acontias*	*namaquensis*		Namaqua Legless Skink	Least Concern	1
Scincidae	*Acontias*	*tristis*		Namaqua Dwarf Legless Skink	Least Concern	23
Scincidae	*Trachylepis*	*occidentalis*		Western Three-striped Skink	Least Concern	1
Scincidae	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern	2
Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern	2
Testudinidae	*Homopus*	*signatus*		Speckled Padloper	Vulnerable	1
Testudinidae	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed	13
Typhlopidae	*Rhinotyphlops*	*schinzi*		Schinz's Beaked Blind Snake	Least Concern	1
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern	1
Viperidae	*Bitis*	*caudalis*		Horned Adder	Least Concern	2

13 ANNEX 3. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in the vicinity of the Enamandla site PV 4. Based on the Frogmap database, while conservation status is from the IUCN Red Lists 2014 and Minter et al. (2004).

Family	Genus	Species	Common name	Red list category	No. records
Bufonidae	*Vandijkophrynus*	*gariepensis*	Karoo Toad (subsp. gariepensis)	Not listed	2
Bufonidae	*Vandijkophrynus*	*robinsoni*	Paradise Toad	Least Concern	10
Microhylidae	*Phrynomantis*	*annectens*	Marbled Rubber Frog	Least Concern	7
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	1
Pyxicephalidae	*Amietia*	*fuscigula*	Cape River Frog	Least Concern	4
Pyxicephalidae	*Cacosternum*	*namaquense*	Namaqua Caco	Least Concern	3
Pyxicephalidae	*Strongylopus*	*springbokensis*	Namaqua Stream Frog	Vulnerable	2
Pyxicephalidae	*Tomopterna*	*delalandii*	Cape Sand Frog	Least Concern	3