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REPORT ON

ECOLOGICAL BASELINE AND IMPACT ASSESSMENT REPORT FOR THE PROPOSED CONSTRUCTION OF PAULPUTS CSP PROJECT NEAR POFADDER, NORTHERN CAPE PROVINCE

Report Number: 2015/013/10/03

Submitted to:

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PURPOSE OF THIS DOCUMENT

Abengoa Solar (herein further referred to as Abengoa) is proposing to establish a new solar facility (Paulputs Tower Facility) on Portion 4 of the Farm Scuitklip in the Northern Cape Province, South Africa. The study area is situated approximately 40km north-east of the town of Pofadder.

In order to obtain Environmental Authorisation for the proposed project, Abengoa is required to conduct an Environmental Impact Assessment (EIA) in terms of GN R. 982 of the National Environmental Management Act, 1998 (Act 107 of 1998) (as amended).

The proposed Paulputs project will consist of a 200 MW concentrated solar power (CSP) tower facility. The CSP facility and its associated infrastructure are likely to cover an area of approximately 900ha.For the purposes of this study a survey of the entire 1600ha study area was conducted. The associated infrastructure to operate the solar development is also taken into account in this Ecological Baseline and Impact Assessment Report.

The purpose of this report is to describe the receiving ecological environment, based on the studies conducted during August 2015 and April 2016, with attention to the following:

Size and location of the study area;

Description of the policy and legislative context applicable to the proposed development;

Methodologies employed during the study;

Vegetation type and communities occurring in the study area;

Plant species diversity and abundance occurring in the study area;

Plant species of concern occurring in (or possibly occurring in) the study area;

Sensitive or protected habitats occurring in the study area;

Fauna species diversity and abundance in the study area;

Fauna species of concern in the study area;

Habitats associated with fauna species of concern;

Potential impacts identified during the study; and

Mitigation measures to address potential impacts.

SUMMARY OF THE CONTENTS OF THIS ECOLOGICAL BASELINE AND IMPACT ASSESSMENT REPORT

The Impact Assessment phase of the EIA process is the earliest of the studies completed for the process (Figure 1) and contains:

- Location of the proposed development;
- Description of the policy and legislative context applicable to the proposed development;
- Methodologies employed during the ecological baseline and impact assessment phase study;
- Description of the receiving ecological environment;

Figure 1: Process of the environmental impact assessment (EIA), the position of the impact assessment phase is indicated by the red outline

EXECUTIVE SUMMARY

Hudson Ecology (Pty) Ltd was commissioned by Savannah Environmrntal (Pty) Ltd to conduct an ecological baseline and impact assessment of ecosystems associated with the proposed Paulputs concentrated solar power (CSP) tower facility.

Abengoa Solar (herein further referred to as Abengoa) is proposing to establish a new solar facility (Paulputs) on Portion 4 of the Farm Scuitklip 92 in the Northern Cape Province, South Africa. The study area is situated approximately 40km north-east of the town of Pofadder.

In order to obtain Environmental Authorisation for the proposed project, Abengoa is required to conduct an Environmental Impact Assessment (EIA) in terms of GN R. 982 of the National Environmental Management Act, 1998 (Act 107 of 1998) (as amended).

The proposed Paulputs project will consist of a CSP facility. The CSP facility and its associated infrastructure is likely to cover an area of approximately 900ha. For the purposes of this study a survey of the entire 1600ha study area was conducted. The associated infrastructure to operate the solar development is also taken into account in this Draft Ecological baseline and impact assessment Report.

The Paulputs CSP facility is to be located in the northern part of the Northern Cape Province, South Africa, approximately 40 km north-east of the town of Pofadder. The project will include a CSP facility. The total area to be developed is approximately 900ha.

The objectives in this study can be summarised as follows:

- Location of the proposed development;
- Description of the policy and legislative context applicable to the proposed development;
- Methodologies employed during the ecological baseline and impact assessment phase study;
- Description of the receiving ecological environment;
- Potential impacts identified during the ecological baseline and impact assessment phase study; and
- Proposed mitigation measures to address the potential impacts.

The scope of work for this project includes:

- Review of existing literature on biodiversity of the area;
- Review of previous work conducted for the project;
- A site investigation for the purposes of a ecological baseline and impact assessment study (conducted from the 4th to the 14th of August 2015 and from the 5th to the 13th of April 2016) as well as short site visit from the 30th of March to the 1st of April;
- Investigation of potential issues identified during the scoping level assessment;
- Compilation of an ecological baseline and impact assessment report comprising of the information described in the aims and objectives section above.

Ecological assessments were conducted during the dry season (August 2015) and during the wet season (March – April 2016).

Based on species composition, physiognomy, moisture regime, rockiness, slope and soil properties, three main communities were recognised. The vegetation communities are described in this report and named according to dominant species and underlying substrate. The vegetation communities are named as follows:

- *Acacia mellifera – Aristida congesta* dune open shrubland;
- *Acacia mellifera – Parkinsonia africana* wash open shrubland; and
- *Stipagrostis ciliata – Aristida congesta* open grassland.

A list of plant species previously recorded in the quarter degree grid in which the study area is situated was obtained from the South African National Biodiversity Institute. Additional species that could occur in similar habitats, as determined from official database searches and reviewed literature, but not recorded in these grids are also listed. A total of 13 species of concern were determined to possibly be occurring in the study area. The

species, listed as possibly occurring in the study area, were evaluated to determine the probability of occurrence in the study area based on habitat suitability. Of the species that are considered to occur within the area under investigation, there were five species that could occur in habitats that are available in the study area. According to IUCN two of these are listed as Vulnerable, one as Near Threatened and two as Declining. One of the vulnerable species, *Aloe dichotoma*, was recorded in the study area and could occur anywhere within the hills in the study area, or in rocky areas in Bushmanland Arid Grassland.

The one Declining species, *Acacia erioloba*, also a protected tree, has a high probability of occurring in the study area, while *Hoodia gordonii* was recorded in the study area in a number of places.

Reptile diversity in the region is high with approximately 45 reptile species occurring in the area. Ten species were confirmed during the site surveys. No exotic herpetofauna species are expected to occur on the study site. Two of the species recorded, namely *Naja nivea* and *Cordylus polyzous,* are considered endemic to southern Africa.

Herpetofauna diversity is generally low in the study area as can be expected in arid areas but what can be noted is that Evenness is high, indicating that there is a high similarity between the species occurring in the different vegetation communities. Most of the expected species in the area are common and widespread, with only the Black-necked spitting Cobra (*Naja nigricollis*) being classified as rare.

The study area is a fair distance from any permanent open water bodies (approximately 30km) and therefore, as expected amphibian diversity is low. Only seven species are expected to occur in the study area, and during the wet and dry season surveys no amphibian species were recorded.

Of the 67 mammal species expected to occur in the study area, according to historic recordings, only 16 were confirmed during both the site visits. Mammal diversity is low as can be expected in arid areas. Evenness is high, indicating that there is a high similarity between the species occurring in the different vegetation communities. A number of bat species are known to occur in the region. Bat species recorded in the area during the surveys are *Rhinolophus darlingi, Neoromicia capensis, Pipistrellus rueppelli* and *Tadarida aegyptiaca* of these species only *Tadarida aegyptiaca* is likely to be attracted to the infrastructure for roosting purposes.

Of the 21 faunal species of concern that may occur in the study area, 1 has no probability of occurrence, 5 have a low probability of occurrence, 9 have a medium probability of occurrence and 6 have a high probability of occurrence. Three of the species with a high probability of occurrence, the Black-necked spitting Cobra, Maccoa Duck and Lanner Falcon, were recorded during the study.

The ecological function of the study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas) to high in the more inaccessible or unutilisable areas. Areas in which overgrazing and clearing have taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced.

Areas that have been severely disturbed such as where settlements occur are considered of low conservation importance. These areas are, however, quite small in relation to the overall study area (<30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural areas are considered of very high conservation importance due to the presence of Red Data species in these areas and the intrinsic importance of these areas. In keeping with the Precautionary Principle, a higher conservation importance is assumed when in doubt.

According to the Khai-Ma Land Use Decision Support tool, the study area falls within an Ecological Support Area (ESA). The ESA is listed as a migration route, although the species utilising this migration route are not indicated. The migration route does seem to be counter-intuitive as it seems to start in the lowlands of the Gariep River, crosses over rocky mountainous areas only to return to the lowlands of the Gariep River lowlands again. Notwithstanding this the development will affect less than 30% of the width of the migration route and should have very little effect on species using this route.

Notwithstanding this, the ESAs are defined as "*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 in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration.*" And it is stated that "*The degree*

of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas" It is also stated that "*some*" level of change in the biodiversity indicators for ESAs is allowed.

It must also be noted that the migration route indicated is part of a large system of migration routes and that the percentage of these migration routes that will be impacted will be negligible.

This impact assessment takes into account the impacts of the construction and operation of the following infrastructure on Portion 4 of the farm Scuit-klip 92, near Pofadder in the Northern Cape:

- Molten salt tower up to 300m in height with surrounding heliostat field;
- Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser;
- On-site project substation, and short 132 kV power line to Eskom's existing Paulputs Transmission Substation;
- Water supply abstraction point located at the Gariep River close to Onseepkans;
- Filter and booster station at abstraction point;
- Water supply pipeline along R357 Onseepkans Road to the site;
- On-site lined ground water storage reservoir and various steel water tanks;
- Lined evaporation ponds;
- Packaged water treatment plant and associated chemical store;
- Auxiliary wet cooled chiller plant;
- Control room and office building; and
- Heliostat assembly building and workshop.

This impact assessment was conducted with the understanding that:

- The pipeline alignment will follow the existing alignment of that associated with the two CSP facilities located adjacent to the proposed site, and that the majority of the impact would occur in this already impacted area;
- Vegetation regrowth will be allowed under the heliostats after construction is completed; and
- All possible mitigation methods advised will be adopted and implemented by the developer.

The impact assessment determined that 8 main impacts are likely to occur due to the development, namely:

- Vegetation Clearing and subsequent loss of species of concern;
- Spillage of harmful or toxic substances;
- Disturbance of biodiversity due to vibration and noise;
- Habitat degradation and fauna impacts due to dust;
- Effects on local migrations;
- Increased prevalence of exotic invasive species;
- Increased erosion; and
- Impact of attracting insects and subsequently bats to the tower due to artificial light at night.

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts of the impacts general to solar facilities are likely to be of a higher order of magnitude than the significance ratings given here. It must however be noted that none of the other solar facilities are tower facilities and impacts unique to tower facilities are therefore unlikely to have a higher cumulative impact.

Areas to the north and west are too undulating to position this form of development, the area to the south consists the Mattheus-Gat Conservation Area Important Bird Area (IBA) of approximately 67 970ha, and to the east the area is also too undulating and traversed by a number of seasonal river systems that drain into the Orange River. Provided the developer adheres to the recommendations provided in the environmental management plan impacts can be mitigated to an acceptable level and this area can be considered one of the few areas in the region that can constitute "acceptable and defendable loss" associated with this kind of development. For this reason we propose this area to be the most suitable site in the immediate region (30km radius) in which to locate this form of solar power production plant.

With the implementation of the proposed mitigation measures and a functional "monitoring – information - management – implementation – monitoring" feedback loop in place in order to monitor and mitigate impacts, all probable ecological impacts can be managed to a low impact rating. Based on this and the fact that South Africa is experiencing a significant energy crisis, the risks and losses associated with this development can be seen as acceptable and defendable. If we were to take this a step further and compare the ecological impact footprint of this development with the probable impact footprint of a coal-burning power station that will produce the same energy the risk and loss associated with this development will be significantly lower from an ecological point of view. Based on all these factors, and with the proviso that we assume that all information available is correct and up to date, no unforeseeable impact synergies arise, no changes will be made to the proposed project and all mitigations proposed will be implemented and adhered to, we are of the opinion that this project could be implemented without causing significant unsustainable damage to the natural environment of the region.

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1 INTRODUCTION

Hudson Ecology (Pty) Ltd was commissioned by Savannah Environmrntal (Pty) Ltd to conduct an ecological baseline and impact assessment of ecosystems associated with the proposed Paulputs concentrated solar power (CSP) tower facility.

Abengoa Solar (herein further referred to as Abengoa) is proposing to establish a new solar facility (Paulputs) on Portion 4 of the Farm Scuitklip 92 in the Northern Cape Province, South Africa. The study area is situated approximately 40km north-east of the town of Pofadder.

In order to obtain Environmental Authorisation for the proposed project, Abengoa is required to conduct an Environmental Impact Assessment (EIA) in terms of GN R. 982 of the National Environmental Management Act, 1998 (Act 107 of 1998) (as amended).

The proposed Paulputs project will consist of a CSP facility. The CSP facility and associated infrastructure are likely to cover an area of approximately 900ha. For the purposes of this study a survey of the entire 1600ha study area was conducted. The associated infrastructure to operate the solar development is also taken into account in this Ecological baseline and impact assessment Report.

The Paulputs CSP facility is to be located in the northern part of the Northern Cape Province, South Africa,

2 LEGISLATIVE CONTEXT

This section provides a brief overview of both the national and international requirements that must be met by this report. It includes international conventions and agreements, as well as the IFC Standards and the Equator Principles.

2.1 National Environmental Management Act

This report has been prepared in terms the EIA Regulations 2014 (South Africa, 2014) promulgated under the National Environmental Management Act No. 107 of 1998 (NEMA) and is compliant with Regulation 982. Specialist reports and reports on specialised processes under the Act. Relevant clauses of the above regulation are quoted below and reflect the required information in the —Control sheet for specialist report‖ given above.

Appointment of EAPs and specialists

12. (1) A proponent or applicant must appoint an EAP at own cost to manage the application.

(2) In addition to the appointment of an EAP, a specialist may be appointed, at the cost of the proponent or applicant, if the level of assessment is of a nature requiring the appointment of a specialist.

(3) The proponent or applicant must

(a) take all reasonable steps to verify whether the EAP and specialist complies with regulation 13(1)(a) and (b); and

(b) provide the EAP and specialist with access to all information at the disposal of the proponent or applicant regarding the application, whether or not such information is favourable to the application.

General requirements for EAPs and specialists

13. (1) An EAP and a specialist, appointed in terms of regulation 12(1) or 12(2), must-

(a) be independent;

(b) have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity;

(c) ensure compliance with these Regulations;

(d) perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;

(e) take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application; and

(f) disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing-

(i) any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or

(ii) the objectivity of any report, plan or document to be prepared by the EAP or specialist, in terms of these Regulations for submission to the competent authority; unless access to that information is protected by law, in which case it must be indicated that such protected information exists and is only provided to the competent authority.

(2) In the event where the EAP or specialist does not comply with subregulation (1)(a), the proponent or applicant must, prior to conducting public participation as contemplated in chapter 5 of these Regulations, appoint another EAP or specialist to externally review all work undertaken by the EAP or specialist, at the applicant's cost.

(3) An EAP or specialist appointed to externally review the work of an EAP or specialist as contemplated in subregulation (2), must comply with subregulation (1).

In terms of Appendix 6 of the Regulations (South Africa, 2014) the specialist impact assessment report must contain:

(a) details of-

(i) the specialist who prepared the report; and

(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;

(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;

(c) an indication of the scope of, and the purpose for which, the report was prepared;

(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;

(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;

(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;

(g) an identification of any areas to be avoided, including buffers;

(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

(i) a description of any assumptions made and any uncertainties or gaps in knowledge;

(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;

(k) any mitigation measures for inclusion in the EMPr;

(l) any conditions for inclusion in the environmental authorisation;

(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;

(n) a reasoned opinion-

(i) as to whether the proposed activity or portions thereof should be authorised; and

(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;

(o) a description of any consultation process that was undertaken during the course of preparing the specialist report; and

(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto.

2.2 Further South African legislation considered in the compilation of this report

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

NEMA requires, inter alia, that:

- Development must be socially, environmentally, and economically sustainable;
- Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; and
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions.

NEMA states that ―the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.‖

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2.2.2 National Forests Act (Act no 84 of 1998)

2.2.2.1 Protected trees

According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. The list of protected tree species are given in the NEM:BA ToPs list (Republic of South Africa, 2004).

2.2.2.2 Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

2.2.3 National Environmental Management: Biodiversity Act (Act No 10 of 2004)

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

2.2.4 Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

2.2.5 National Water Act

Wetlands, riparian zones, and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse‖ in terms of the National Water Act (act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks. A water use license (WUL) is required for any activities listed in terms of Section 21 of the Act.

2.3 Key authorities for the EIA application

The DEA will be the decision-making authority for the environmental authorisation process, which is being undertaken in terms of the NEMA.

The Department of Water and Sanitation (DWS) is the authority responsible for issuing WULs. The water requirements for the project are already known. The EIA will support the application for a WUL which can only be issued after the project is selected as a preferred bidder. .

2.4 International Conventions and Agreements

Relevant environmental and social international conventions and agreements to which South Africa is a party are presented in Table 1.

Table 1: Relevant international conventions to which South Africa is a party Convention Summary of objectives or relevant conditions South African Status

Convention	Summary of objectives or relevant conditions	South African Status
CITES Convention (1 July 1975)	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Party to
Convention on Biological Diversity (29 December 1993)	Develop strategies, plans or programs for conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programs which shall reflect, inter alia, the measures set out in this Convention.	Party to.
Convention on Wetlands of International Importance (Ramsar) (21 December 1975)	To stem the progressive encroachment and loss of wetlands now and in the future.	Party to.
United Nations Convention to Combat Desertification (26 December 1996)	To combat desertification and mitigate the effects of drought through national action programs.	Party to.
Stockholm Convention on Persistent Organic Pollutants (POPs) (17 May 2004)	This convention seeks to ban the production and use of persistent organic chemicals but allow the use of some of these banned substances, such as DDT, for vector control.	Party to.

3 AIMS AND OBJECTIVES

The aim of this ecological baseline and impact assessment level study was to provide a detailed description of the receiving ecological environment (including identified ecological patterns and processes), which may be impacted upon by the proposed project, and identify possible ecological issues associated with the ecology of the study area and surrounds. Issues identified will make specific reference to species of concern and habitats and will be investigated as to how significant the impacts will be, what mitigation can be applied to reduce the impact significance to an acceptable level and what cumulative and residual impacts will occur.

The objectives in this study can be summarised as follows:

- Description of the location of the proposed development;
- Description of the policy and legislative context applicable to the proposed development;
- Description of the Methodologies employed during the ecological baseline and impact assessment phase study;
- Description of the receiving ecological environment;
- Description and assessment of the potential impacts identified during the ecological baseline and impact assessment phase study; and
- Recommendation of proposed mitigation measures to address the potential impacts.

4 SCOPE OF WORK

The scope of work for this project includes:

- Review of existing literature on biodiversity of the area;
- Review of previous work conducted for the project;
- A site investigation for the purposes of a ecological baseline and impact assessment study (conducted from the 4th to the 14th of August 2015 and from the 5th to the 13th of April 2016) as well as short site visit from the 30th of March to the 1st of April;
- Investigation of potential issues identified during the scoping level assessment;
- Compilation of an ecological baseline and impact assessment report comprising of the information described in the aims and objectives section above.

5 STUDY AREA

The proposed development area (study area) covers approximately 1600ha on portion 4 of the Farm Scuitklip 92. . The area of interest which was considered is the northern half of the larger farm portion, and the remaining part of the farm which is not currently under construction, or where infrastructure is standing. The study area is situated along a minor road that connects the N14 and the R357 to the north-east of the town of Pofadder, in Khai-Ma Municipal District of the Northern Cape (Figure 2). The site falls within the quarter degree grid 2819DC. No alternative site is currently being considered for the proposed solar CSP tower facility.

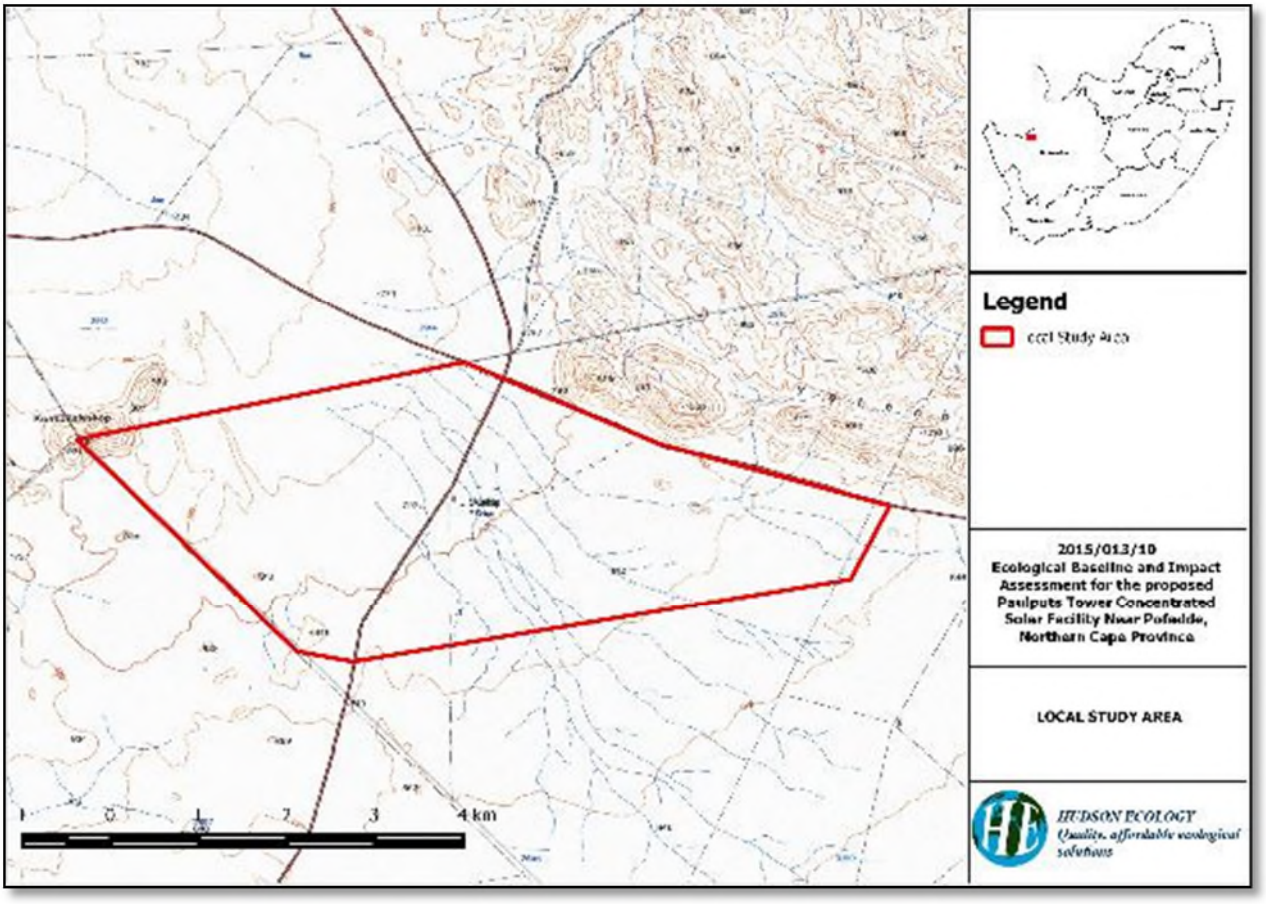

Figure 2: Locality of the study area

The study area is relatively isolated and is situated along a minor road that connects the N14 and the R357. The N14 connects Pofadder and Kakamas and the R358 connects Pofadder and Karasburg in Namibia. Although these are relatively minor roads, the site is easily accessible from Upington which is located approximately 180 km to the east on the N14.

6 METHODOLOGY

6.1 Desktop review of relevant documentation

A number of literature sources were reviewed for the purposes of this report. These include, *inter alia*, vegetation descriptions, field guides and atlases for the various flora and fauna taxa, and scientific articles in order to determine species lists for the area. Previous studies conducted in the area and scientific online literature.

6.2 Methodologies

Twelve study sites were randomly selected within the regional study area (Figure 3), these sites were investigated during both the 2015 and 2016 surveys. In order to enable a characterization of the environment, as well as floral and faunal species that may be impacted by the proposed construction activities, faunal and floral groups were investigated. These species were then used in order to determine the possible magnitude of the impact of the proposed activities. The following taxa were investigated:

- Vegetation;
- Arthropoda;
- Mammals;
- Herpetofauna (Reptiles); and
- Amphibia.

All methods implemented during this investigation are based on accepted scientific investigative techniques and principles, and were performed to accepted standards and norms, whilst taking the limitations of this investigation into consideration. The Precautionary Principle (COMEST, 2005) was applied throughout the assessments.

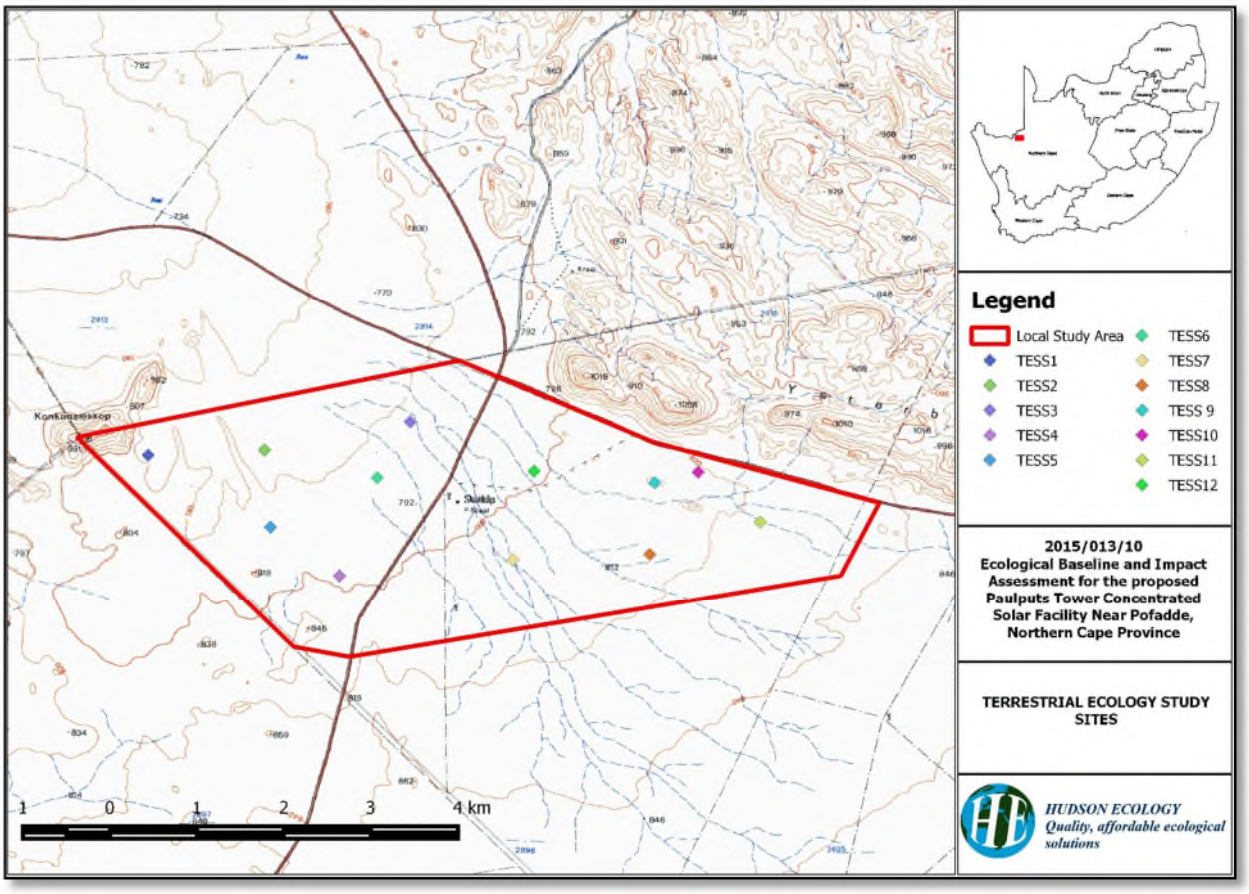

Figure 3: Terrestrial ecology study sites (TESS)

6.2.1 General Floristic Attributes

The vegetation assessment was based on a variation of the Braun-Blanquet method (Mueller-Dombois & Ellenberg, 1974; Westhoff & Van der Maarel, 1978) whereby vegetation is stratified, by means of aerial or satellite imagery with physiognomic characteristics as a first approximation. Stratification was further augmented by sites being selected to represent each of the areas that will be impacted by the current development footprint. Representative areas within these stratifications are then surveyed by means of line-point transects for grasses, sedges and forbs, as well as belt transects for shrubs and trees. Data obtained from these surveys are then subject to analysis to establish differences or similarities between observed units. Results and species lists provided should be interpreted with the above mentioned survey limitations in mind.

During the floral surveys conducted during the August 2015 survey, cognisance was taken of the following environmental attributes and general information:

- Biophysical environment (geology, topography, aspect, slope etc.);
- Regional vegetation;
- Current status of habitats;
- Red Data habitat suitability;
- Digital photographs; and

- GPS reference points.

Phytosociological data accumulated include the following:

- Plant species and growth forms;
- Dominant plant species;
- Cover abundance values; and
- Samples or digital images of unidentified plant species.

The desktop analysis of data was used to establish differences or similarities between vegetation communities, which were then described in terms of floristic species composition as well as driving environmental parameters. Results and species lists provided should be interpreted with the abovementioned survey limitations in mind.

6.2.2 Red Data Floral Assessment

- Compared data collected during the surveys and the IUCN Red Data plant species list and South African Threatened and Protected species (TOPS) list to compile a list of plant species of concern that may potentially occur within the study area and that were recorded in the study area.
- A survey of this kind (instantaneous sampling bout or "snapshot" investigations) poses limitations to the identification of Red Data plant species. Therefore, emphasis was placed on the identification of habitat that would be suitable for sustaining Red Data plant species, by associating available habitat to known habitat requirements of Red Data plant species.

6.2.3 Floristic Sensitivity Analysis

Floristic sensitivity analysis was determined by taking two factors into account namely ecological function and conservation importance. This sensitivity was quantified by subjectively assessing the ecological function and conservation importance of the vegetation. These were defined as follows:

Ecological Function:

- High ecological function: Sensitive ecosystems with either low inherent resistance or resilience towards disturbance factors or highly dynamic systems considered to be stable and important for the maintenance of ecosystems integrity (e.g. pristine grasslands, pristine wetlands and pristine ridges);
- Medium ecological function: Relatively important ecosystems at gradients of intermediate disturbances. An area may be considered of medium ecological function if it is directly adjacent to sensitive/pristine ecosystem; and
- Low ecological function: Degraded and highly disturbed systems with little or no ecological function.

Conservation Importance:

- High conservation importance: Ecosystems with high species richness and usually provide suitable habitat for a number of threatened species. Usually termed 'no-go' areas and unsuitable for development, and should be protected;
- Medium conservation importance: Ecosystems with intermediate levels of species diversity without any threatened species. Low-density development may be allowed, provided the current species diversity is conserved; and
- Low conservation importance: Areas with little or no conservation potential and usually species poor (most species are usually exotic).

The Precautionary Principle was applied throughout this investigation (COMEST, 2005).

6.2.4 General Faunal Attributes

6.2.4.1 Reptilia

Suitable areas were identified and sampled using active search and capture methods. Searches were concentrated in rocky areas and disused ant hills were investigated for the presence of snakes. Snakes and other reptiles are identified visually and only

captured if visual identification is hampered by swift-moving snakes or if the snake is obscured from view. Branch (1996) and Broadley (1971) were used as identification guides, where necessary.

6.2.4.2 Amphibia

Suitable areas for frogs were sampled by means of active search and capture and acoustic identification methods, especially at night when highest amphibian activity is expected. Areas were also netted for tadpoles and amphibian species identified by means of tadpoles. Du Preez and Carruthers (2009) was used to confirm identification where necessary.

6.2.4.3 Mammalia

Visual sightings and ecological indications were used to identify the small mammal inhabitants of the study area. Scats were also collected and used for identification of nocturnal small mammals. A number of reference sources *inter alia* Stuart and Stuart (2007) and Smithers (1983) were used for identification purposes.

6.2.5 Red Data Faunal Assessment

The following parameters were used to assess the Probability of Occurrence of each Red Data species:

- Habitat requirements (HR) – Most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics in the study area was evaluated;
- Habitat status (HS) – The status or ecological condition of available habitat in the area is assessed. Often a high level of habitat degradation prevalent in a specific habitat will negate the potential presence of Red Data species (this is especially evident in wetland habitats); and
- Habitat linkage (HL) – Movement between areas for breeding and feeding forms an essential part of the existence of many species. Connectivity of the study area to surrounding habitat and the adequacy of these linkages are evaluated for the ecological functioning of Red Data species within the study area.

Probability of occurrence is presented in four categories, namely:

- Low;
- Medium;
- High; and
- Recorded.

In order to assess the status of fauna species of concern in the study area, the following sources were used:

- IUCN Red List Categories and Criteria (IUCN, 2001);
- IUCN Red List of Threatened Species (IUCN, 2011); and
- South African Threatened and Protected species (TOPS) list (Republic of South Africa, 2004).

6.2.6 Statistical Analyses

6.2.6.1 Flora

Data, collected during the flora surveys, were analysed using the PC-Ord 5 multivariate analysis program. The data was analysed to confirm the vegetation units initially identified as well as to further divide the initial vegetation units into further plant communities based on species diversity data. TWINSPAN (Two Way INdicator SPecies ANalysis) was used to determine the dominant species in each of the vegetation units and a cluster analysis and non-metric multidimensional scaling was used to determine the similarities of the plant communities at each of the sites. The Shannon Diversity index was used to determine species diversity at each of the sites.

The Shannon index is one of several diversity indices used to measure diversity in categorical data. It is simply the information entropy of the distribution, treating species as symbols and their relative population sizes as the probability. The advantage of this index is that it takes into account the number of species and the evenness of the species. The index is increased either by having additional unique species, or by having greater species evenness.

$$H' = -\sum_{i=1}^{S}(p_i \ln p_i) - [(S-1)/2N]$$

Where:

i is the abundance of species.

S is the number of species, also referred to as species richness.

N is the total number of all individuals.

$\mathbf{p_i}$ is the relative abundance of each species, calculated as the proportion of individuals of a given species to the total number of individuals in the community.

6.2.6.2 Fauna

Data collect during the flora survey was analysed using the PC-Ord 5 multivariate analysis program. Pielou's Evenness was used to determine the numerical similarity between sites while the Shannon Diversity index for each of the plant communities was used to determine species diversity at each of the sites.

Species evenness is a measure of biodiversity which quantifies how equal the community is numerically. The evenness of a community can be represented by Pielou's evenness index:

$$J' = \frac{H'}{H'_{\max}}$$

Where H' is the number derived from the Shannon diversity index and H' max is the maximum value of H', equal to:

$$H_{\max} = -\sum_{i=1}^{S}\frac{1}{S}\ln\frac{1}{S} = \ln S.$$

E is constrained between 0 and 1. The less variation in communities between the species, the higher ***E*** is.

S is the total number of species.

6.3 Impact Assessment Methodology

6.3.1 Determination of Impacts

The Environmental Impact Assessment methodology that has been used in the evaluation of the overall effect of a proposed activity on the environment includes an assessment of the significant direct, indirect, and cumulative impacts. The significance of environmental impacts is to be assessed by means of the criteria of extent (scale), duration, magnitude (severity), probability (certainty) and direction (negative, neutral or positive).

The nature of the impact refers to the causes of the effect, what will be affected and how it will be affected.

Significance (S) - Rating of low, medium or high. Significance is determined through a synthesis of the characteristics described above where:

$$\boldsymbol{S = (E + D + M) \times P}$$

The significance weighting should influence the development project as per

Table 2:

Table 2: Significance ratings of impacts and influence on the project

Significance	Influence on the project
Low significance (significance weighting: <30 points)	If the negative impacts have little real effects, it should not have an influence on the decision to proceed with the project. In such circumstances, there is a significant capacity of the environmental resources in the area to respond to change and withstand stress and they will be able to return to their pre-impacted state within the short-term.
Medium significance (significance weighting: 30 – 60 points)	If the impact is negative, it implies that the impact is real and sufficiently important to require mitigation and management measures before the proposed project can be approved. In such circumstances, there is a reduction in the capacity of the environmental resources in the area to withstand stress and to return to their pre-impacted state within the medium to long-term.
High significance (significance weighting: >60 points)	The environmental resources will be destroyed in the area leading to the collapse of the ecosystem pattern, process and functioning. The impact strongly influences the decision whether or not to proceed with the project. If mitigation cannot be effectively implemented, the proposed activity should be terminated.

The extent (E) of the impact indicates the spatial scale, of the impact in question, in relation to the development site. The rating scores of the extent of an impact are given in Table 3:

Table 3: Ratings for the extent (E) of impacts

Extent of impact	Rating Score
Development site only	1
Local (within 5km of development site)	2
Regional	3
National	4
Global	5

The duration (D) of the impact indicates the temporal scale, of the impact in question. The rating scores of the extent of an impact are given in Table 4:

Table 4: Ratings for the duration (D) of impacts

Duration	Rating Score
Very short term – up to 1 year	1
Short term – >1 – 5 years	2
Moderate term - >5 – 15 years	3
Long term – >15 years	4
Permanent	5

Magnitude (M) describes the severity of the impact in question. The ratings scores for the severity of an impact are given in Table 5:

Table 5: Ratings for the magnitude (M) of impacts

Magnitude	Rating Score
Small impact – the ecosystem pattern, process and functioning are not affected	0
Minor impact - a minor impact on the environment and processes will occur	2
Low impact - slight impact on ecosystem pattern, process and functioning	4
Moderate intensity – valued, important, sensitive or vulnerable systems or communities are negatively affected, but ecosystem pattern, process and functions can continue albeit in a slightly modified way	6
High intensity – environment affected to the extent that the ecosystem pattern, process and functions are altered and may even temporarily cease. Valued, important, sensitive or vulnerable systems or communities are substantially affected	8
Very high intensity – environment affected to the extent that the ecosystem pattern, process and functions are completely destroyed and may permanently cease	10

Probability (P) describes the probability or likelihood of the specific impact actually occurring, and is rated as shown in Table 6:

Table 6: Ratings for the duration (D) of impacts

Probability (P)	Rating Score
Very improbable – where the impact will not occur, either because of design or because of historic experience	1
Improbable – where the impact is unlikely to occur (some possibility), either because of design or historic experience	2
Probable - there is a distinct probability that the impact will occur (<50% chance of occurring)	3
Highly probable - most likely that the impact will occur (50 – 90% chance of occurring)	4
Definite – the impact will occur regardless of any prevention or mitigating measures (>90% chance of occurring).	5

6.3.2 Determination of cumulative impacts

The assessment of cumulative impacts is required in terms of Regulations 2 (c) and 3 (j) of Appendix 3 of the EIA Regulations 2014.

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that, in itself, may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section should address whether the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or wholescale changes to the environment or sense of place
- Unacceptable increase in impact

6.3.3 Determination of Mitigation Measures

A common approach to describing mitigation measures for critical impacts is to specify a range of targets with a predetermined acceptable range and an associated monitoring and evaluation plan. To ensure successful implementation, mitigation measures will be unambiguous statements of actions and requirements that are practical to execute. The following summarize the different approaches that will be used in prescribing and designing mitigation measures:

6.3.3.1 Avoidance

Mitigation by not carrying out the proposed action on the specific site, but rather on a more suitable site.

6.3.3.2 Minimization

Mitigation by scaling down the magnitude of a development, reorienting the layout of the project or employing technology to limit the undesirable environmental impact.

6.3.3.3 Rectification

Mitigation through the restoration of environments affected by the action.

6.3.3.4 Reduction

Mitigation by taking maintenance steps during the course of the action.

6.3.3.5 Offsetting

Mitigation by identification of an alternative site with similar attributes that can be protected in order to ensure a gain of biodiversity after all mitigation measures have been implemented.

7 ASSUMPTIONS AND LIMITATIONS

- Accuracy of the maps, ecosystems, routes and desktop assessments were made using Google earth and converting the .kml files to .shp files and are subject to the accuracy of Google Earth imagery with some loss of accuracy during the conversion process;
- GPS co-ordinates are accurate to within 10m and lines drawn on maps can only be assumed to be accurate to within a distance of 100m;
- Data obtained from published articles, reference books, field guides, official databases or any other official published or electronic sources are assumed to be correct and no review of such data was undertaken by Hudson Ecology Pty Ltd;
- Satellite imagery obtained was limited to imagery on Google Earth, thus the ability to accurately map vegetation communities was limited;
- Time and budget constraints do not allow for an intensive survey of the entire study area, and as with any survey of this kind, rare and cryptic species may be overlooked during the study; and
- Every possible precaution was taken to reduce the effect of the above-mentioned limitations on the data collected for this study.

- The fact that a species or Red Data species is not recorded during a survey cannot support the assumption that the species in question does not occur in the area, it can only indicate a decreased probability of the species occurring in the area. This is particularly pertinent if the species has been recently or historically recorded in the area; and
- Ecological studies should be undertaken over a number of seasons in order to obtain long term ecological data. Studies are usually conducted in this way in order to eliminate the effects of unusual climatic conditions or other unusual conditions prevailing at the study area during the time of study. The results of this study are based on a literature review and wet and dry season field surveys, conducted in August 2015 and March – April 2016.

8 RESULTS

This section provides a discussion of the terrestrial ecology baseline environment and context in which the proposed project will take place.

8.1 Physical Setting

8.1.1 Topography

The study area is located mostly on flat plains, gently sloping from the south-west to the north east (Figure 4). The western corner is characterised by a single hill (Konkoonsieskop) and a range of four small outcrops to the south of the Ysterberg (Figure 5). Konkoonsieskop, in the north-western corner of the study area, reaches a peak of 922 m above sea level, approximately 150 m above the surrounding plains over a distance of approximately 250 m.

A drainage line (wash) bisects the study area from east to west, gradually narrowing towards the North West boundary of the study area (Figure 4).

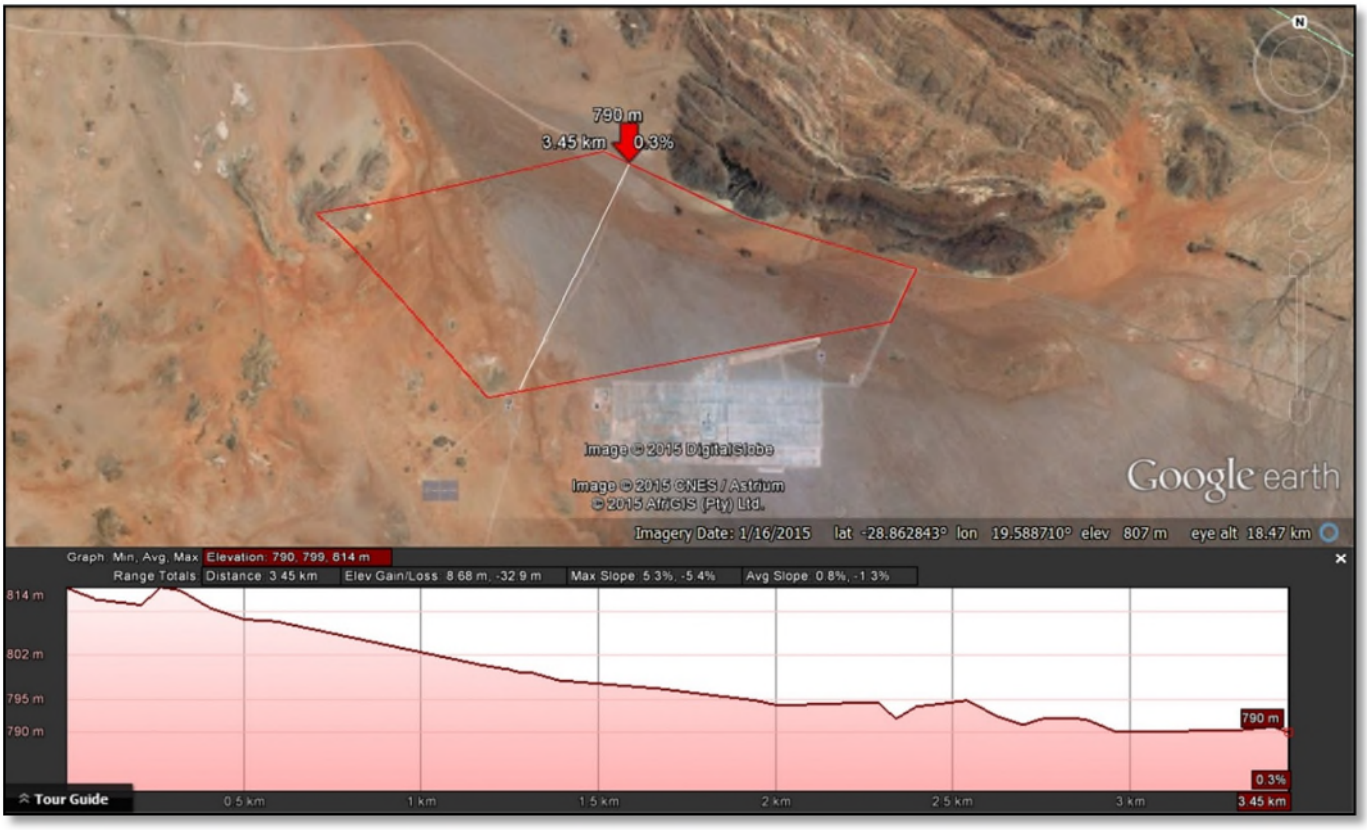

Figure 4: Gradient of the study area (reproduced from Google Earth)

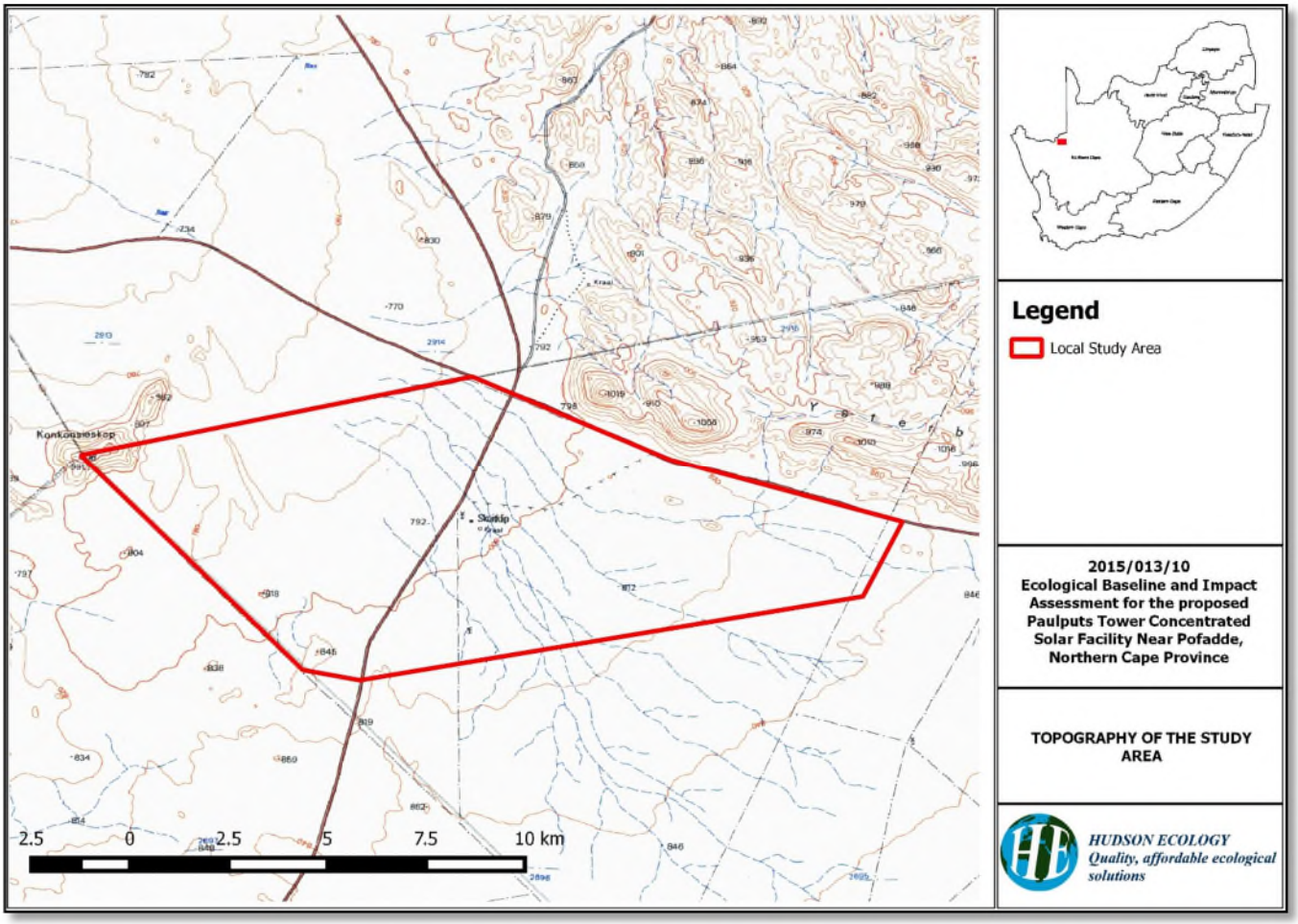

Figure 5: Topography of the study area

8.1.2 Geology & Soils

Most of the area is covered by recent (Quaternary) alluvium and calcrete. Gneisses and metasediments of Mokolian age outcrop in the area. The soils of most of the area are red-yellow apedal soils, freely drained, with a high base status and <300 mm deep, with about one fifth of the area deeper than 300 mm, typical of Ag and Ae land types. (Mucina & Rutherford, 2006)

8.1.3 Climate

Rainfall largely in late summer/early autumn (major peak) and very variable from year to year. MAP ranges from about 70 mm in the west to 200 mm in the east. Mean maximum and minimum monthly temperatures for Kenhardt are 40.6°C and –3.7°C for January and July respectively. Corresponding values for Pofadder are 38.3°C and –0.6°C. Frost incidence ranges from around 10 frost days per year in the northwest to about 35 days in the east. Whirl winds (dust devils) are common on hot summer days. See also climate diagram for NKb 3 Bushmanland Arid Grassland. (Mucina & Rutherford, 2006)

8.1.4 Biome and Vegetation Types

The study area falls within the Karoo Biome (Rutherford & Westfall 1986). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina & Rutherford, 2006). This map shows two vegetation types occurring in the area. The vegetation types are Bushmanland Arid Grassland (more than 90% of the site) and Lower Gariep Broken Veld (small portion of the site) – refer to Figure 6.

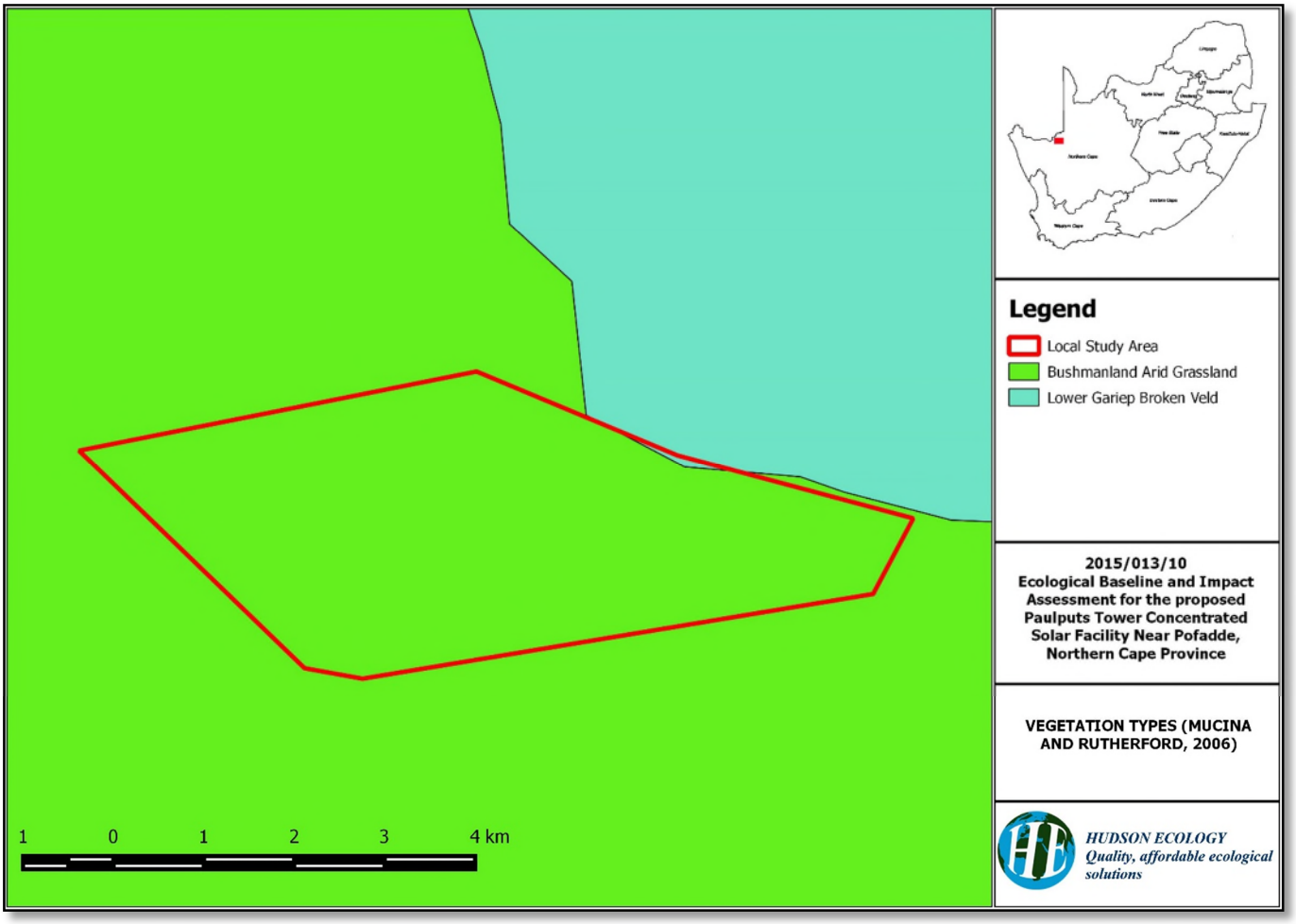

Figure 6: Vegetation types occurring in the study area (Mucina and Rutherford, 2006)

8.1.4.1 Bushmanland Arid Grassland

Synonyms: VT 29 Arid Karoo and Desert False Grassveld (36%), VT 32 Orange River Broken Veld (36%) (Acocks 1953). LR 51 Orange River Nama Karoo (51%) (Low & Rebelo 1996).

Distribution

Northern Cape Province: Spanning about one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the northwest this vegetation unit borders on desert vegetation (northwest of Aggeneys and Pofadder). The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Most of the western border is formed by the edge of the Namaqualand hills. Altitude varies mostly from 600–1 200 m (Mucina & Rutherford, 2006).

Vegetation & Landscape Features

Extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses *(Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe'. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected (Mucina & Rutherford, 2006).

Important Taxa

Graminoids:

Aristida adscensionis (d), *A. congesta* (d), *Enneapogon desvauxii* (d), *Eragrostis nindensis* (d), *Schmidtia kalahariensis* (d), *Stipagrostis ciliata* (d), *S. obtusa* (d), *Cenchrus ciliaris, Enneapogon scaber, Sporobolus nervosus, Stipagrostis brevifolia, S. uniplumis* and *Tragus berteronianus* (Mucina & Rutherford, 2006).

Small Trees:

Acacia mellifera and *Boscia foetida subsp. foetida* (Mucina & Rutherford, 2006).

Tall Shrubs:

Lycium cinereum (d), *Rhigozum trichotomum* (d), *Cadaba aphylla* and *Parkinsonia africana* (Mucina & Rutherford, 2006).

Low Shrubs:

Aptosimum spinescens (d), *Hermannia spinosa* (d), *Pentzia spinescens* (d), *Aptosimum elongatum, Barleria rigida, Berkheya annectens, Blepharis mitrata, Eriocephalus ambiguus, E. spinescens, Limeum aethiopicum, Lophiocarpus polystachyus, Monechma incanum, M. spartioides, Pentzia pinnatisecta, Polygala seminuda, Pteronia leucoclada, P. mucronata, P. sordida, Rosenia humilis, Senecio niveus, Sericocoma avolans, Solanum capense, Tetragonia arbuscula* and *Zygophyllum microphyllum* (Mucina & Rutherford, 2006).

Succulent Shrubs:

Kleinia longiflora, Lycium bosciifolium, Salsola tuberculate and *S. glabrescens* (Mucina & Rutherford, 2006).

Herbs:

Acanthopsis hoffmannseggiana, Aizoon canariense, Amaranthus praetermissus, Chamaesyce inaequilatera, Dicoma capensis, Indigastrum argyraeum, Lotononis platycarpa, Sesamum capense, Tribulus pterophorus, T. terrestris and *Vahlia capensis* (Mucina & Rutherford, 2006).

Succulent Herbs:

Psilocaulon coriarium and *Trianthema parvifolia.*

Geophytic Herb:

Moraea venenata (Mucina & Rutherford, 2006).

Biogeographically Important Taxon (Bushmanland endemic)

Tridentea dwequensis (Mucina & Rutherford, 2006).

Endemic Taxa:

Dinteranthus pole-evansii, Larryleachia dinteri, L. marlothii, Ruschia kenhardtensis, Lotononis oligocephala and Nemesia *maxii*. (Mucina & Rutherford, 2006)

Conservation

Least threatened. Target 21%. Only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed. Erosion is very low (60%) and low (33%) (Mucina & Rutherford, 2006).

8.1.4.2 Lower Gariep Broken Veld

VT 32 Orange River Broken Veld (70%) (Acocks 1953). LR 51 Orange River Nama Karoo (95%) (Low & Rebelo 1996).

Distribution

Northern Cape Province: Hardeveld along the Orange River from Onseepkans in the west, including the canyon below the Augrabies Falls and parts of Riemvasmaak and adjacent areas to Keimoes resuming from the Boegoeberg to around Prieska in the east. A series of inselbergs and koppies occurring between Keimoes and around Kakamas, and the ridge running west of Groblershoop from Karos in the north to around Marydale in the south. The unit also occurs in neighbouring Namibia. Most of the area varies from 400–1 200 m in altitude (Mucina & Rutherford, 2006).

Vegetation & Landscape Features

Hills and low mountains, slightly irregular plains but with some rugged terrain (e.g. downstream of the Augrabies Falls) with sparse vegetation dominated by shrubs and dwarf shrubs, with annuals conspicuous, especially in spring, and perennial grasses and herbs. Groups of widely scattered low trees such as *Aloe dichotoma var. dichotoma* and *Acacia mellifera subsp. detinens* occur on slopes of koppies and on sandy soils of foot slopes respectively (Mucina & Rutherford, 2006).

Important Taxa

Succulent Trees: *Aloe dichotoma var. dichotoma* (Mucina & Rutherford, 2006).

Small Trees:

Acacia mellifera subsp. detinens (d), *Commiphora gracilifrondosa, Ficus cordata, Pappea capensis, Rhus populifolia* and *Ziziphus mucronata subsp. mucronata* (Mucina & Rutherford, 2006).

Tall Shrubs:

Rhigozum trichotomum (d), *Adenolobus garipensis*

, Antherothamnus pearsonii, Cadaba aphylla, Caesalpinia bracteata, Ehretia rigida subsp. rigida, Nymania capensis and *Rhus burchellii* (Mucina & Rutherford, 2006).

Epiphytic Semiparasitic Shrub:

Tapinanthus oleifolius (Mucina & Rutherford, 2006).

Succulent Shrubs:

Ceraria namaquensis, Cryptolepis deciduaW, Euphorbia avasmontana, E. gregaria, Kleinia longiflora, Lycium bosciifolium and *Zygophyllum dregeanum* (Mucina & Rutherford, 2006).

Woody Succulent Climber:

Sarcostemma viminale (Mucina & Rutherford, 2006).

Low Shrubs:

Blepharis mitrata (d), *Aizoon schellenbergii, Aptosimum albomarginatum, A. lineare, A. marlothii, Barleria rigida, Berkheya spinosissima subsp. namaensis, Dyerophytum africanum, Hermannia spinosa, H. vestita, Hibiscus elliottiae, Indigofera heterotricha, Limeum aethiopicum, Lophiocarpus polystachyus, Monechma spartioides, Phaeoptilum spinosum, Phyllanthus maderaspatensis, Polygala seminuda, Ptycholobium biflorum subsp. biflorum, Sericocoma avolans, Solanum capense, Stachys burchelliana, Talinum arnotii, Tetragonia arbuscula* and *Zygophyllum rigidum* (Mucina & Rutherford, 2006).

Semiparasitic Shrub:

Thesium lineatum (Mucina & Rutherford, 2006).

Graminoids:

Aristida adscensionis (d), *Enneapogon desvauxii* (d), *E. scaber* (d), *Eragrostis nindensis* (d), *Stipagrostis obtusa* (d), *S. uniplumis* (d), *Aristida congesta, A. engleri, Cenchrus ciliaris, Digitaria eriantha, Enneapogon cenchroides, Eragrostis annulata, E. lehmanniana, E. porosa, Schmidtia kalahariensis, Setaria verticillata, Sporobolus fimbriatusE, Stipagrostis anomala, S. ciliata, Tragus berteronianus, Triraphis ramosissima* (Mucina & Rutherford, 2006).

Herbs:

Forsskaolea candida (d), *Acanthopsis hoffmannseggiana, Barleria lichtensteiniana, Chamaesyce glanduligera, Chascanum garipense, Cleome angustifolia subsp. diandra, Codon royenii, Dicoma capensis, Rogeria longiflora, Sesamum capense, Tribulus zeyheri* and *Trichodesma africanum* (Mucina & Rutherford, 2006).

Succulent Herbs:

Orbea lutea subsp. lutea and *Stapelia flavopurpurea* (Mucina & Rutherford, 2006).

Endemic Taxom:

Ruschia pungens (Mucina & Rutherford, 2006).

Conservation:

Least threatened. Target 21%. Statutorily conserved in Augrabies Falls National Park (4%). Only a very small part transformed. Erosion is low (58%), very low (27%) and moderate (14%) (Mucina & Rutherford, 2006).

8.2 Flora Assessment

8.2.1 Vegetation Communities

Flora assessments were conducted during the dry season (August 2015) and during the wet season (March – April 2016). Based on species composition, physiognomy, moisture regime, rockiness, slope and soil properties, three main communities were recognised.

8.2.1.1 Statistical analyses of flora data

On the basis of the TWINSPAN, cluster analysis and Principle Components Analysis (PCA) results the 12 sample plots or relevés were divided into different plant communities (Figure 7 and Figure 8).

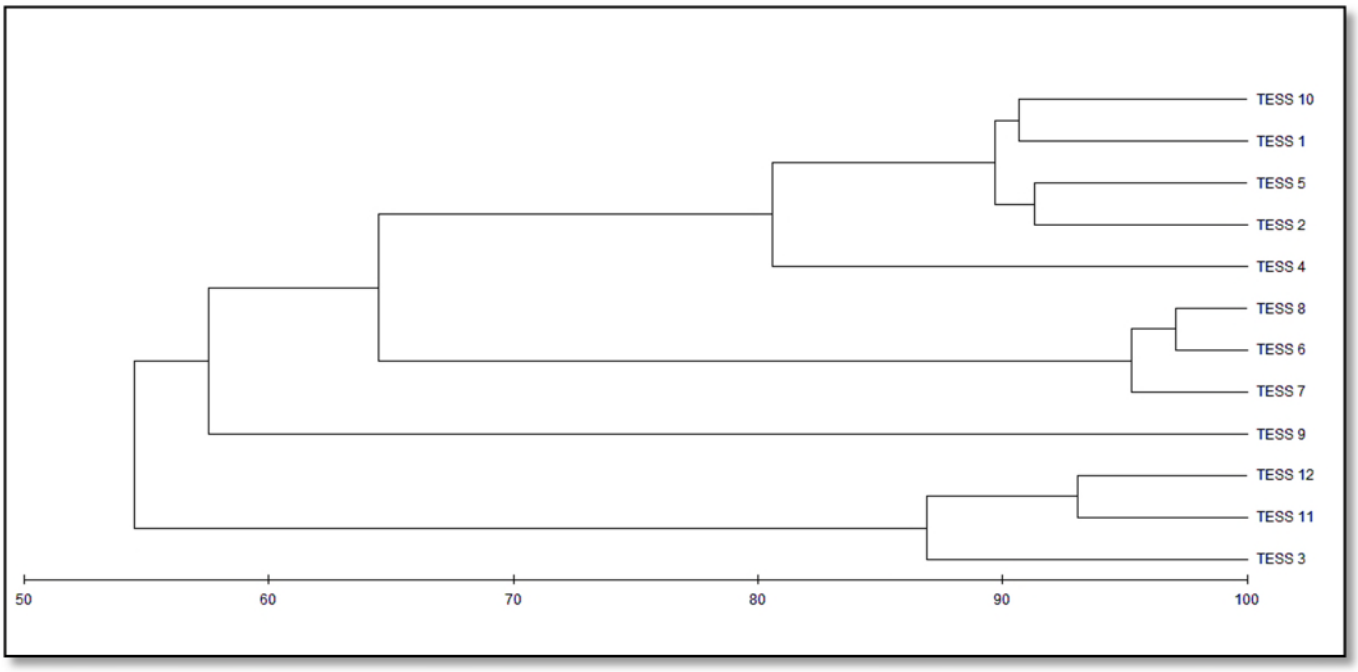

Figure 7: Dendrogram showing the similarities of the vegetation communities at the relevés.

A major division separates the relevés into grassland, riparian (wash) and dune communities (Figure 7). Relevés 3, 11 and 12 were classified as *Acacia mellifera – Parkinsonia africana* wash open shrubland, due to the dominance of these species and showed approximately a >85% similarity in species diversity (Figure 7). Relevés 6, 7 and 8 all occur on gravelly soil and show a high degree of similarity of approximately 95% (Figure 7) due to dominant vegetation and underlying substrate the plant community in which these releves fall is classified as *Stipagrostis ciliata – Aristida congesta* open grassland. Relevés 1, 2, 4, 5 and 10 all occurred within the in the *Acacia mellifera – Aristida congesta* dune open shrubland and showed a > 90% similarity (Figure 7). Relevé 9 was conducted on one of the rock hills and therefore shows an approximate similarity of only 55% with relevés 3, 11 and 12 and an approximate similarity of 58% with the remainder of the relevés (Figure 7). Although species recorded at this releve are a subset of many of the other releves, species diversity and abundances are very low leading to the low similarity to other relevés.

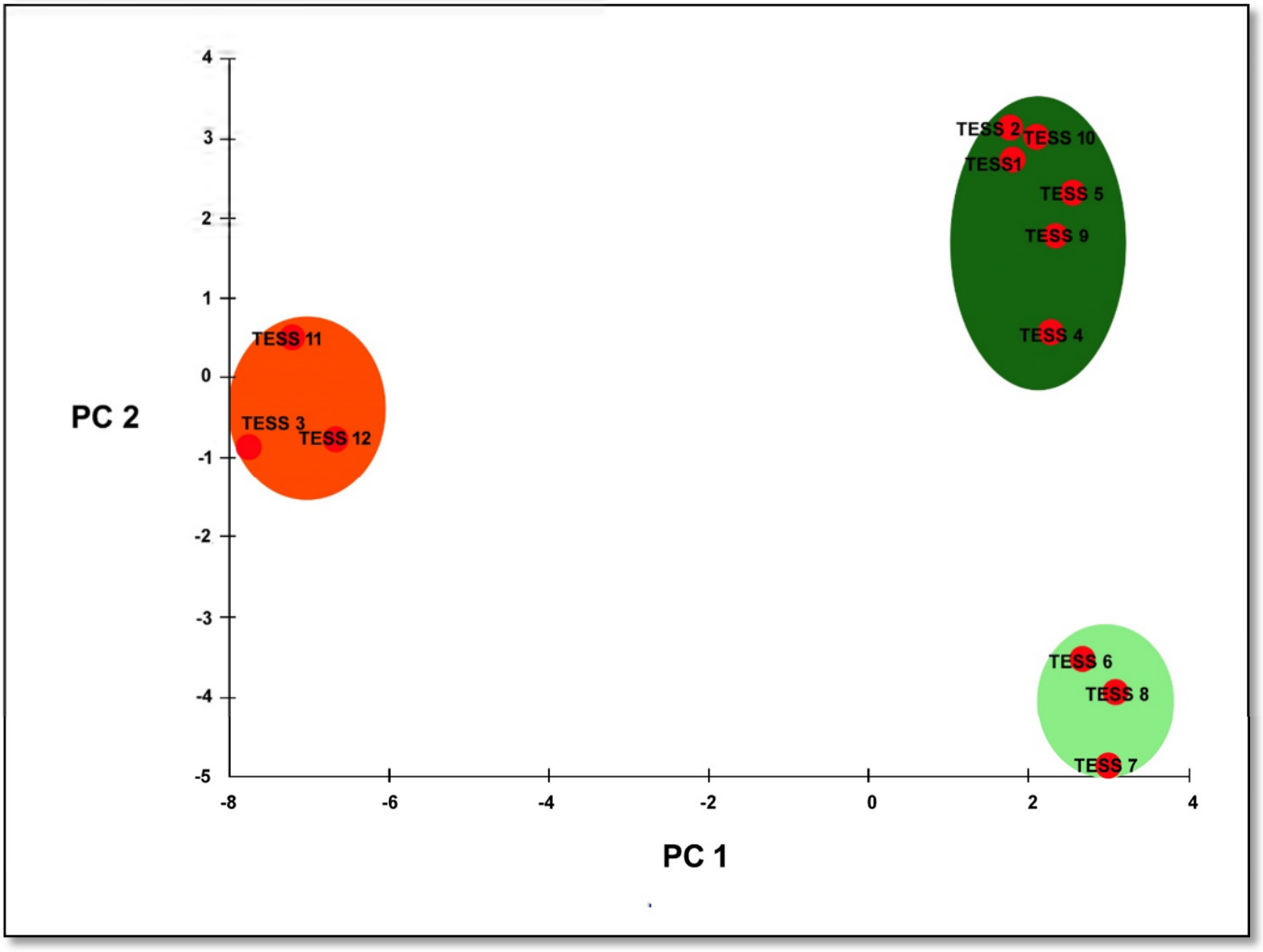

Figure 8: Principle Components Analysis of the relevés conducted during the study.

The vegetation communities are described in this report and named according to dominant species and underlying substrate. The vegetation communities are named as follows:

- *Acacia mellifera – Aristida congesta* dune open shrubland;
- *Acacia mellifera – Parkinsonia africana* wash open shrubland; and
- *Stipagrostis ciliata – Aristida congesta* open grassland.

These vegetation communities are shown in Figure 9 and the cover of each vegetation community is given in Table 7.

The total area of the study area was calculated to be 1590ha. Table 7 gives the relative areas of each of the vegetation communities to the study area.

Table 7: Areas of vegetation communities at Paulputs CSP project

Vegetation Community	*Area in ha*	*% of total study area*
***Acacia mellifera – Aristida congesta* dune open shrubland**	***462***	***29.05%***
***Acacia mellifera – Parkinsonia africana* wash open shrubland**	***355***	***22.33%***
***Stipagrostis ciliata – Aristida congesta* open grassland**	***773***	***48.62%***
Total	*1590*	*100.00%*

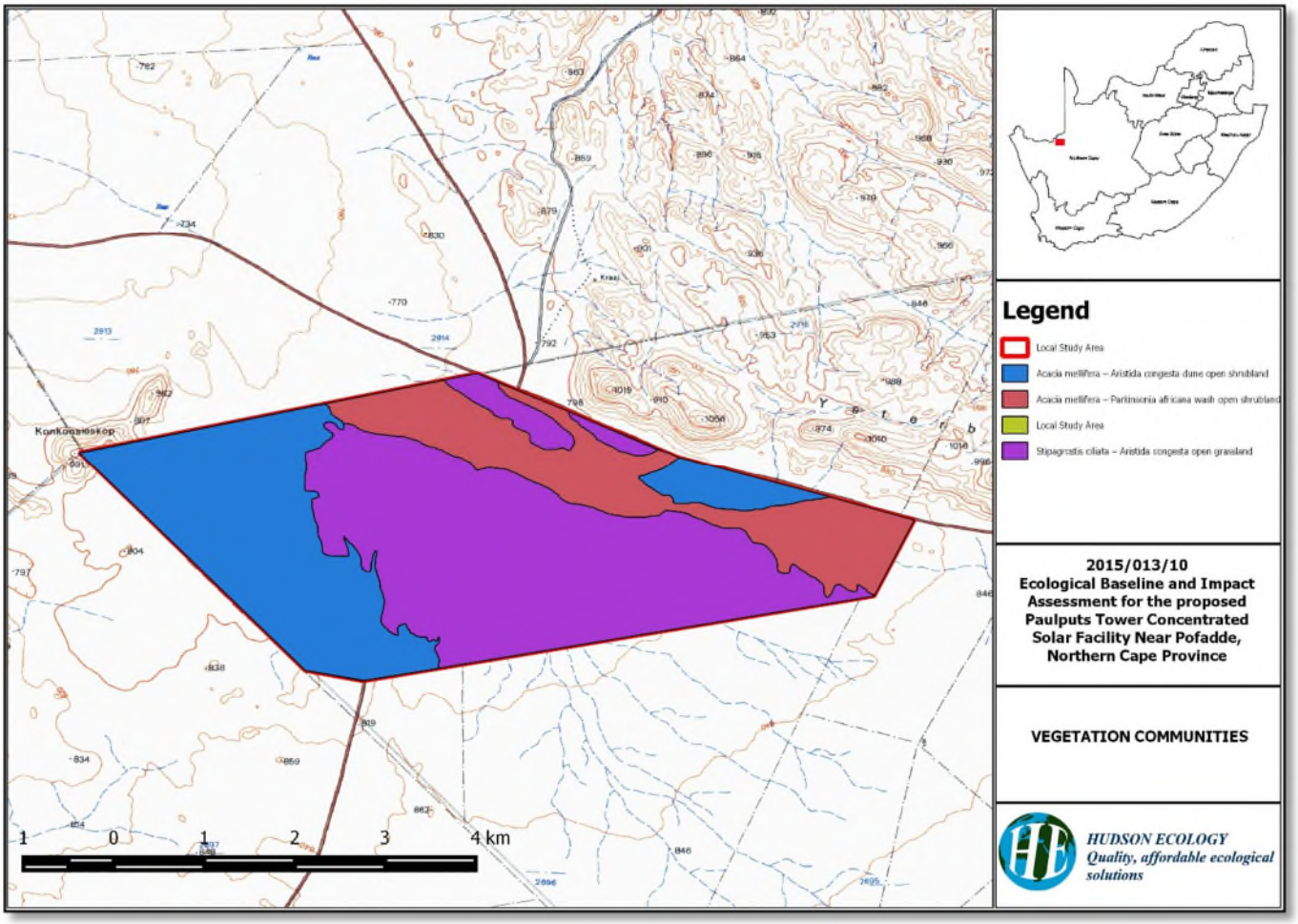

Figure 9: Paulputs study area showing vegetation communities

A list of plant species known to occur in the region are given in APPENDIX A. Recorded species are highlighted in the Appendix..

8.2.1.2 Acacia mellifera – Aristida congesta dune open shrubland

This vegetation community is characterised by deposit dunes of deeper finer typical red sand with little or no calcrete deposits. This vegetation community is typically covered by sparse open grassland, with *Stipagrostis ciliata* and *Aristida congesta* being the dominant grass species. Other grass species occurring in this vegetation community include *Stipagrostis obtusa, Aristida adscensionis, Fingerhuthia africana* and *Eragrostis lehmanniana,* although these species occur in very modest abundance. Due to the deeper soils, as well as soil chemistry and an increased water retention potential, larger *Acacia mellifera* are dominant in this vegetation community, with scattered, drought resistant dwarf shrubs or small trees, e.g. *Rhigozum trichotomum* and Boscia *foetida* (Figure 10). This vegetation community also hosts a number of annual herb species in the wet season. Species of concern found to occur in this vegetation community are the protected species *Aloe dichotoma* and *Boscia foetida*. Due to the very sandy soil, protected species that prefer a more solid substrate, such as *Hoodia gordonii*, are absent.

Figure 10: *Acacia mellifera – Aristida congesta* dune open shrubland in the northern part of the study area

Sensitivity aspects

- This vegetation community on the site has been moderately disturbed;
- Depending on the severity of the vegetation clearing , which has taken place, rehabilitation of this vegetation community could be relatively easily conducted, but in more severely degraded areas rehabilitation will be more difficult;
- Low - moderate species diversity;
- Floristic status of this variation is low - moderate;
- Suitability of the habitat for flora and fauna species of concern is high (*Aloe dichotoma* and *Boscia foetida* recorded);
- Ecological integrity of this community is moderate; and
- The Conservation importance of this community is high.

8.2.1.3 Acacia mellifera – Parkinsonia africana wash open shrubland

The drainage lines within the plains of the study area are regarded as washes, as water will only flow after good rains, and soon dry up again. The increased water retention in the underlying substrate allows for the growth of larger individuals of the species *Acacia mellifera* and *Parkinsona africana*. These washes are wide and sandy, and blend into the landscape, merging with the adjacent grassland vegetation, but are nevertheless visible due to their microtopography and change in species composition (Figure 11). The vegetation is often somewhat heterogeneous and infested with weeds, due to the disturbance of the periodic flooding.

Washes are of conservation concern and regarded as sensitive ecosystems, due to the ecosystem processes linked to provision and transport of water in the landscape.

Figure 11: Wash shrubby grassland running from left to right in the central part of the photo

Sensitivity aspects

- This vegetation community on the site has been moderately to severely disturbed;
- Rehabilitation of this vegetation community will be difficult due to existing levels of degradation;
- Low indigenous species diversity;
- Floristic status of this variation is low;
- Suitability of the habitat for Red Data flora and fauna species is low – moderate although *Boscia foetida* was recorded;
- No floral Red Data species were recorded in this vegetation community;
- Ecological integrity of this community is moderate; and
- The Conservation importance of this community is low - moderate.

8.2.1.4 Stipagrostis ciliata – Aristida congesta open grassland

The flat sandy plains are covered with shallow sand with calcrete exposed locally. The open, sparse grassland is dominated by *Stipagrostis ciliata* and *Aristida congesta*. The shrubby *Rhigozum trichotomum* is prominent on the sandy localities while *Salsola aphylla* is more prominent where calcrete is exposed (Figure 12). Other dominant grass species occurring in this vegetation community include *Stipagrostis obtusa, Aristida adscensionis* and, to a much lesser extent, *Fingerhuthia africana* and *Eragrostis lehmanniana.*

Figure 12: Calcrete shrubby grassland

Sensitivity aspects

- This vegetation community on the site has been severely disturbed;
- Depending on the severity of degradation, rehabilitation of this vegetation community could be relatively easily conducted, in more severely degraded areas rehabilitation will be more difficult;
- Low - moderate species diversity;
- Floristic status of this variation is low - moderate;
- Suitability of the habitat for Red Data flora and fauna species is high (*Hoodia gordonii* recorded as well as isolated individuals of *Boscia foetida*);
- Ecological integrity of this community is low - moderate; and
- The Conservation importance of this community is moderate - high.

8.2.1.5 Sparse *Acacia mellifera – Aristida congesta* rocky outcrop vegetation

The vegetation on the slopes and crests of the mountains and hills is a shrubland with both succulent and non-succulent bushes and a sparse grassy layer. The geology is varied and complex with metamorphic rocks consisting of clastic sediments, volcanic and intrusive rocks of Mokolian age. The land type is mostly Ib and Ic, indicating the shallow rocky or gravelly soils (Figure 13). This vegetation community was not mapped as a separate vegetation community as it is a subset of the *Acacia mellifera – Aristida congesta* dune open shrubland vegetation community in which it occurs. These vegetation communities are dominated by *Acacia*

mellifera and *Aristida congesta* with, to a lesser extent, *Stipagristis ciliata, Aristida adscensionis, Stipagrostis obtusa* and *Eragrostis lehmanniana,* with isolated stunted *Boscia foetida* and *Parkinsona africana* near the foothills of the outcrops

Figure 13: Rocky outcrop vegetation

Sensitivity aspects

- This vegetation community on the site is relatively undisturbed;
- Rehabilitation of this vegetation community could be very difficult;
- Low - moderate species diversity;
- Floristic status of this variation is moderate;
- Suitability of the habitat for Red Data flora and fauna species is high;
- Ecological integrity of this community is high; and
- The Conservation importance of this community is high.

8.2.2 Flora species of concern

A list of plant species previously recorded in the quarter degree grid in which the study area is situated was obtained from the South African National Biodiversity Institute (APPENDIX A). Additional species that could occur in similar habitats, as determined from official database searches and reviewed literature, but not recorded in these grids are also listed. A total of 11 species were determined to possibly be occurring in the study area.

The species, listed as possibly occurring in the study area, were evaluated to determine the probability of occurrence in the study area based on habitat suitability. Of the species that are considered to occur within the area under investigation, there were five species that could occur in habitats that are available in the study area. According to IUCN (IUCN, 2013) two of these are listed as Vulnerable, one as Near Threatened and two as Declining. One of the vulnerable species, *Aloe dichotoma*, was recorded in the study area and could occur anywhere within the hills in the study area, or in rocky areas in Bushmanland Arid Grassland.

Figure 14: Aloe dichotoma recorded in the study area

The other vulnerable species, *Lithops olivaea*, occurs only in white translucent quartzite patches. This habitat was not found in the study area during the ecological baseline and impact assessment study. The species has been recorded 30 km away, and has a wide distribution within the Gariep Centre of Floristic Endemism, there is thus a high probability of occurrence on site, if available habitat is present. The Near Threatened species, *Conophytum limpidum*, is found on inselbergs in Bushmanland in vertical crevices in rocks, generally preferring shaded situations. If it occurs in the study area, it is most likely to be found on the hills or rocky areas. The one Declining species, *Acacia erioloba*, also a protected tree, has a high probability of occurring in the study area, while *Hoodia gordonii* was recorded in the study area in a number

of places (

Figure 15).

Figure 15: Hoodia gordonii recorded in the study area

The quantity and quality of floristic data for the study area is poor. There are few taxonomic collections and relatively little floristic information for the area (Van Wyk & Smith, 2001). There are over 400 succulent species listed as being endemic or near-endemics for the Gariep Centre of Endemism as well as a long list of non-succulents (Van Wyk & Smith, 2001). A number of these have been recorded in the region around the current study area, for example, *Aloe gariepensis, Crassula corallina* subsp. *macrorrhiza*, *Hoodia gordonii*, *Ruschia muricata* and *Sarcocaulon patersonii. Aloe gariepensis, Ruschia muricata* and *Maerua gilgii* are found in Bushmanland Arid Grassland, *Crassula corallina* subsp. *macrorrhiza* is found in Lower Gariep Broken Veld and *Sarcocaulon patersonii* is found in a variety of vegetation types, including Lower Gariep Broken Veld and Bushmanland Arid Grassland. Areas associated with calcareous soils and heavy metals are likely to have high numbers of species of restricted distribution. There is also a high probability that there are previously undescribed species from the site or surrounding areas. A

list of flora species of concern, as well as their probability of occurrence and reasoning behind the probability of occurrence is given in Table 8.

Table 8: Red Data floral species possibly occurring in the area

Family	Taxon	Status	Habitat	Likelihood of occurrence in the study area
FABACEAE	*Acacia erioloba*	Declining	Savanna, semi-desert and desert areas, deep sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops.	HIGH
ASPHODALACEAE	*Aloe dichotoma subsp. dichotoma*	VU	North-facing rocky slopes (particularly dolomite) in the south of its range. Lower Gariep Broken Veld and rocky areas in Bushmanland Arid Grassland	RECORDED
CAPPARACEAE	*Boscia foetida*	Protected	Savanna, semi-desert and desert areas, deep sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops	RECORDED
APIACEAE	*Anginon jaarsveldii*	EN	Pofadder. Groot Pellaberg. Dry rocky area, xerophytic plants. Agganeys Gravel Vygieveld.	LOW, nearest locality is 50 km away
ASPHODALACEAE	*Bulbine striata*	Critically rare	Groot Pellaberg, this species appears to be endemic to the mountains north of Pella. Quartz pebbles and rocks in well-drained soil on the upper and middle slopes at the base of sheer rock faces.	LOW, nearest locality is 50 km away
FABACEAE	*Caesalpinia bracteata*	VU	This species is only known from below the Augrabies Falls near the Orange River and Klein Pella on granite. Blouputs Karroid Thornveld.	LOW, nearest locality is 20 km away
MESEMBRYANTHEMACEAE	*Conophytum achabense*	VU	Namiesberge, near Poffader. Western end of the Namiesberge on an elevated quartz vlakte. Bushmanland Inselberg Shrubland.	LOW, nearest locality is 60 km away
MESEMBRYANTHEMACEAE	*Conophytum limpidum*	NT	Inselbergs in Bushmanland. Particularily dense on the Namiesberg. Vertical crevices generally prefering shaded situations. Lower Gariep Broken Veld	HIGH
EBENACEAE	*Euclea pseudebenus*	LC	Euclea pseudebenus is found in harsh, stony and sandy desert and semi-desert areas, usually in lowlying areas along watercourses, or fairly nearby.	LOW, nearest lrecorded locality is approximately 40km from the site
MESEMBRYANTHEMACEAE	*Conophytum ratum*	VU	Ghaamsberg, South West of Pofadder. Spongy quartz soil.	LOW, nearest locality is 70 km away
APOCYNACEAE	*Hoodia gordonii*	Declining	Wide variety of arid habitats	RECORDED
MESEMBRYANTHEMACEAE	*Lithops dinteri subsp. frederici*	VU	Only known from a small area near Pella (near Pofadder) in Northern Cape. Eastern Gariep Plains Desert	LOW, nearest locality is 50 km away
MESEMBRYANTHEMACEAE	*Lithops dorotheae*	EN	Just N of Pofadder / Pella vicinity, Pella mountains between Pella and Pofadder. Grows on fine grained, sheared, feldspathic quartzite. False Succulent Karoo Veld or Orange River Broken Veld (Eastern Gariep Rocky Desert)	LOW, known distribution is to the west
MESEMBRYANTHEMACEAE	*Lithops olivacea*	VU	Aggenys to Pofadder. Habitat specialist - grows on white translucent quartzite in Arid Karoo Veld (Aggeneys Gravel Vygieveld).	MEDIUM

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

8.3 Fauna Assessment

The faunal assessment was conducted in the dry season during the month of August 2015 and in the wet season during April 2016.

8.3.1 Recorded Faunal Species

8.3.1.1 Herpetofauna

Reptile diversity in the area is high with approximately 45 reptile species (APPENDIX B) occurring in the area and reptile endemism is especially high in the region with 19 species (42%) being endemic. Ten species were confirmed during the wet and dry season site surveys (Table 9). Although the number of species does not seem high, herpetofauna are by nature shy animals and the fact that almost 25% of the species known to occur in the area were recorded indicates quite high species richness in the area. No exotic herpetofauna species are expected to occur on the study site. Two of the species recorded, namely *Naja nivea* and *Cordylus polyzous,* are considered endemic to southern Africa.

Table 9: Reptile species recorded during the August 2015 and April 2016 surveys

Order	Suborder	Family	Subfamily	Biological Name	Common Name	Status
Squamata	Serpentes (Ophidia)	Colubridae	Boadontinae	*Lamprophis fuliginosus*	Brown House Snake	
			Psammophinae	*Psammophis notostictus*	Karoo Whip Snake	
		Elapidae	Najinae	*Naja nivea*	Cape Cobra	E
				Naja nigricollis	Black-necked Spitting Cobra	Rare
			Viperinae	*Bitis arietans*	Puff Adder	
				Bitis caudalis	Horned Adder	
	Sauria (Lacertillia)	Scincidae	Lygosomatiinae	*Mabuya striata*	Striped Skink	
				Mabuya variegata	Variegated Skink	
		Agamidae		*Agama aculeata*	Ground Agama	
		Cordylidae	Cordylinae	*Cordylus polyzous*	Karoo Girdled Lizard	E

Most of the expected species in the area (Table 9) are common and widespread, with only the Black-necked spitting Cobra (Naja nigricollis) being classified as rare. Species of concern are discussed further in section 6.2.5.

Figure 16: Karoo Girdled lizard, Cordylus polyzous, recorded during the study

The results of the statistical analysis of the herpetofauna occurring in the three vegetation communities are given in Figure 17. From this figure it can be seen that diversity is generally low as can be expected in arid areas. What can be noted is that Evenness is high, an indication that there is a high similarity between the species occurring in the different vegetation communities. The *Acacia mellifera – Parkinsonia africana* wash vegetation community showed the highest diversity. This can be as a result of water retention causing a greater diversity of vegetation attracting a higher diversity of prey items for herpetofauna.

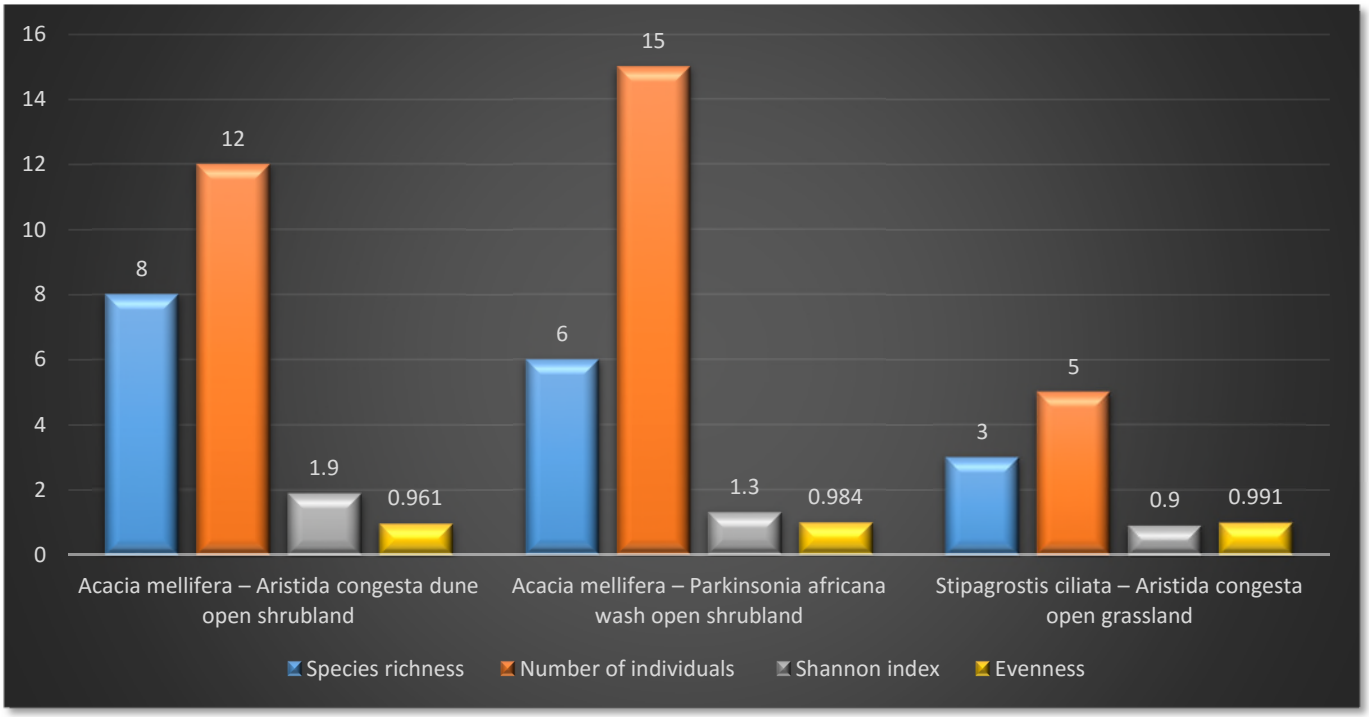

Figure 17: Herpetofauna species diversity between vegetation communities

Most of the expected species in the area (*Table **9***) are common and widespread, with only the Black-necked spitting Cobra (Naja nigricollis) being classified as rare. Species of concern are discussed further in section 6.2.5.

8.3.1.2 Amphibia

The study area is a fair distance from any permanent open water bodies and therefore, as expected amphibian diversity is low. Only seven species are expected to occur in the study area (APPENDIX C), and during the wet and dry season surveys no amphibian species were recorded. Due to the dry conditions, distance from any open water bodies and distance from the Orange River, the lack of amphibian species in the study area was expected. The study site area falls outside the natural range of giant bullfrogs, desert rain frog and the Karoo caco, and these species should not occur on the study site. Due to the fact that no amphibian species were recorded on site, no statistical analyses were conducted.

8.3.1.3 Mammalia

Of the 67 mammal species expected to occur in the study area, according to historic recordings (APPENDIX D), only 16 were confirmed during both the site visits (Table 10). A number of species may contribute to the low species diversity and abundance recorded in the mammal population, these include overgrazing and local extinctions due to anthropogenic impacts.

Table 10: Mammal species recorded during the study

Family	Biological Name	Common Name
MACROSCELIDIDAE (Sengis/Elephant Shrews)	*Elephantulus rupestris*	Western Rock Sengi
SORICIDAE (Shrews)	*Crocidura cyanea*	Reddish-grey Musk Shrew
LEPORIDAE (Hares and Rabbits)	*Lepus saxatillis*	Scrub Hare
BATHYERGIDAE (Rodent Moles / Mole Rats)	*Cryptomys hottentotus*	Common (African) Mole-rat
HYSTRICIDAE (Porcupine)	*Hystrix africaeaustralis*	Cape Porcupine
MURIDAE (Rats and Mice)	*Saccostomus campestris*	Pouched Mouse
MURIDAE (Rats and Mice)	*Michaelamys namaquensis*	Namaqua Rock Mouse
MURIDAE (Rats and Mice)	*Rhabdomys pumilio*	Four-striped Grass Mouse
MURIDAE (Rats and Mice)	*Mastomys natalensis*	Natal Multimammate Mouse
CANIDAE	*Otocyon megalotis*	Bat Eared Fox
HERPESTIDAE	*Galerella pulverulenta*	Small Grey Mongoose

Family	Biological Name	Common Name
HERPESTIDAE	*Suricata suricatta*	Suricate (Meerkat)
ORYCTEROPODIDAE	*Orycteropus afer*	Aardvark
PROCAVIIDAE	*Procavia capensis*	Rock Dassie (Hyrax)
RUMINANTIA	*Raphicerus campestris*	Steenbok
RUMINANTIA	*Sylvicapra grimmia*	Common Duiker

Mammals reliant on wetland and arboreal habitats were a priori omitted from the list of occurrences since these habitat-types are absent from the study site. As such a species richness of 56 species in an area with average habitat diversity and a low carrying capacity is high.

All 16 species recorded are robust and widespread, mostly with the proviso that suitable habitat and sufficient space to maintain home ranges / territories are available. Given no or lowkey persecution all species are capable of maintaining their presences in remote areas such as the site and surrounding properties. The nearby roads are obviously a main source of fatalities – several carcasses were recorded during transit to and from the study area.

The results of the statistical analysis of the mammalia occurring in the three vegetation communities are given in Figure 18. From this figure it can be seen that diversity is low as can be expected in arid areas. Evenness is high, indicating that there is a high similarity between the species occurring in the different vegetation communities. The Ac*acia mellifera - Aristida congesta* dune open shrubland community showed the highest diversity, although the variation is so little that it cannot be seen as definitive of a significant variation in species diversity.

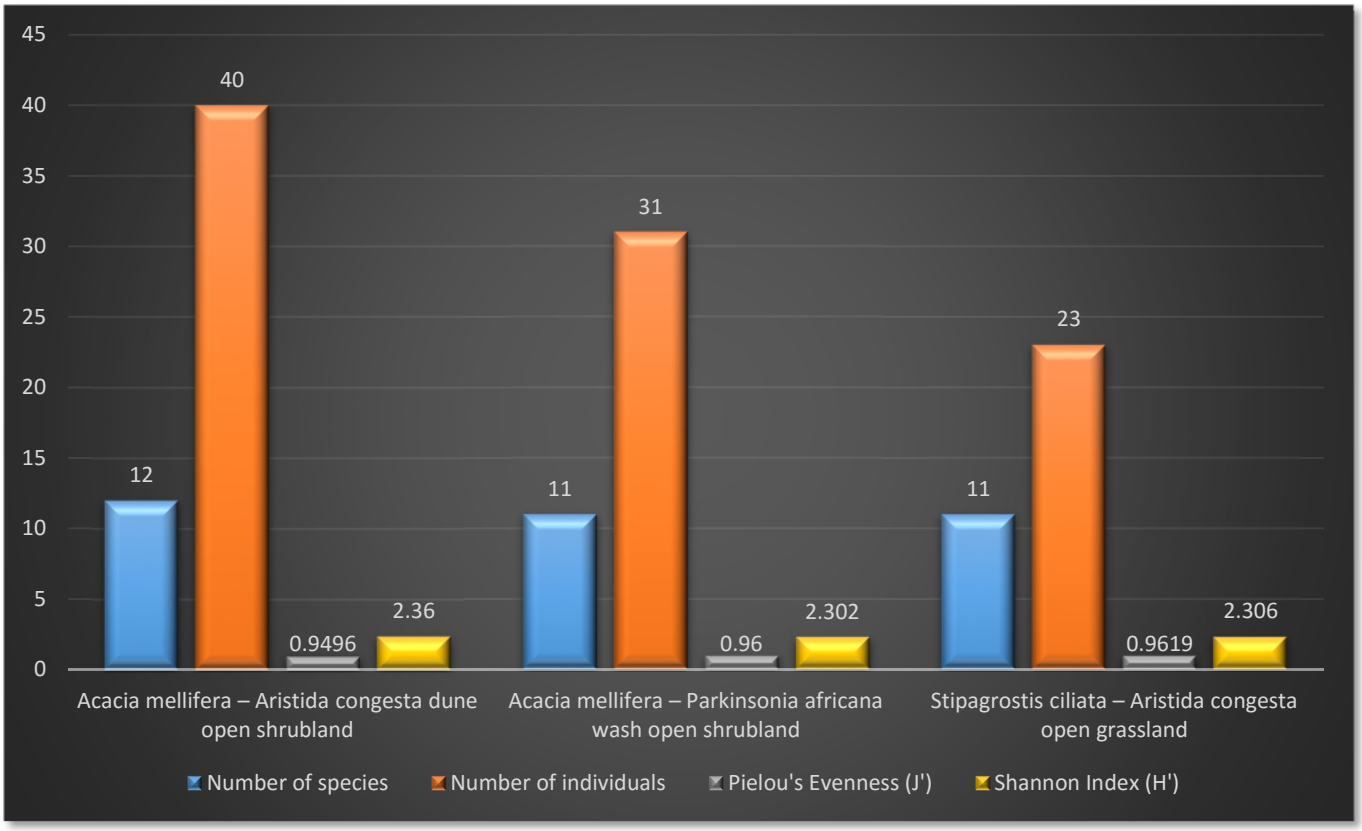

Figure 18: Mammalia species diversity between vegetation communities

A number of bat species are known to occur in the region. The bat species known to occur in the general area are given in Table 11. Bat species recorded in the area during the surveys area are *Rhinolophus darlingi, Neoromicia capensis, Pipistrellus rueppelli* and *Tadarida aegyptiaca*. Of these species only *Tadarida aegyptiaca* is likely to be attracted to the infrastructure for roosting

purposes due to the fact that they are human commensal species that are unlikely to be deterred by the activities in the area and also often utilise man-made constructions to roost.

Table 11: Bat species likely to occur in the study area

Biological Name	Common Name	Habitat Feeding and Roosting	Likelihood of being attracted to the infrastructure for roosting
Nycteris thebiaca	Egyptian Slit-faced Bat	This species is able to thrive in a variety of tropical and temperate habitats throughout Africa and the Arabian peninsula. It can live in widely diverse habitats, including forests, caves, deserts, savannas, shrublands, and grasslands (Mickleburgh, et al., 2008).	LOW
Rhinolophus clivosus	Geoffrey's Horseshoe Bat	This species has been recorded from a wide variety of habitats, ranging from savanna woodland, Mediterranean-type shrubland, dry (and possibly moist) savanna, open grasslands and semi-desert to even more arid environments. Roosting has been recorded in caves, rock cervices, disused mines, and various rural and urban buildings (Kock, et al., 2008).	LOW
Rhinolophus darlingi	Darling's Horseshoe Bat	Generally associated with savanna and savanna-woodland type habitats. It is dependant on caves, mines, broken rocky areas, buildings and similar structures as roost sites (Jacobs, et al., 2008)	MODERATE
Rhinolophus denti	Dent's Horseshoe Bat	This species is typically associated with savanna habitats. Populations are largely dependent on caves, abandoned mines and similar habitats for roosting although they have also been found roosting in hollow trees (Jacobs, et al., 2008).	LOW
Cistugo seabrai	Angolan Hairy Bat	Little is known about the natural history of this species. All of the localities from which they have been collected are arid with a mean annual rainfall of less than 100 mm. Specimens have usually been caught close to open water, and have been observed gleaning insects from orange trees (Griffin & Jacobs, 2008).	LOW
Neoromicia capensis	Cape Serotine Bat	This is a lowland species that typically inhabits lowland tropical moist forest, tropical dry forest, and dry and moist savanna. It has also been recorded from more arid areas, grassland, bushveld and *Acacia* woodland. Animals roost under the bark of trees and similar vegetation, between cracks in walls and under the roofs of houses both thatched and corrugated iron or tiled (Jacobs, et al., 2014).	LOW
Pipistrellus rueppelli	Ruppell's Pipistrelle	Found in semi-desert and desert. Roosts under rocks and in buildings (Jacobs, et al., 2008).	MODERATE
Tadarida aegyptiaca	Egyptian Free-tailed Bat	This species is found in varied habitat types from arid areas to humid hills and valleys. It roosts under banner boards, crevices in caves, cliff faces, large boulders and rocks, narrow spaces between pillars, walls, crevices in old buildings, temples, and forts, either in small groups of 2 or 3 individuals to hundreds and thousands of individuals (Mickleburgh, et al., 2008).	HIGH

During the public participation meeting held at the end of 2015, the question was raised as to whether the residual glow from the tower would attract insects and thereby attract bats to the tower risking injury to the bats (we assume from the heat causing the "residual glow"). We feel that there is some misconception as to how the tower works and thus feel the need to clarify this issue. There is no "residual glow" from the tower after sundown, there is no material at the cavities of the tower (or on earth for that matter) that will retain enough heat, after the gradual cooling that occurs during dusk, to create any kind of glow. Insects, and subsequently predatory bats, may be attracted to the tower due to artificial lighting against the tower at night. This may be mitigated by painting the tower with a less reflective paint and a darker colour, but as the tower is non-functional at night there is no greater risk to bats than any other large structure they may encounter. Bats may utilize the tower as a roosting habitat, but at the times they leave or return to the tower, the tower is not functioning and thus the risk for injury is minor. This may still be mitigated by preventing bats from entering the tower by making sure all entrances and crevices are sealed. Bat boxes can be erected in order to provide bats with an alternative to roosting in the tower if this does become an issue.

8.3.2 Red Data Faunal Species

Table 12 describes the habitat requirements and probability of occurrence of fauna species of concern identified as likely to occur in the study area.

Table 12: Red Data fauna species that may occur in the study area

Common name	Taxon	Habitat	Status	Likelihood of occurrence
Black rhinoceros	*Diceros bicornis bicornis*	Wide variety of habitats, but currently only occurs in game reserves.	CR	**NONE**, only occurs in game reserves
Hartmann's mountain zebra	*Equus zebra hartmannae*	Rocky barren areas, ecotones between mountains and plains / flats, grazer	EN	**LOW,** only occurs in game reserves.
Angolan Wing-gland Bat	*Cistugo seabrai*	Nama-Karoo, gleaning insectivore, roosts unrecorded, but probably in crevices in rocks. Occurs in areas with less than 100 mm rainfall.	VU	**MEDIUM**, previously recorded in neighbouring grid, on edge but within geographical distribution, no roosting habitat available on site.
Honey badger	*Mellivora capensis*	Wide variety of habitats. Probably only in natural habitats.	NT	**MEDIUM**, overall geographical distribution includes this area, habitat is suitable.
Darling's horseshoe bat	*Rhinolophus darlingii*	Savanna, rossting in caves and sub-terranean habitats	NT	**MEDIUM**, recorded in nearby grid, on edge of distribution; suitable habitat may occur on site.
Dent's horseshoe bat	*Rhinolophus denti*	Savanna, nama-Karoo, succulent Karoo, and distribution follows rivers. Caves and subterranean habitats. Aerial insectivore.	NT	**LOW**, on edge of distribution; suitable habitat may occur on site or may be vagrant from Orange River valley.
Littledale's whistling rat	*Parotomys littledalei*	Desert, Karoo. Sandy or gravel open plains. Tends to excavate burrow beneath a shrub, but will also contruct stick nest at the base of a shrub. Herbivorous, favouring leaves of Zygophullum and Mesembryanthemaceae.	NT	**HIGH**, site is in core of distribution range. Habitat suitable on site.
Dassie Rat	*Petromus typicus*	Rocky barren areas on rocky outcrops and koppies. Flat rock crevices. Eats soft vegetable matter, including leaves of shrubs and flowers of many Asteraceae.	NT	**HIGH**, site is in core of distribution range. Habitat suitable on site.

Common name	Taxon	Habitat	Status	Likelihood of occurrence
Reddish-grey musk shrew	*Crocidura cyanea*	Wide variety of habitats. Nocturnal, terrestrial.	DD	**MEDIUM**, previously recorded in nearby grid and geographical distribution includes this area.
Lesser red musk shrew	*Crocidura hirta*	Wide range of habitats from moist savanna and wetlands to Kalahari thornveld. Terrestrial, nocturnal.	DD	**LOW**, overall distribution includes this area, but low reporting rate in arid part of country.
Rock dormouse	*Graphiurus platyops*	Rocky terrain, also been found in camelthorn trees. Eats insects and seeds. Nocturnal.	DD	**MEDIUM**, not previously recorded in this area, but habitat suitable and within overall geographical distribution.
Bushveld Gerbil	*Tatera leucogaster*	Terrestrial, sandy soils. Excavates burrows in sandy soils, usually at the base of small shrubs, but also in the open. Granivorous, insectivorous and herbivorous.	DD	**MEDIUM**, recorded in nearby grid, on edge of distribution; suitable habitat may occur on site.
Bushveld Elephant-shrew	*Elephantulus intufi*	Savanna, grassland, shrubland. Sandy soils with sparse grass cover. Requires cover of low bushes. Eats insects, primarily ants, but also catches grasshoppers.	DD	**MEDIUM**, recorded in nearby grid, on edge of distribution; suitable habitat may occur on site.
Giant Bullfrog	*Pyxicephalus adspersus*	Widely distributed in southern Africa, mainly at higher elevations. Inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas; also utilises non-permanent vleis and shallow water on margins of waterholes and dams. Prefer sandy substrates although they sometimes inhabit clay soils.	NT	**LOW,** just outside known distribution range.
Black-necked spitting cobra	*Naja nigricollis woodi*	Favours rocky terrain and dry rocky watercourses.	RARE	**HIGH,** overall geographical distribution includes this area; suitability of habitat on site appears favourable.

Of the 21 faunal species of concern that may occur in the study area, 1 has no probability of occurrence, 5 have a low probability of occurrence, 9 have a medium probability of occurrence and 6 have a high probability of occurrence. Three of the species with a high probability of occurrence, the Black-necked spitting Cobra, Maccoa Duck and Lanner Falcon, were recorded during the study.

8.4 Ecological Integrity

The ecological function of the study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas) to high in the more inaccessible or unutilisable areas. Areas in which overgrazing and clearing have taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced. Areas of high ecological integrity are areas that have been minimally impacted. These areas can be considered as areas of high sensitivity and development in these areas should be limited, while areas of moderate and low ecological are areas where a greater amount of perturbation has already occurred and, in order to conserve areas of high ecological integrity, should be preferable for development. The ecological function of the study area is indicated in Figure 19.

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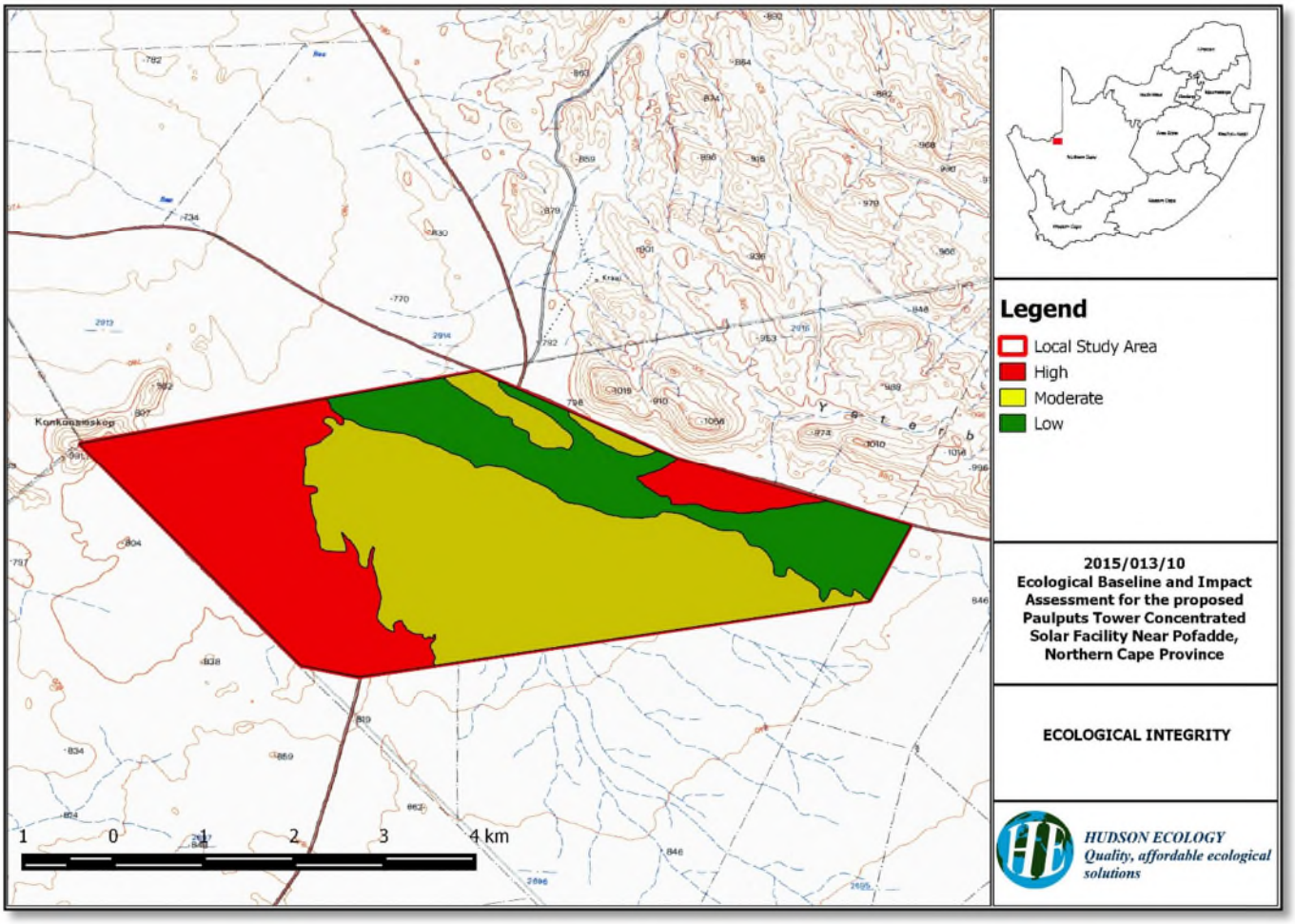

Figure 19: Ecological integrity within the study area

8.5 Conservation Importance

Areas of high conservation importance can be considered as areas of high sensitivity, due to the fact that they are proven to host species of conservation and development in these areas should be limited and impacts well mitigated, while areas of moderate and low ecological are areas where a greater amount of perturbation has already occurred and species of concern are less likely to be present and, in order to conserve areas of high conservation importance, should be preferable for developmentAreas that have been severely disturbed such as settlements are considered of low conservation importance. These areas are, however, quite small in relation to the overall study area (<30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural areas are considered of very high conservation importance due to the presence of Red Data species in these areas and the intrinsic importance of these areas. In keeping with the Precautionary Principle (COMEST, 2005), we need to assume a higher conservation importance when in doubt.

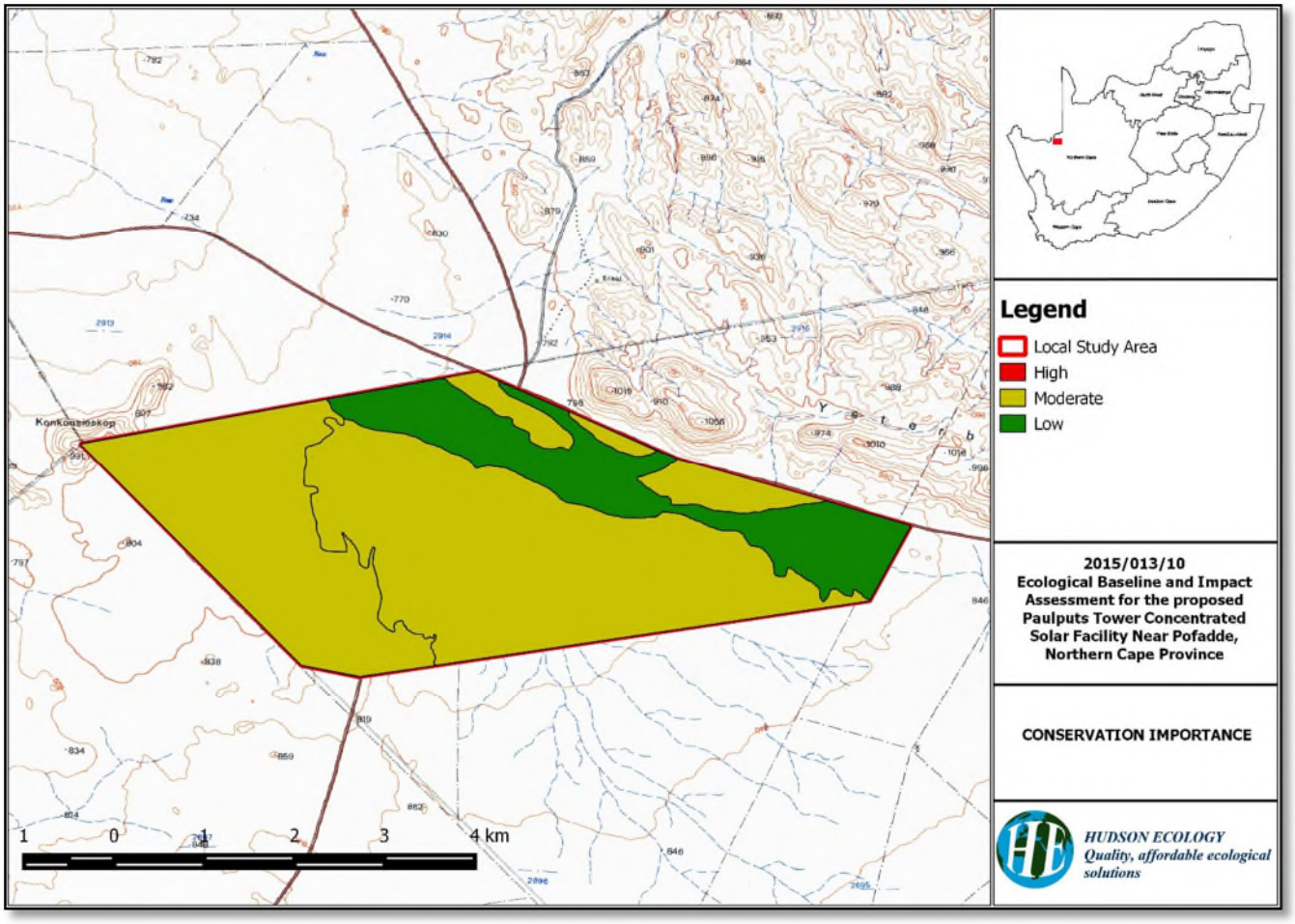

Figure 20: Conservation importance within the study area

8.6 Critical Biodiversity Areas and Ecological Support Areas

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multisectoral planning and decision making tools.

The identification and mapping of CBAs form part of the biodiversity assessment of the Northern Cape Province which will be used to inform the development of the Provincial Biodiversity Sector plans, bioregional plans, and also be used to inform Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and in the Environmental Impact Assessment (EIA) process in the province.

Simply put the purpose of the CBA is to indicate spatially the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which the province would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process.

According to the guidelines for bioregional plans, three basic CBA categories can be identified based on three high-level and management objectives (Table 13).

Table 13: Definitions and framework for linking CBAs to land-use planning and decision-making guidelines based on a set of high-level land biodiversity management objectives

CBA category	Land Management Objective
Critical Biodiversity Areas (CBAs) Definition: CBAs 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	

CBA category	Land Management Objective
delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannon be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.	
Protected Areas (PA) & CBA 1	**Natural landscapes:** Ecosystems and species fully intact and undisturbed. » These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. » These are landscapes that are at or past their limits of acceptable change.
CBA 2	**Near-natural landscapes:** » Ecosystems and species largely intact and undisturbed. » Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. » These are landscapes that are approaching but have not passed their limits of acceptable change.
Ecological Support Areas (ESAs) Definition: ESAs 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 in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.	
ESA	**ESA Functional landscapes:** » Ecosystem moderately to significantly disturbed but still able to maintain basic functionality. » Individual species or other biodiversity indicators may be severely disturbed or reduced. » These are areas with low irreplaceability with respect to biodiversity pattern targets only.
ONA (Other Natural Areas) and Transformed	**Production landscapes:** Manage land to optimize sustainable utilization of natural resources.

The high-level land management objectives (natural, near-natural and functional) can be further unpacked using the three ecosystem integrity indicators namely; ecosystem composition, structure and function. Composition relates to biodiversity pattern, whereas structure and function relate to ecological process and services **Table 14**).

Table 14: Land management Objectives

Land management objective	Land Management Objective Biodiversity Indicators			
	Component of Biodiversity	Biodiversity Pattern	Ecological Services and Processes	
	Indicator category	Composition	Structure	Functioning

	Specific Indicators	• Habitat types; • Species; • Populations; • Meta-populations; • Alien Plants	• Transformation • Fragmentation	• Fire; • Grazing regimes; • Biogeochemical processes; • Hydrological functioning; • Soil formation and erosion; • Biotic processes
	CBA Category	Limit of Acceptable Change (LAC): Permitted amount or degree of change in biodiversity indicator.		
Natural	PA / CA	None	None	None
	CBA1	None	None	None
Near Natural	CBA2	Some	Some	None
Functional	ESA1	Significant	Some	none
	ESA2	Significant	Some	Some
	ONA	Significant	Significant	Some
	Transformed	Significant	Significant	Significant

According to the Khai-Ma Land Use Decision Support tool, the study area falls with an Ecological Support Area (ESA) (Figure 22). The ESA is listed as a migration route, although the species utilising this migration route are not indicated. The migration route does seem to be counter-intuitive as it seems to start in the lowlands of the Gariep River, crosses over rocky mountainous areas only to return to the lowlands of the Gariep River lowlands again. Notwithstanding this the development will affect less than 30% of the width of the migration route and should have very little effect on species using this route.

Notwithstanding this the ESAs are defined as "*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 in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration.*" And it is stated that "*The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas*" It is also stated that "*some*" level of change in the biodiversity indicators for ESAs is allowed.

CBA 2 areas are areas of near-natural landscapes, and "*ecosystems and species largely intact and undisturbed. Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change*". The fact that the development borders of an CBA 2 area, should have no bearing on the ability to achieve targets.

It must also be noted that the migration route indicated in Figure 20 is part of a large system of migration routes and that the percentage of these migration routes that will impacted upon will be negligible (Figure 21).

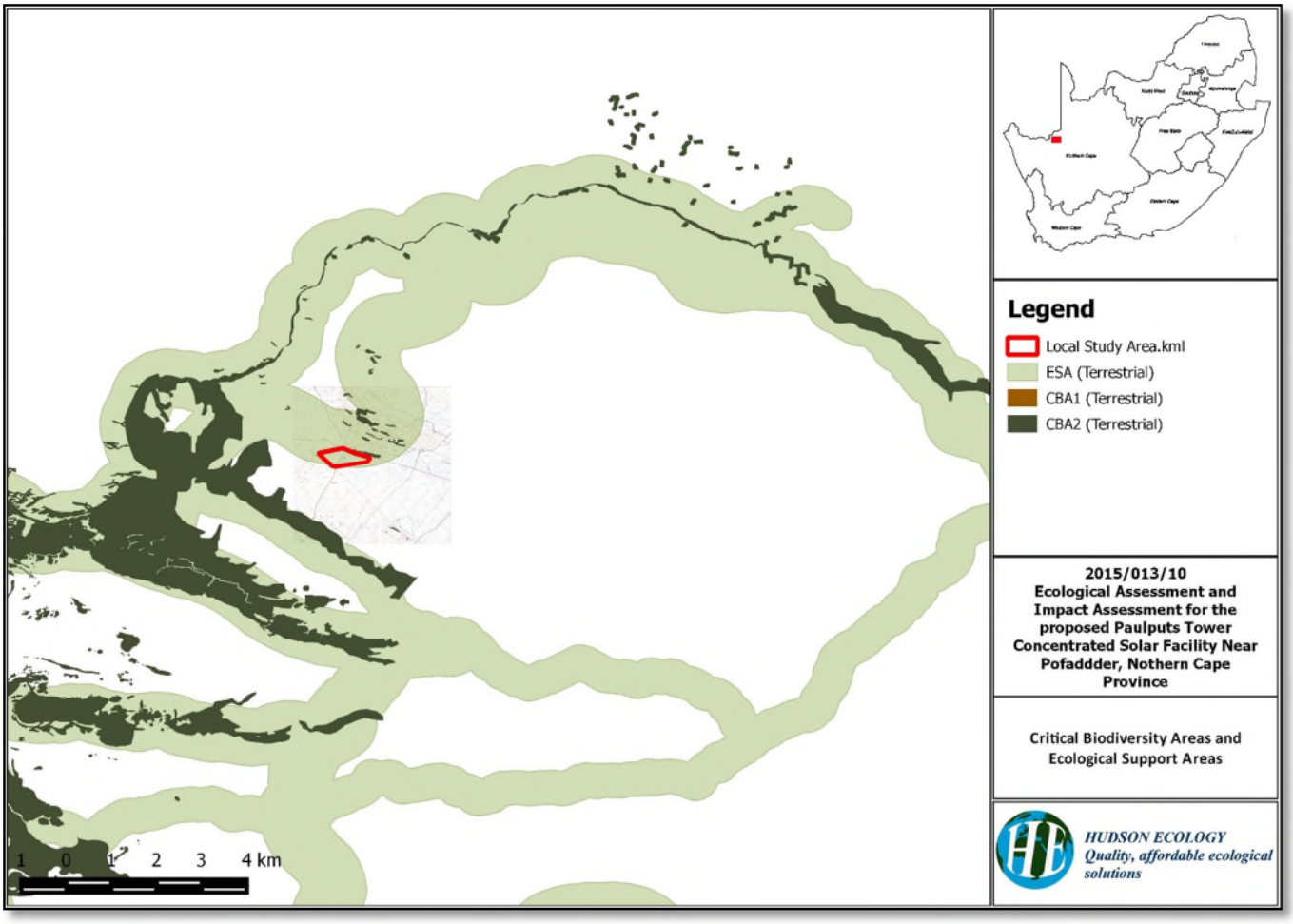

Figure 21: Regional extent of the migration routes

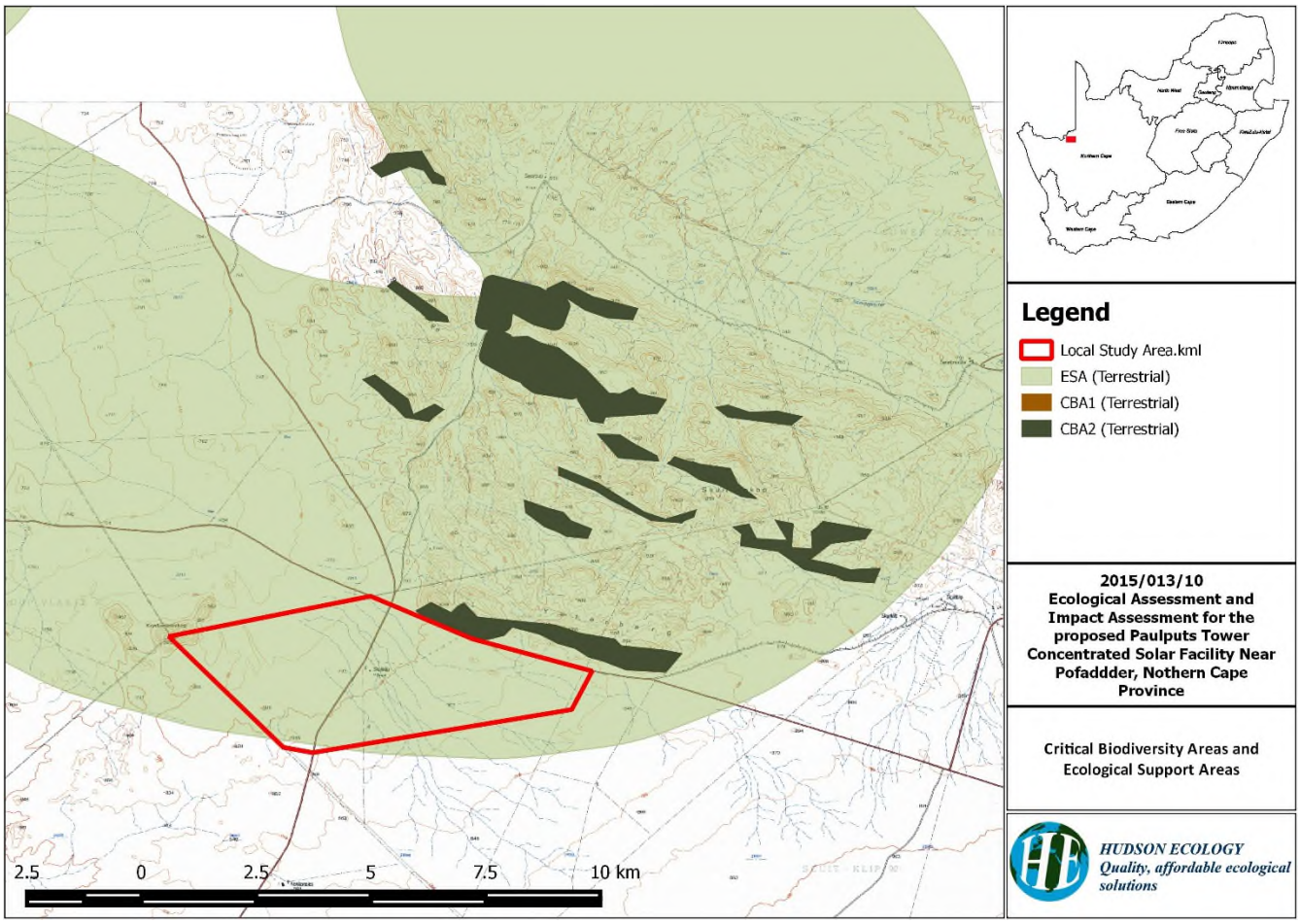

Figure 22: Ecological Support Area as per the LUDS

8.7 DAFF comments

In their letter (Ref: F13/11/2/328), Jacoline Mans of the South African Department of Agriculture Forestry and Fisheries raised the following concerns:

- Impacts on *Euclea pseudebenus* needs to be addressed;
- Cumulative impacts on NFA listed protected tree species; and
- Impacts on *Schotia brachypetala* var. *angustifolia* need to be avoided.

Schotia brachypetala var angustifolia is a tropical to subtropical tree species that occurs on the eastern parts of South Africa and does not occur west of the 27°E line of longitude. It is therefore highly unlikely that there will be any impact on this tree species.

9 ECOLOGICAL IMPACT ASSESSMENT

9.1 Impact Assessment

This impact assessment takes into account the impacts of the construction and operation of the following infrastructure on Portion 4 of the farm Scuit-klip 92, near Pofadder in the Northern Cape:

- Molten salt tower up to 300m in height with surrounding heliostat field
- Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser
- On-site project substation, and short 132 kV power line to Eskom's existing Paulputs Transmission Substation

- Water supply abstraction point located at the Gariep River close to Onseepkans
- Filter and booster station at abstraction point
- Water supply pipeline along R357 Onseepkans Road to the site
- On-site lined ground water storage reservoir and various steel water tanks
- Lined evaporation ponds
- Packaged water treatment plant and associated chemical store
- Auxiliary wet cooled chiller plant
- Control room and office building
- Heliostat assembly building and workshop.

The infrastructure layout is shown in Figure 23.

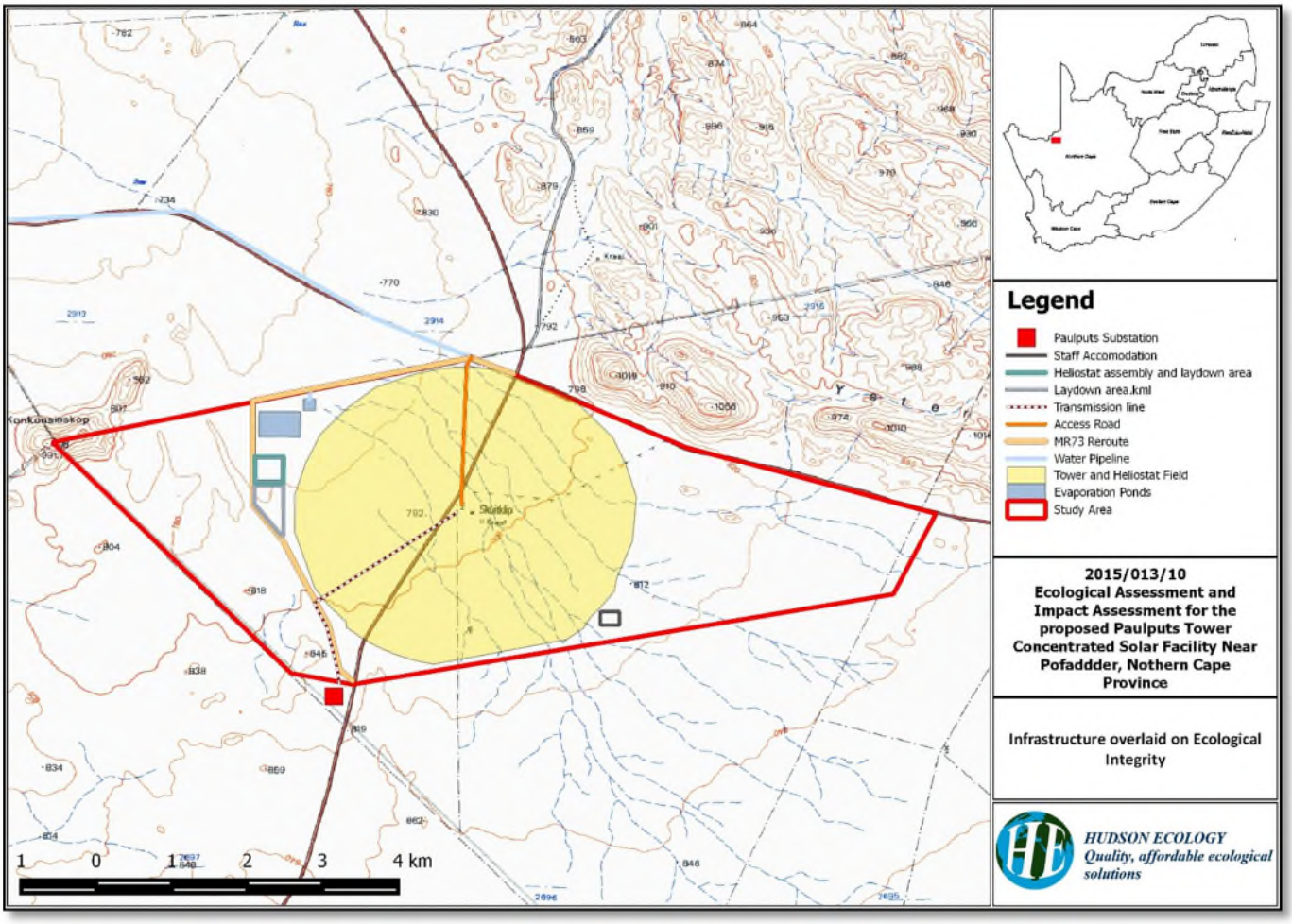

Figure 23: Proposed project infrastructure

This impact assessment was conducted with the understanding that:

- The pipeline alignment will follow the existing alignment as that associated with the other CSP facilities in the area, and that the majority of the impact would occur in this already impacted area;
- Vegetation regrowth will be allowed under the heliostats after construction is completed; and
- All possible mitigation methods advised will be adopted and implemented by the developer.

The ecological integrity and conservation importance mapping overlaid by the infrastructure are given in Figure 24 and Figure 25.

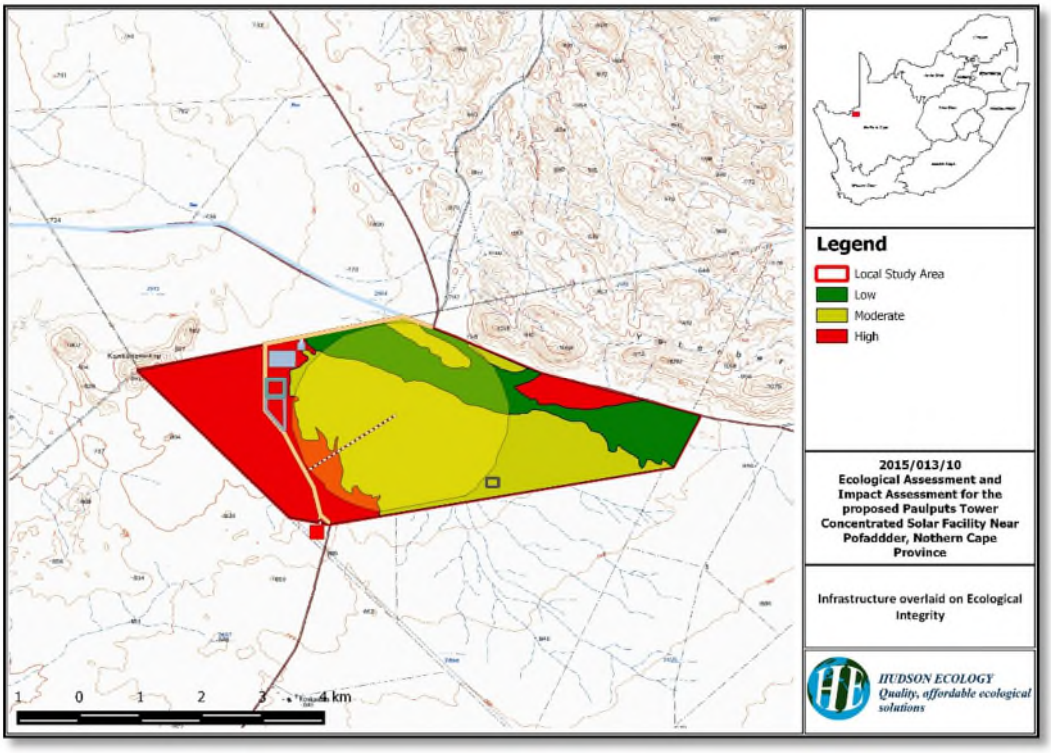

Figure 24: Ecological integrity with infrastructure overlain

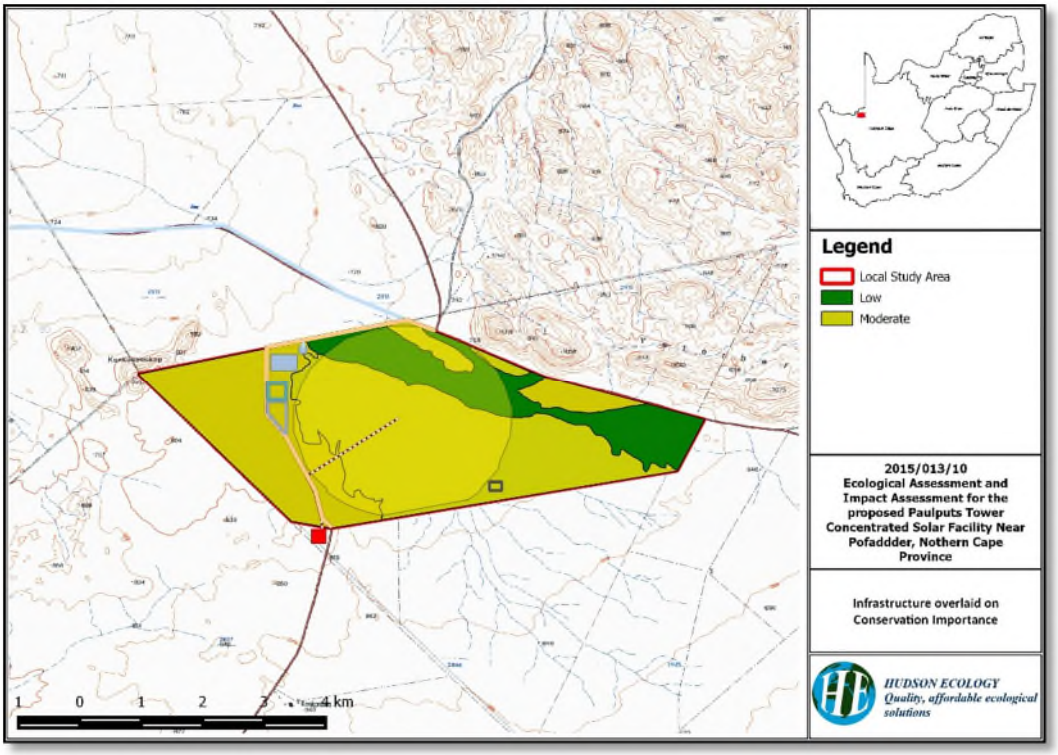

Figure 25: Conservation importance with infrastructure overlain

Impacts and mitigations are discussed in the tables below:

9.1.1 Construction Phase

Impact 1: Vegetation Clearing and loss of species of concern				
Vegetation clearing is likely to be the greatest impact on the vegetation communities affected by the proposed development and activities. All vegetation communities are likely to be affected by this impact, with the *Stipagrostis ciliata – Aristida congesta* open grassland vegetation community being the vegetation community with the most vegetation cleared. Habitats affected are mianly those with moderate ecological integrity and moderate conservation importance. High, moderate and low ecological integrity and -conservation importance of the areas that will be affected by this impact are low to moderate, however species of concern (such as *Hoodia gordonii, Boscia foetida* and *Aloe dichotoma*) may be impacted upon.				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	5	Permanent	4	>15 years
Magnitude (M)	6	Moderate	2	Minor
Probability (P)	5	Definite	4	Highly_Probable
Significance (S = [E+D+M]xP)	65	Moderate	28	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Moderate		High	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				
Vegetation clearing is inevitable and unavoidable. Mitigation of this impact can, however, be implemented by keeping the area cleared to a minimum and careful removal and replanting of plants and trees of conservation importance. Seed collection, propagation and re-planting of saplings to make up for lost species should also be considered. Areas of high conservation importance and/or ecological integrity should be avoided or kept to a minimum and any species of concern relocated, or demarcated to prevent destruction, before the ground clearing begins. Ground clearing should take place at the beginning of winter in order to minimise impacts on young of burrowing animals and nesting birds. The impact of vegetation clearing is likely to be a long term impact, but through careful planning and rehabilitation can be greatly reduced. Changing the rerouting of the M73 to the east of the infrastructure instead of though areas of greater biodiversity importance to the west of the infrastructure will reduce this impact. Topsoil should be kept for revegetation once construction is completed.				
Residual impacts:				
Localised loss of vegetation				

Impact 2: Spillage of harmful or toxic substances				
Harmful or toxic substances that may affect the biota of the area if they were to enter the system include: diesel, hypoid oil, motor oil, polluted water used during the operations and chemicals transported to and from site and used in the operations. Habitats affected are mainly those with moderate ecological integrity and moderate conservation importance. The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity. Impacts on high ecological integrity and -conservation importance areas are low to moderate, however species of concern (such as *Hoodia gordonii, Boscia foetida* and *Aloe dichotoma*) may be impacted upon.				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	4	>15 years	1	0 - 1 years
Magnitude (M)	8	High	4	Low
Probability (P)	4	Probable	1	Very Improbable

Significance (S = [E+D+M]xP)	56	Moderate	6	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		High	
Irreplaceable loss of resources	Yes		No	
Mitigability	Yes		Yes	

Mitigation measures:

Mitigation: The spillage of harmful or toxic substances can be mitigated by the implementation of best practice management measures for the storage and handling of all hazardous substances as well as through the implementation of a sound emergency spillage containment plan, which can be implemented as soon as a spill of harmful or toxic substances occurs. Changing the rerouting of the M73 to the east of the infrastructure instead of though areas of greater biodiversity importance to the west of the infrastructure will reduce this impact.

Residual impacts:

Localised loss of species

Impact 3: Disturbance of biodiversity due to vibration and noise

Vibration and noise will have a significant effect mainly on fauna species in the immediate vicinity of the development, due to the heavy machinery utilised. Vibration can affect a number of subterranean fauna taxa, such as burrowing mammals, reptiles and arthropods. Vibration affects these animals by causing the collapsing of burrows, and causing these animals to leave the area due to the vibration. Noise will also affect a wide range of taxa including avifauna, mammals, reptiles, amphibians and arthropods. Avifauna, especially songbirds, and amphibians may find it difficult to find mates in areas of increased noise. Mammals, reptiles and arthropods may find increased noise disturbing and therefore move away from the area. Areas of high conservation importance and/or ecological integrity should be avoided.

	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	2	2 - 5 years	2	2 - 5 years
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	4	Highly_Probable
Significance (S = [E+D+M]xP)	50	Moderate	28	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Mitigation measures:

Vibration and noise from heavy machinery can be kept to a minimum by reducing the movement of heavy vehicles to a minimum necessary for operations. Placing the vehicle yard as close to the construction area as possible will also reduce the scale of impact of vibration. Changing the rerouting of the M73 to the east of the infrastructure instead of though areas of greater biodiversity importance to the west of the infrastructure will reduce this impact.

Residual impacts:

Localised loss of species

Impacts 4: Habitat degradation and fauna impacts due to dust

Increased dust will occur in all areas where vegetation is cleared. Dust will be caused by excavation, and construction. Dust in the area will be greatly increased due to the dry weather conditions and the nature of the soil in the area. Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment.

	Without Mitigation		With Mitigation	
Extent (E)	2	Local	1	Site Only
Duration (D)	2	2 - 5 years	2	2 - 5 years
Magnitude (M)	6	Moderate	6	Moderate
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	50	Moderate	18	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				
Mitigation: The following methods can be used to prevent conditions conducive to dust generation and suppress dust should it occur: • Dust suppression on roads by water bowsers or the use of other appropriate dust suppressants, if no water is available; • Adjacent paved areas and roads used for construction traffic can be maintained free of tracked soil or fill materials. At minimum, paved traffic areas, can be cleaned on a daily basis by wet sweeping and/or washing. More frequent cleaning can be provided as necessary. Adjacent paved areas and roads can be left clean at the end of each day; • Exposed excavations, disturbed ground surfaces, and unpaved traffic areas can be maintained in a moist condition; • During non-working hours, the site can be left in a condition that will prevent dust from being generated. At the end of each work day, disturbed areas can be wetted down and security fencing can be installed and or inspected to prevent access and additional disturbance; • Provide temporary cover and daily maintenance for soil stockpiles and keep active surfaces moist; • A temporary decontamination pad and/or a stabilized construction entrance can be provided at active site entrance/egress locations to keep adjacent paved areas clean; and • Construction activities should be conducted using methods that minimize dust generation. The following Best Management Practices (BMPs) can also be followed to help minimize and control dust emissions at the Site to the greatest extent possible: • All onsite traffic can be restricted to specific designated roads. Off-road travel can only be authorized on a case-by-case basis (e.g. access to a remote monitoring well, etc.). Traffic speed can also be restricted to an appropriate level on all designated roads. All designated roads can be considered as high potential dust source areas, and as such, can be a priority for dust controls utilizing water and/or gravel. • This plan can be in effect during all hours of operation at the site. During non-business hours, there can be no activities generating dust; therefore, dust control actions can be restricted to hours of operation only. However, as a best management practice, if high winds are evident at the close of a business day (or immediately prior to a weekend, holiday, etc.), site personnel should evaluate vulnerable areas and implement controls, as appropriate, to minimize off-hours emissions.				
Residual impacts:				
None				

Impact 5: Effects on local migrations				
Local migrations of fauna in the area may be affected by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact. This impact is likely to be low due to the greatly reduced wildlife in the area due to previous disturbances in the area causing a greatly reduced species. Furthermore, many of the roads are already in use. The study area is recognised as an ESA due to being a migratory route, this requires further investigation.				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	65	High	20	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	

Mitigability	Yes	Yes
Mitigation measures:		
Impacts on local migrations can be mitigated by: • The construction area and subsequent functional facility can be isolated by means of a chain link fence in order to prevent animals on local migrations entering the area and being killed; • Evaporation ponds should be fenced to prevent access by animals and reduce the risk of animals drowning in the evaporation ponds; • The effect of roads on local migrations can be mitigated by the installation of culverts at regular intervals along the roads and the installation of drift fences towards the culverts, although these methods may not eliminate the mortalities among migrating animals, they should greatly reduce the number of animals killed on roads; and • A low speed limit can be strictly enforced in order to reduce collisions with animals on the roads.		
Residual impacts:		
None		

Impact 6: Increased prevalence of exotic invasive species				
The fact that the area will be cleared for construction creates niches that can be colonised by exotic and/or invasive species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to be monitored and mitigated. Areas of high conservation importance and/or ecological integrity should be avoided.				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	65	High	20	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				
Mitigation: An exotic/invasive species monitoring and management plan should be put in place to manage exotic and invasive species.				
Residual impacts:				
None				

Impact 7: Increased soil erosion				
Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	5	Permanent	5	Permanent

Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	65	High	20	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Mitigation measures:

This impact can be mitigated by:
• An erosion monitoring and mitigation plan being put in place to help with the early detection of erosion and advising management on problem areas and remedation plans; and
• The implementation of a stormwater management plan and the management of stormwater to prevent large volumes of high energy water flowing over or off site.

Residual impacts:

None

Impact 8: Impact of attracting insects and subsequently bats to the tower due to artificial light at night

Light shining against the tower (especially if it is painted white) will attract large numbers of insects at night especially during the wet season. This increase in insect activity may subsequently attract bats to the operational area. Bats are unlikely to be impacted upon through collisions with the heliostats and, because they will usually be at the plant at night, they are unlikely to be affected by solar flux. There is, however, the chance that they may use the tower as a roosting site and be flushed during the day when activity starts and then be injured.

	Without Mitigation		**With Mitigation**	
Extent (E)	3	Regional	2	Local
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	70	High	22	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Mitigation measures:

This impact can be mitigated by:

- Not illuminating the tower at night and thereby reducing the number of insects attacted; and
- Painting the tower a darker colour (not white) so that any light shining on the tower is not so effectively reflected;
- Closing up any openings and/or crevases that bats may use to roost in or gain entry to the tower;
- Placement of bat boxes around the tower and rest of the plant to provide a more suitable and safer roosting area for bats that may choose to inhabit the area; and
- Regular monitoring of the power facility for any signs of bat roosting or activity.

Residual impacts:

None

9.1.2 Operational Phase

Impact 1: Spillage of harmful or toxic substances				
Harmful or toxic substances that may affect the biota of the area if they were to enter the system include: diesel, hypoid oil, motor oil, polluted water used during the operations and chemicals transported to and from site and used in the operations. Habitats affected are mainly those with moderate ecological integrity and moderate conservation importance. The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity. Impacts on high ecological integrity and -conservation importance areas are low to moderate, however species of concern (such as *Hoodia gordonii, Boscia foetida* and *Aloe dichotoma*) may be impacted upon.				
	Without Mitigation		**With Mitigation**	
Extent (E)	1	Site Only	1	Site Only
Duration (D)	4	>15 years	1	0 - 1 years
Magnitude (M)	6	Moderate	4	Low
Probability (P)	4	Improbable	1	Very Improbable
Significance (S = [E+D+M]xP)	44	Moderate	6	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		High	
Irreplaceable loss of resources	Yes		No	
Mitigability	Yes		Yes	
Mitigation measures:				
Mitigation: The spillage of harmful or toxic substances can be mitigated by the implementation of best practice management measures for the storage and handling of all hazardous substances as well as through the implementation of a sound emergency spillage containment plan, which can be implemented as soon as a spill of harmful or toxic substances occurs.				
Residual impacts:				
Localised loss of species				

Impact 2: Disturbance of biodiversity due to vibration and noise				
Vibration and noise will have a significant effect mainly on fauna species in the immediate vicinity of the development, due to the heavy machinery utilised. Vibration can affect a number of subterranean fauna taxa, such as burrowing mammals, reptiles and arthropods. Vibration affects these animals by causing the collapsing of burrows, and causing these animals to leave the area due to the vibration. Noise will also affect a wide range of taxa including avifauna, mammals, reptiles, amphibians and arthropods. Avifauna, especially songbirds, and amphibians may find it difficult to find mates in areas of increased noise. Mammals, reptiles and arthropods may find increased noise disturbing and therefore move away from the area. Areas of high conservation importance and/or ecological integrity should be avoided.				
	Without Mitigation		**With Mitigation**	
Extent (E)	1	Site Only	1	Site Only
Duration (D)	2	2 - 5 years	2	2 - 5 years
Magnitude (M)	4	Low	4	Low
Probability (P)	5	Definite	4	Highly_Probable
Significance (S = [E+D+M]xP)	35	Moderate	28	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				

Vibration and noise from heavy machinery can be kept to a minimum by reducing the movement of heavy vehicles to a minimum necessary for operations. Changing the rerouting of the M73 to the east of the infrastructure instead of though areas of greater biodiversity importance to the west of the infrastructure will reduce this impact.
Residual impacts:
Localised loss of species

Impacts 3: Habitat degradation and fauna impacts due to dust				
Increased dust will occur in all areas where vegetation is cleared. Dust in the area will be greatly increased due to the dry weather conditions and the nature of the soil in the area. Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment.				
	Without Mitigation		**With Mitigation**	
Extent (E)	1	Local	1	Site Only
Duration (D)	2	2 - 5 years	2	2 - 5 years
Magnitude (M)	4	Moderate	6	Moderate
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	35	Moderate	18	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				
Mitigation: The following methods can be used to prevent conditions conducive to dust generation and suppress dust should it occur: • Dust suppression on roads by water bowsers or the use of other appropriate dust suppressants, if no water is available; • Disturbed ground surfaces, and unpaved traffic areas can be maintained in a moist condition; • During non-working hours, the site can be left in a condition that will prevent dust from being generated. At the end of each work day, disturbed areas can be wetted down and security fencing can be installed and or inspected to prevent access and additional disturbance; and • Provide temporary cover and daily maintenance for soil stockpiles and keep active surfaces moist. The following Best Management Practices (BMPs) can also be followed to help minimize and control dust emissions at the Site to the greatest extent possible: • All onsite traffic can be restricted to specific designated roads. Off-road travel can only be authorized on a case-by-case basis (e.g. access to a remote monitoring well, etc.). Traffic speed can also be restricted to an appropriate level on all designated roads. All designated roads can be considered as high potential dust source areas, and as such, can be a priority for dust controls utilizing water and/or gravel. • This plan can be in effect during all hours of operation at the site. During non-business hours, there can be no activities generating dust; therefore, dust control actions can be restricted to hours of operation only. However, as a best management practice, if high winds are evident at the close of a business day (or immediately prior to a weekend, holiday, etc.), site personnel should evaluate vulnerable areas and implement controls, as appropriate, to minimize off-hours emissions.				
Residual impacts:				
None				

Impact 5: Effects on local migrations				
Local migrations of fauna in the area may be affected by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact. This impact is likely to be low due to the greatly reduced wildlife in the area due to previous disturbances in the area causing a greatly reduced species. Furthermore, many of the roads are already in use. The study area is recognised as an ESA due to being a migratory route, this requires further investigation.				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only

Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	65	High	20	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				
Impacts on local migrations can be mitigated by: • The facility can be isolated by means of a chain link fence in order to prevent animals on local migrations entering the area and being killed; • Evaporation ponds should be fenced to prevent access by animals and reduce the risk of animals drowning in the evaporation ponds; • The effect of roads on local migrations can be mitigated by the installation of culverts at regular intervals along the roads and the installation of drift fences towards the culverts, although these methods may not eliminate the mortalities among migrating animals, they should greatly reduce the number of animals killed on roads; and • A low speed limit can be strictly enforced in order to reduce collisions with animals on the roads.				
Residual impacts:				
None				

Impact 6: Increased prevalence of exotic invasive species				
Any cleared area creates niches that can be colonised by exotic and/or invasive species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to be monitored and mitigated. Areas of high conservation importance and/or ecological integrity should be avoided.				
	Without Mitigation		**With Mitigation**	
Extent (E)	2	Local	1	Site Only
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	65	High	20	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Mitigation measures:				
Mitigation: An exotic/invasive species monitoring and management plan should be put in place to manage exotic and invasive species.				
Residual impacts:				
None				

Impact 7: Increased soil erosion

Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in the form of thundershowers in summer.

	Without Mitigation		With Mitigation	
Extent (E)	2	Local	1	Site Only
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	65	High	20	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Mitigation measures:

This impact can be mitigated by:
• An erosion monitoring and mitigation plan being put in place to help with the early detection of erosion and advising management on problem areas and remedation plans; and
• The implementation of a stormwater management plan and the management of stormwater to prevent large volumes of high energy water flowing over or off site.

Residual impacts:

None

Impact 8: Impact of attracting insects and subsequently bats to the tower due to artificial light at night

Light shining against the tower (especially if it is painted white) will attract large numbers of insects at night especially during the wet season. This increase in insect activity may subsequently attract bats to the operational area. Bats are unlikely to be impacted upon through collisions with the heliostats and, because they will usually be at the plant at night, they are unlikely to be affected by solar flux. There is, however, the chance that they may use the tower as a roosting site and be flushed during the day when activity starts and then be injured.

	Without Mitigation		With Mitigation	
Extent (E)	3	Regional	2	Local
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	6	Moderate	4	Low
Probability (P)	5	Definite	2	Improbable
Significance (S = [E+D+M]xP)	70	High	22	Low
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Mitigation measures:

This impact can be mitigated by: • Not illuminating the tower at night and thereby reducing the number of insects attacted; and • Painting the tower a darker colour (not white) so that any light shining on the tower is not so effectively reflected; • Closing up any openings and/or crevases that bats may use to roost in or gain entry to the tower; • Placement of bat boxes around the tower and rest of the plant to provide a more suitable and safer roosting area for bats that may choose to inhabit the area; and • Regular monitoring of the power facility for any signs of bat roosting or activity.
Residual impacts:
None

9.2 Cumulative impacts

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts are likely to be of a higher order of magnitude than the significance ratings given in the impact assessment section. It must however be noted that none of the other solar facilities are tower facilities and therefore impacts unique to tower facilities are unlikely to have a higher cumulative impact. We cannot comment on the impacts, mitigation plans and their effectiveness, of other projects, therefore we cannot determine what the mitigated impacts would be and thus the cumulative impacts given here are based on all other projects' unmitigated impacts cumulated with this project's mitigated impacts.

Cumulative impacts are given in the impact assessment tables below:

Impact 1: Vegetation Clearing

Vegetation clearing is likely to be the greatest impact on the vegetation communities affected by the proposed development and activities. All vegetation communities are likely to be affected by this impact, with the *Stipagrostis ciliata – Aristida congesta* open grassland vegetation community being the vegetation community with the most vegetation cleared. Habitats affected area mianly those with moderate ecological integrity and moderate conservation importance.
High, moderate and low ecological integrity and -conservation importance of the areas that will be impacted by this impact are low to moderate, however species of concern (such as Hoodia gordonii, Boscia foetida and Aloe dichotoma) may be impacted upon.

	Overall impact of the proposed project considered in isolation (with mitigation)		**Cumulative Impact of the project and other projects in the area**	
Extent (E)	2	Local	3	Regional
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	4	Low	6	Moderate
Probability (P)	2	Improbable	3	Probable
Significance (S = [E+D+M]xP)	22	Low	42	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Confidence in findings: High

Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Impact 2: Spillage of harmful or toxic substances

Harmful or toxic substances that may affect the biota of the area if they were to enter the system include: diesel, hypoid oil, motor oil, polluted water used during the operations and chemicals transported to and from site and used in the operations. Habitats affected area mianly those with moderate ecological integrity and moderate conservation importance. The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity.
High, moderate and low ecological integrity and -conservation importance areas may be impacted by this impact are low to moderate, however species of concern (such as Hoodia gordonii, Boscia foetida and Aloe dichotoma) may be impacted upon.

	Overall impact of the proposed project considered in isolation (with mitigation)		**Cumulative Impact of the project and other projects in the area**	
Extent (E)	1	Site Only	3	Regional
Duration (D)	1	0 - 1 years	4	>15 years
Magnitude (M)	4	Low	6	Moderate
Probability (P)	1	Very Improbable	4	Highly_Probable
Significance (S = [E+D+M]xP)	6	Low	52	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Low		Moderate	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Confidence in findings: High

Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Impact 3: Disturbance of biodiversity due to vibration and noise

Vibration and noise will have a significant effect mainly on fauna species in the immediate vicinity of the development, due to the heavy machinery utilised. Vibration can affect a number of subterranean fauna taxa, such as burrowing mammals, reptiles and arthropods. Vibration affects these animals by causing the collapsing of burrows, and causing these animals to leave the area due to the vibration. Noise will also affect a wide range of taxa including avifauna, mammals, reptiles, amphibians and arthropods. Avifauna, especially songbirds, and amphibians may find it difficult to find mates in areas of increased noise, mammals, reptiles and arthropods may find increased noise disturbing and therefore move away from the area. Areas of high conservation importance and/or ecological integrity should be avoided.

	Overall impact of the proposed project considered in isolation (with mitigation)		**Cumulative Impact of the project and other projects in the area**	
Extent (E)	1	Site Only	3	Regional
Duration (D)	2	2 - 5 years	3	5 - 15 years
Magnitude (M)	4	Low	6	Moderate
Probability (P)	4	Highly_Probable	4	Highly_Probable
Significance (S = [E+D+M]xP)	28	Low	48	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Moderate		Low	

Irreplaceable loss of resources	Yes	Yes
Mitigability	Yes	Yes

Confidence in findings: High

Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Impacts 4: Habitat degradation due to dust

Increased dust will occur in all areas where vegetation is cleared. Dust in the area will be greatly increased due to the dry weather conditions and the nature of the soil in the area. Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment.

	Overall impact of the proposed project considered in isolation (with mitigation)		**Cumulative Impact of the project and other projects in the area**	
Extent (E)	1	Site Only	3	Regional
Duration (D)	2	2 - 5 years	3	5 - 15 years
Magnitude (M)	6	Moderate	6	Moderate
Probability (P)	2	Improbable	3	Probable
Significance (S = [E+D+M]xP)	18	Low	36	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Moderate		Low	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	

Confidence in findings: High

Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Impact 5: Effects on local migrations

Local migrations of fauna in the area may be affected by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact. This impact is likely to be low due to the greatly reduced wildlife in the area due to previous disturbances in the area causing a greatly reduced species. Furthermore, many of the roads are already in use. The study area is recognised as an ESA due to being a migratory route, this requires further investigation.

	Overall impact of the proposed project considered in isolation (with mitigation)	**Cumulative Impact of the project and other projects in the area**

Extent (E)	1	Site Only	3	Regional
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	4	Low	6	Moderate
Probability (P)	2	Improbable	3	Probable
Significance (S = [E+D+M]xP)	20	Low	42	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Moderate		Low	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Confidence in findings: High				
Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region				

Impact 6: Increased prevalence of exotic invasive species				
The fact that the area will be cleared for construction creats niches that can be colonised by exotic and/or invasive species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to monitored and mitigated. Areas of high conservation importance and/or ecological integrity should be avoided.				
	Overall impact of the proposed project considered in isolation (with mitigation)		**Cumulative Impact of the project and other projects in the area**	
Extent (E)	1	Site Only	3	Regional
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	4	Low	8	High
Probability (P)	2	Improbable	4	Highly_Probable
Significance (S = [E+D+M]xP)	20	Low	64	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Moderate		Low	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Confidence in findings: High				
Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region				

Impact 7: Increased erosion				
Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion. Increased erosion can eventually lead to the loss of vegetation and habitats for further species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion.				
	Overall impact of the proposed project considered in isolation (with mitigation)		**Cumulative Impact of the project and other projects in the area**	
Extent (E)	1	Site Only	3	Regional
Duration (D)	5	Permanent	5	Permanent
Magnitude (M)	4	Low	6	Moderate
Probability (P)	2	Improbable	4	Highly_Probable
Significance (S = [E+D+M]xP)	20	Low	56	Moderate
Status (Positive, negative or neutral)	Negative		Negative	
Reversibility	Moderate		Low	
Irreplaceable loss of resources	Yes		Yes	
Mitigability	Yes		Yes	
Confidence in findings: High				
Mitigation: Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region				

10 DISCUSSION AND CONCLUSIONS

Based on species composition, physiognomy, moisture regime, rockiness, slope and soil properties, three main communities were recognised. The vegetation communities are described in this report and named according to dominant species and underlying substrate. The vegetation communities are named as follows:

- *Acacia mellifera – Aristida congesta* dune open shrubland;
- *Acacia mellifera – Parkinsonia africana* wash open shrubland; and
- *Stipagrostis ciliata – Aristida congesta* open grassland.

A list of plant species previously recorded in the quarter degree grid in which the study area is situated was obtained from the South African National Biodiversity Institute. Additional species that could occur in similar habitats, as determined from official database searches and reviewed literature, but not recorded in these grids are also listed. A total of 13 species of concern were determined to possibly be occurring in the study area. The species, listed as possibly occurring in the study area, were evaluated to determine the probability of occurrence in the study area based on habitat suitability. Of the species that are considered to occur within the area under investigation, there were five species that could occur in habitats that are available in the study area. According to IUCN two of these are listed as Vulnerable, one as Near Threatened and two as Declining. One of the vulnerable species, *Aloe dichotoma*, was recorded in the study area and could occur anywhere within the hills in the study area, or in rocky areas in Bushmanland Arid Grassland.

The one Declining species, *Acacia erioloba*, also a protected tree, has a high probability of occurring in the study area, while *Hoodia gordonii* was recorded in the study area in a number of places.

Reptile diversity in the region is high with approximately 45 reptile species occurring in the area. Ten species were confirmed during the site surveys. No exotic herpetofauna species are expected to occur on the study site. Two of the species recorded, namely *Naja nivea* and *Cordylus polyzous,* are considered endemic to southern Africa.

Herpetofauna diversity is generally low in the study area as can be expected in arid areas but what can be noted is that Evenness is high, indicating that there is a high similarity between the species occurring in the different vegetation communities. Most of the expected species in the area are common and widespread, with only the Black-necked spitting Cobra (*Naja nigricollis*) being classified as rare.

The study area is a fair distance from any permanent open water bodies (approximately 30km) and therefore, as expected amphibian diversity is low. Only seven species are expected to occur in the study area, and during the wet and dry season surveys no amphibian species were recorded.

Of the 67 mammal species expected to occur in the study area, according to historic recordings, only 16 were confirmed during both the site visits. Mammal diversity is low as can be expected in arid areas. Evenness is high, indicating that there is a high similarity between the species occurring in the different vegetation communities. A number of bat species are known to occur in the region. Bat species recorded in the area during the surveys are *Rhinolophus darlingi, Neoromicia capensis, Pipistrellus rueppelli* and *Tadarida aegyptiaca* of these species only *Tadarida aegyptiaca* is likely to be attracted to the infrastructure for roosting purposes.

Of the 21 faunal species of concern that may occur in the study area, 1 has no probability of occurrence, 5 have a low probability of occurrence, 9 have a medium probability of occurrence and 6 have a high probability of occurrence. Three of the species with a high probability of occurrence, the Black-necked spitting Cobra, Maccoa Duck and Lanner Falcon, were recorded during the study.

The ecological function of the study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas) to high in the more inaccessible or unutilisable areas. Areas in which overgrazing and clearing have taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced.

Areas that have been severely disturbed such as where settlements occur are considered of low conservation importance. These areas are, however, quite small in relation to the overall study area (<30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural areas are considered of very high conservation importance due to the presence of Red Data species in these areas and the intrinsic importance of these areas. In keeping with the Precautionary Principle, a higher conservation importance is assumed when in doubt.

According to the Khai-Ma Land Use Decision Support tool, the study area falls within an Ecological Support Area (ESA). The ESA is listed as a migration route, although the species utilising this migration route are not indicated. The migration route does seem to be counter-intuitive as it seems to start in the lowlands of the Gariep River, crosses over rocky mountainous areas only to return to the lowlands of the Gariep River lowlands again. Notwithstanding this the development will affect less than 30% of the width of the migration route and should have very little effect on species using this route.

Notwithstanding this, the ESAs are defined as "*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 in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration.*" And it is stated that "*The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas*" It is also stated that "*some*" level of change in the biodiversity indicators for ESAs is allowed.

It must also be noted that the migration route indicated is part of a large system of migration routes and that the percentage of these migration routes that will be impacted will be negligible.

This impact assessment takes into account the impacts of the construction and operation of the following infrastructure on Portion 4 of the farm Scuit-klip 92, near Pofadder in the Northern Cape:

- Molten salt tower up to 300m in height with surrounding heliostat field;
- Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser;

- On-site project substation, and short 132 kV power line to Eskom's existing Paulputs Transmission Substation;
- Water supply abstraction point located at the Gariep River close to Onseepkans;
- Filter and booster station at abstraction point;
- Water supply pipeline along R357 Onseepkans Road to the site;
- On-site lined ground water storage reservoir and various steel water tanks;
- Lined evaporation ponds;
- Packaged water treatment plant and associated chemical store;
- Auxiliary wet cooled chiller plant;
- Control room and office building; and
- Heliostat assembly building and workshop.

This impact assessment was conducted with the understanding that:

- The pipeline alignment will follow the existing alignment of that associated with the two CSP facilities located adjacent to the proposed site, and that the majority of the impact would occur in this already impacted area;
- Vegetation regrowth will be allowed under the heliostats after construction is completed; and
- All possible mitigation methods advised will be adopted and implemented by the developer.

The impact assessment determined that 8 main impacts are likely to occur due to the development, namely:

- Vegetation Clearing and subsequent loss of species of concern;
- Spillage of harmful or toxic substances;
- Disturbance of biodiversity due to vibration and noise;
- Habitat degradation and fauna impacts due to dust;
- Effects on local migrations;
- Increased prevalence of exotic invasive species;
- Increased erosion; and
- Impact of attracting insects and subsequently bats to the tower due to artificial light at night.

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts of the impacts general to solar facilities are likely to be of a higher order of magnitude than the significance ratings given here. It must however be noted that none of the other solar facilities are tower facilities and impacts unique to tower facilities are therefore unlikely to have a higher cumulative impact.

Areas to the north and west are too undulating to position this form of development, the area to the south consists the Mattheus-Gat Conservation Area Important Bird Area (IBA) of approximately 67 970ha, and to the east the area is also too undulating and traversed by a number of seasonal river systems that drain into the Orange River. Provided the developer adheres to the recommendations provided in the environmental management plan impacts can be mitigated to an acceptable level and this area can be considered one of the few areas in the region that can constitute "acceptable and defendable loss" associated with this kind of development. For this reason we propose this area to be the most suitable site in the immediate region (30km radius) in which to locate this form of solar power production plant.

In conclusion, with implementable mitigation measures and a functional monitoring – management – implementation – monitoring feedback loop in order to monitor and mitigate impacts, all probable ecological impacts can be managed to a low impact rating. Based on this and the fact that South Africa is experiencing a significant energy crisis, the risks and losses associated with this development can be seen as acceptable and defendable. If we were to take this a step further and compare the ecological impact footprint of this development with the probable impact footprint of a coal-burning power station that will produce the same energy the risk and loss associated with this development will be significantly lower from an ecological point of view. Based on all these factors, and with the proviso that we assume that all information available is correct and up to date, no changes will be made to the proposed project, no unforeseeable impact synergies arise and all mitigations proposed will be

implemented and adhered to, we are of the opinion that this project could be implemented without causing significant unsustainable damage to the natural environment of the region.

11 ENVIRONMENTAL MANAGEMENT PLAN INPUTS

The following Objectives are required to be included in the draft EMP for the project:

11.1 Construction Phase

OBJECTIVE 1: Identification and relocation of plant and tree species prior to ground clearing. Marking of protected tree species to be conserved *in situ.*

Project component/s	Ground clearing for tower, power block, heliostat field, evaporation ponds, road realignment, critical staff quarters, heliostat area and laydown area.
Potential Impact	The impact would include the local extinction of a number of individuals (>50) of the protected species *Hoodia gordonii, Boscia foetida, Aloe dichotoma* and, possibly, *Acacia erioloba*
Activity/risk source	Ommiting individuals of protected species while marking trees and plants for removal or *in situ* conservation. Ground clearing beginning before the objective is complete. Unqualified personnel utilised for the activity
Mitigation: Target/Objective	Non-destruction of at least 90% of protected species occurring in the area identified for ground clearing.

Mitigation: Action/control	Responsibility	Timeframe
• Identification of flora species of concern. • Marking of species to be relocated and conserved *in situ*. • Identification of suitable relocation sites for each species. • Removal and relocation of species of concern to be relocated. • Marking of species to be conserved *in situ*. • Monitoring during ground clearing to assess conservation of species and relocation of any individuals that may have been overlooked • Ground clearing should be kept to a minimum • Topsoil should be collected during groundclearing and kept for revegetation purposes.	Abengoa Environmental Manager Appointed ecologist or horticulturist	Identification marking and relocation to be completed before ground clearing starts. Monitoring to occur continuously until ground clearing is completed.

Performance Indicator	Number of species and individuals identified Number of individuals successfully relocated Number of species successfully maintained in situ after ground clearing is completed. Number of species collected during ground clearing minimal. 90% or more species of concern protected insitu and/or by relocation.
Monitoring	Report including the locations of all species of concern to be completed before ground clearing starts Number of species relocated to be recorded on a daily basis during relocation and cross checked with initial report Number of species marked for in situ conservation to be recorded daily Number of trees to be conserved in situ to be checked cross checked against the trees marked for in situ conservation after ground clearing is completed Final relocation report to be compiled and submitted to the relevant authorities

OBJECTIVE 2: Compile an effective and efficient spillage containment plan in order to prevent spillage, leakage or release of harmful or toxic substances during transport or at areas where they are stored or used such as filling stations and the power production facility and also to clean up any spills before they can be taken up by any possible natural receptors.

Project component/s	Any component that involves the use, transport or storage of hazardous materials. This includes materials used in construction and transport vehicles such as oil, fuel hypoid oil, hydraulic fluid etc
Potential Impact	The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity
Activity/risk source	Failure to effectively implement a hazardous substance containment plan
Mitigation: Target/Objective	No hazardous substances must enter the potential receiving ecological systems.

Mitigation: Action/control	Responsibility	Timeframe
• Excessive soil contamination by fuel or oil spills, for example, from construction vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ using bioremediation, in accordance with Abengoa's existing procedures and legal requirements.	Abengoa Environmental Manager Plant manager Contractors	The hazardous substances management plan should be in place before any construction begins and the management plan should be continuous throughout the life of the project.

• Vehicles will be maintained regularly and kept in a good working order. • No oils or fuels from vehicles, machinery or generators should be allowed to enter ecosystems, in the case of accidental spills, immediate clean-up action must be initiated to prevent further spread. • Standard operating procedures for the transport of potentially dangerous substances need to be put in place and followed.		

Performance Indicator	No hazardous chemicals are to be allowed to enter the receiving ecosystems.
Monitoring	All spills must be recorded Remedial actions taken and results of the remedial actions need to be recorded All recorded incidents need to be included in an incident register to be included in a monthly report

OBJECTIVE 3: Compile a vibration and noise management plan in order to minimise the disturbance of biodiversity due to vibration and noise.

Project component/s	Any component that involves the use and transport of heavy vehicles and construction vehicles
Potential Impact	Vibration and noise will have a significant effect mainly on fauna species in the immediate vicinity of the development, due to the heavy machinery utilised. Vibration can affect a number of subterranean fauna taxa, such as burrowing mammals, reptiles and arthropods. Vibration affects these animals by causing the collapsing of burrows, and causing these animals to leave the area due to the vibration. Noise will also affect a wide range of taxa including avifauna, mammals, reptiles, amphibians and arthropods. Avifauna, especially songbirds, and amphibians may find it difficult to find mates in areas of increased noise, mammals, reptiles and arthropods may find increased noise disturbing and therefore move away from the area.
Activity/risk source	Failure to effectively implement a noise and vibration management plan
Mitigation: Target/Objective	Vibration and noise from heavy machinery can be kept to a minimum, especially during periods when indigenous species area active.

Mitigation: Action/control	**Responsibility**	**Timeframe**

• Vibration and noise from heavy machinery can be kept to a minimum by reducing the movement of heavy vehicles to a minimum necessary for operations. • Placing the vehicle yard as close to the construction area as possible will also reduce the spatial scale of impact of vibration. • Changing the rerouting of the M73 to the east of the infrastructure instead of through areas of greater biodiversity importance to the west of the infrastructure will reduce this impact.	Abengoa Environmental Manager Plant manager Contractors	The vibration and noise reduction measures should be in place before any construction begins and the management plan should be continuous throughout the life of the project.

Performance Indicator	Vibration and noise should be kept to a minimum and limited to diurnal periods and also minimised in higher biodiversity areas.
Monitoring	Measures and success of measures implemented in order to reduce vibrations and noise need to be reported on monthly. Any incidents of contravention of the measures resulting in excessive noise, noise during the wrong time of the day or noise in the wrong areas need to be recorded and reported on monthly.

OBJECTIVE 4: Habitat degradation due to dust

Project component/s	Any component that involves the use and transport of heavy vehicles on dirt roads, ground clearing, excavation and construction
Potential Impact	Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment. Furthermore excessive dust can affect the respiratory systems of fauna species and affect visibility of predatory species thus affecting their hunting abilities and also that of prey species thus affecting their ability to evade predators.
Activity/risk source	Failure to effectively implement an effective dust suppression plan Availability of water Availability of bowsers Breakdown of bowsers

Mitigation: Target/Objective	Dust from cleared areas, dirt roads, construction areas and excavation areas should be kept to a minimum.

Mitigation: Action/control	Responsibility	Timeframe
The following methods can be used to prevent conditions conducive to dust generation and suppress dust should it occur: • Dust suppression on roads by water bowsers or other forms of dust suppressants; • Adjacent paved areas and roads used for construction traffic can be maintained free of tracked soil or fill materials. At minimum, paved traffic areas, can be cleaned on a daily basis by wet sweeping and/or washing. More frequent cleaning can be provided as necessary. Adjacent paved areas and roads can be left clean at the end of each day; • Exposed excavations, disturbed ground surfaces, and unpaved traffic areas can be maintained in a moist condition; • During non-working hours, the site can be left in a condition that will prevent dust from being generated. At the end of each work day, disturbed areas can be wetted down and security fencing can be installed and or inspected to prevent access and additional disturbance; • Provide temporary cover and daily maintenance for soil stockpiles and keep active surfaces moist; and • A temporary decontamination pad and/or a stabilized construction entrance can be provided at active site entrance/egress locations to keep adjacent paved areas clean. Construction activities should be conducted using methods that minimize dust generation. The following Best Management Practices (BMPs) can also be followed to help minimize and control dust emissions at the site to the greatest extent possible: • All onsite traffic can be restricted to specific designated roads. Off-road	Abengoa Environmental Manager Plant manager Contractors	The dust suppression measures should be in place before any construction begins and the management plan should be continuous throughout the life of the project.

travel can only be authorized on a case-by-case basis. Traffic speed can also be restricted to an appropriate level on all designated roads. All designated roads can be considered as high potential dust source areas, and as such, can be a priority for dust controls utilizing water and/or gravel; and • This plan can be in effect during all hours of operation at the site. During non-working hours, there can be no activities generating dust. Therefore, dust control actions can be restricted to hours of operation only. However, as a best management practice, if high winds are evident at the close of a business day (or immediately prior to a weekend, holiday, etc.), site personnel should evaluate vulnerable areas and implement controls, as appropriate, to minimize off-hours emissions.		

Performance Indicator	Dust generation should be kept to a minimum and limited to diurnal periods. An acceptable level of dust is 50 µg/m3 as recorded by standard air quality methods.
Monitoring	Measures and success of measures implemented in order to dust generation need to be reported on monthly. Any incidents of contravention of the measures resulting in excessive dust need to be recorded and reported on monthly.

OBJECTIVE 5: Minimise effects on local migrations

Project component/s	Any linear infrastructure, roads, fencing and buildings may negatively affect fauna species ability to conduct local migrations after food water or shelter
Potential Impact	Local migrations of fauna in the area may be affected by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact.

Activity/risk source	Failure to effectively implement a plan to reduce the impacts of these structures
Mitigation: Target/Objective	Minimum impact of migrating fauna. No fatalities caused by linear infrastructure roads and other infrastructure and fencing.

Mitigation: Action/control	Responsibility	Timeframe
The following methods can be used to prevent impacts on local migrations: • The construction area can be isolated by means of a chain link fence in order to prevent animals on local migrations entering the area and being killed; • The effect of roads on local migrations can be mitigated by the installation of culverts at regular intervals along the roads and the installation of drift fences towards the culverts , although these methods may not eliminate the mortalities among migrating animals, they should greatly reduce the number of animals killed on roads; and • A low speed limit can be strictly enforced in order to reduce collisions with animals on the roads.	Abengoa Environmental Manager Plant manager Contractors	The migration assistance measures should be in place during construction and the management plan should be continuous throughout the life of the project.

Performance Indicator	Effects on local migrations and migrating animal mortalities needs kept to a minimum. Preferably zero incidents.
Monitoring	Any incidents involving the impediment of local migration or animal mortalities on roads or against fences need to be recorded and reported on monthly.

OBJECTIVE 6: Manage prevalence of exotic invasive species

Project component/s	Vegetation clearing of any kind, transport of – and by heavy vehicles

Potential Impact	The fact that the area will be cleared for construction creates niches that can be colonised by exotic and/or invasive species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to monitored and mitigated.
Activity/risk source	Failure to effectively implement a plan to reduce the increase in prevalence of exotic species
Mitigation: Target/Objective	Keep exotic species on site to a minimum, preferably zero.

Mitigation: Action/control	**Responsibility**	**Timeframe**
The following methods can be used to reduce the prevalence of exotic and invasive species: • Monitoring of exotic and invasive species should be conducted biannually; • A plan must be developed and implemented in order to eradicate exotic and invasive species within the property; and • A monitoring plan should be put in place to monitor exotic and invasive species in order to report on progress and advise management of measure that need to be implemented.	Abengoa Environmental Manager Plant manager Appointed consultant	The exotic and invasive species control plan should be in place before construction and the management plan should be continuous throughout the life of the project.

Performance Indicator	All exotic species within the site eradicated or, at a minimum controlled and no increase measured.
Monitoring	A monitoring plan should be put in place to monitor exotic and invasive species in order to report on progress and advise management of measure that need to be implemented, this monitoring should be conducted bi-annually.

OBJECTIVE 7: Manage erosion

Project component/s	Vegetation clearing of any kind unpaved roads any surface water runoff

Potential Impact	Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion. Increased erosion can eventually lead to the loss of vegetation and habitats for further species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion.
Activity/risk source	Failure to effectively implement a plan to reduce erosion
Mitigation: Target/Objective	Keep erosion and soil loss on site to a minimum, preferably zero.

Mitigation: Action/control	Responsibility	Timeframe
Develop an erosion control map including: • Drainage patterns or approximate slopes after major grading activities. • Indicate the direction of flow for all runoff from the site. • Areas where soil disturbance will occur (shade or use border) including parking on or storing items on grass as disturbance. • Show the location of all structural controls, either planned or in place, on the map. This includes concrete washout areas, fueling areas, soil stockpiles, stabilized construction entrances, etc • Locations where stabilization practices are expected to occur. • Locations of off-site material, waste, borrow, fill, or equipment storage areas. If the staging yard is not on the site, a separate map for the yard is required. • Surface waters or riverbeds either adjacent or in close proximity to the project area.	Abengoa Environmental Manager Plant manager Appointed consultant	The erosion measures should be in place before construction and the measures should be continuous throughout the life of the project.

• Locations where storm water discharges from the site directly to a surface water body, river or riverbed. • Determine methods for the reduction of runoff water energy. • Determine the location for collection areas, conduits, energy dissipation pools, gabions and culverts. • Determine Erosion and Sediment Control • Determine how disturbed areas will be restored. This includes vegetation, paved, gravelled or mulched areas.		

Performance Indicator	Erosion within the site kept to a minimum or completely eliminated
Monitoring	A monitoring plan should be put in place to monitor erosion in order to report on progress and advise management of measures that need to be implemented, this monitoring should be conducted bi-annually.

11.2 Operational Phase

OBJECTIVE 1: Compile an effective and efficient spillage containment plan in order to prevent spillage, leakage or release of harmful or toxic substances during transport or at areas where they are stored or used such as filling stations and the power production facility and also to clean up any spills before they can be taken up by any possible natural receptors.

Project component/s	Any component that involves the use, transport or storage of hazardous materials. This includes materials used in construction and transport vehicles such as oil, fuel hypoid oil, hydraulic fluid etc
Potential Impact	The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and

	humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity
Activity/risk source	Failure to effectively implement a hazardous substance containment plan
Mitigation: Target/Objective	No hazardous substances must enter the potential receiving ecological systems.

Mitigation: Action/control	Responsibility	Timeframe
• Excessive soil contamination by fuel or oil spills, for example, from construction vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ using bioremediation, in accordance with Abengoa's existing procedures and legal requirements. • Vehicles will be maintained regularly and kept in a good working order. • No oils or fuels from vehicles, machinery or generators should be allowed to enter ecosystems, in the case of accidental spills, immediate clean-up action must be initiated to prevent further spread. • Standard operating procedures for the transport of potentially dangerous substances need to be put in place and followed.	Abengoa Environmental Manager Plant manager Contractors	The hazardous substances management plan should be in place before any construction begins and the management plan should be continuous throughout the life of the project.

Performance Indicator	No hazardous chemicals are to be allowed to enter the receiving ecosystems.
Monitoring	All spills must be recorded Remedial actions taken and results of the remedial actions need to be recorded All recorded incidents need to be included in an incident register to be included in a monthly report

OBJECTIVE 2: Habitat degradation due to dust

Project component/s	Any component that involves the use and transport of vehicles on dirt roads
Potential Impact	Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment. Furthermore excessive dust can affect the respiratory systems of fauna species and affect visibility of predatory species thus affecting their hunting abilities and also that of prey species thus affecting their ability to evade predators.
Activity/risk source	Failure to effectively implement an effective dust suppression plan Availability of water Availability of bowsers Breakdown of bowsers
Mitigation: Target/Objective	Dust from cleared areas and dirt roads should be kept to a minimum.

Mitigation: Action/control	Responsibility	Timeframe
The following methods can be used to prevent conditions conducive to dust generation and suppress dust should it occur: • Dust suppression on roads by water bowsers or other forms of dust suppressants; • Paved areas and roads can be maintained free of tracked soil or fill materials. At minimum, paved traffic areas, can be cleaned on a daily basis by wet sweeping and/or washing. More frequent cleaning can be provided as necessary. Paved areas and roads can be left clean at the end of each day; • Disturbed ground surfaces, and unpaved traffic areas can be maintained in a moist condition; • During non-working hours, the facility can be left in a condition that will prevent dust from being generated. At the end of each work day, disturbed areas can be wetted down and security fencing can be installed and or inspected to prevent access and additional disturbance; • Provide temporary cover and daily maintenance for soil stockpiles and keep active surfaces moist; and • A temporary decontamination pad and/or a stabilized construction	Abengoa Environmental Manager Plant manager Contractors	The dust suppression measures should be in place before any construction begins and the management plan should be continuous throughout the life of the project.

entrance can be provided at active site entrance/egress locations to keep adjacent paved areas clean. The following Best Management Practices (BMPs) can also be followed to help minimize and control dust emissions at the site to the greatest extent possible: • All onsite traffic can be restricted to specific designated roads. Off-road travel can only be authorized on a case-by-case basis. Traffic speed can also be restricted to an appropriate level on all designated roads. All designated roads can be considered as high potential dust source areas, and as such, can be a priority for dust controls utilizing water and/or gravel; and • This plan can be in effect during all hours of operation at the site. During non-working hours, there can be no activities generating dust. Therefore, dust control actions can be restricted to hours of operation only. However, as a best management practice, if high winds are evident at the close of a business day (or immediately prior to a weekend, holiday, etc.), site personnel should evaluate vulnerable areas and implement controls, as appropriate, to minimize off-hours emissions.		

Performance Indicator	Dust generation should be kept to a minimum and limited to diurnal periods. An acceptable level of dust is 50 µg/m3 as recorded by standard air quality methodsand should not be exceeded.
Monitoring	Measures and success of measures implemented in order to dust generation need to be reported on monthly. Any incidents of contravention of the measures resulting in excessive dust need to be recorded and reported on monthly.

OBJECTIVE 3: Manage artificial light insects and bats at night

Project component/s	CSP tower
Potential Impact	Light shining against the tower (especially if it is painted white) will attract large numbers of insects at night especially during the wet season. This increase in insect activity may subsequently attract bats to the operational area. Bats are unlikely to be impacted upon through collisions of the heliostats and, because they will usually be at the plant at night, they are unlikely to be affected by solar flux. There is, however, the chance that they may use the tower as a roosting site and be flushed during the day when activity starts and then be injured.
Activity/risk source	Failure to effectively implement a plan to prevent bats from utilising the tower or other infrastructure for roosting
Mitigation: Target/Objective	Keep bats from utilising potentially dangerous infrastructure and prevent bat mortalities.

Mitigation: Action/control	Responsibility	Timeframe
• Monitor bat activity in the area. • Determine areas of roosting and access. • Determine species utilising the infrastructure. • Determine the risk associated with the bats' utilisation of infrastructure. • Reduce illumination of the tower at night thus reducing the number of insects attacted; • Paint the tower a darker colour (not white) so that any light shining on the tower is not so effectively reflected; • Seal any openings and/or crevasses that bats may use to roost in or gain entry to the tower; • Place of bat boxes around the tower and rest of the plat to provide a more suitable and safer roosting area for bats that may choose to inhabit the area; and • Regular monitoring of the power facility for any signs of bat roosting or activity.	Abengoa Environmental Manager Plant manager Appointed Specialist	The bat monitoring and management plan should be in place before construction and the management plan should be continuous throughout the life of the project.

Performance Indicator	Bat mortalities at the tower minimised
Monitoring	A monitoring plan should be put in place to monitor bat activity and mortalities to report on progress and advise management of measures that need to be implemented. This monitoring should be conducted bi-annually.

OBJECTIVE 4: Minimise effects on local migrations

Project component/s	Any linear infrastructure, roads, fencing and buildings may negatively affect fauna species ability to conduct local migrations after food water or shelter
Potential Impact	Local migrations of fauna in the area may be affected by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact.
Activity/risk source	Failure to effectively implement a plan to reduce the impacts of these structures
Mitigation: Target/Objective	Minimum impact of migrating fauna. No fatalities caused by linear infrastructure roads and other infrastructure and fencing.

Mitigation: Action/control	Responsibility	Timeframe
The following methods can be used to prevent impacts on local migrations: • The facility area can be isolated by means of a chain link fence in order to prevent animals on local migrations entering the area and being killed; • The effect of roads on local migrations can be mitigated by the installation of culverts at regular intervals along the roads and the installation of drift fences towards the culverts , although these methods may not eliminate the mortalities among migrating animals, they should greatly reduce the number of animals killed on roads; • Evaporation ponds need to be fenced with the lower edge of the fence buried and reinforced with concrete	Abengoa Environmental Manager Plant manager Contractors	The migration assistance measures should be in place during construction and the management plan should be continuous throughout the life of the project.

to prevent animals from burrowing under the fence; and • A low speed limit can be strictly enforced in order to reduce collisions with animals on the roads.		

Performance Indicator	Effects on local migrations and migrating animal mortalities needs kept to a minimum. Preferably zero incidents.
Monitoring	Any incidents involving the impediment of local migration or animal mortalities on roads or against fences need to be recorded and reported on monthly.

OBJECTIVE 5: Manage prevalence of exotic invasive species

Project component/s	Vegetation clearing of any kind, transport of – and by heavy vehicles
Potential Impact	Parts of the facility may remain cleared, thus creating niches that can be colonised by exotic and/or invasive species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to monitored and mitigated.
Activity/risk source	Failure to effectively implement a plan to reduce the increase in prevalence of exotic species
Mitigation: Target/Objective	Keep exotic species on site to a minimum, preferably zero.

Mitigation: Action/control	**Responsibility**	**Timeframe**
The following methods can be used to reduce the prevalence of exotic and invasive species: • Monitoring of exotic and invasive species should be conducted biannually; • A plan must be developed and implemented in order to eradicate exotic and invasive species within the property; and	Abengoa Environmental Manager Plant manager Appointed consultant	The exotic and invasive species control plan should be in place before construction and the management plan should be continuous throughout the life of the project.

• A monitoring plan should be put in place to monitor exotic and invasive species in order to report on progress and advise management of measure that need to be implemented.		

Performance Indicator	All exotic species within the site eradicated or, at a minimum controlled and no increase measured.
Monitoring	A monitoring plan should be put in place to monitor exotic and invasive species in order to report on progress and advise management of measure that need to be implemented, this monitoring should be conducted bi-annually.

OBJECTIVE 6: Manage erosion

Project component/s	Vegetation clearing of any kind unpaved roads any surface water runoff
Potential Impact	Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Increased erosion can eventually lead to the loss of vegetation and habitats for further species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion.
Activity/risk source	Failure to effectively implement a plan to reduce erosion
Mitigation: Target/Objective	Keep erosion and soil loss on site to a minimum, preferably zero.

Mitigation: Action/control	Responsibility	Timeframe
Develop an erosion control map including: • Drainage patterns or approximate slopes after major grading activities. • Indicate the direction of flow for all runoff from the site.	• Abengoa Environmental Manager • Plant manager • Appointed consultant	The erosion measures should be in place before construction and the measures should be continuous throughout the life of the project.

• Areas where soil disturbance will occur (shade or use border) including parking on or storing items on grass as disturbance. • Show the location of all structural controls, either planned or in place, on the map. This includes concrete washout areas, fueling areas, soil stockpiles, stabilized construction entrances, etc • Locations where stabilization practices are expected to occur. • Locations of off-site material, waste, borrow, fill, or equipment storage areas. If the staging yard is not on the site, a separate map for the yard is required. • Surface waters or riverbeds either adjacent or in close proximity to the project area. • Locations where storm water discharges from the site directly to a surface water body, river or riverbed. • Determine methods for the reduction of runoff water energy. • Determine the location for collection areas, conduits, energy dissipation pools, gabions and culverts. • Determine Erosion and Sediment Control • Determine how disturbed areas will be restored. This includes vegetation, paved, gravelled or mulched areas.		

Performance Indicator	Erosion within the site kept to a minimum or completely eliminated

Monitoring	A monitoring plan should be put in place to monitor erosion in order to report on progress and advise management of measures that need to be implemented, this monitoring should be conducted bi-annually.

12 LIST OF ACRONYMS AND ABBREVIATIONS

BIL	Background Information Letter
CSP	Concentrated Solar Power
DEA	Department of Environmental Affairs
DEIAR	Draft Ecological Impact Assessment Report
DNI	Direct Normal Irradiance
DoE	Department of Energy
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIA	Regulations National Environmental Management Act, 1998 (Act 107 of 1998) Environmental Impact Assessment Regulations, 2014
EMP	Environmental Management Programme
GN	General Notice
ha	Hectares
HTF	Heat Transfer Fluid
I&APs	Interested and affected parties
IFC	International Finance Corporation
km	Kilometre
m	metres
masl	metres above sea level
MW	Megawatt
MWe	Megawatt electrical
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
PS	Performance Standards
PV	Photovoltaic
REIPPP	Renewable Energy Independent Power Producer Procurement Programme
SG	Surveyor General

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APPENDIX A

Plant species recorded as occurring in the 2819DC QDS

Family	Species	Threat status	SA Endemic	Lifecycle	Growth forms
ACANTHACEAE	*Acanthopsis disperma Nees*	LC	No	Annual (occ. perennial)	Herb
ACANTHACEAE	*Barleria lancifolia T.Anderson subsp. lancifolia*	LC	No	Perennial	Dwarf shrub
ACANTHACEAE	*Blepharis pruinosa Engl.*		No	Perennial	Dwarf shrub
AIZOACEAE	*Aizoon canariense L.*	LC	No	Perennial	Herb
AIZOACEAE	*Galenia africana L.*	LC	No	Perennial	Shrub
AIZOACEAE	*Galenia fruticosa (L.f.) Sond.*	LC	No	Perennial	Dwarf shrub
AIZOACEAE	*Galenia sarcophylla Fenzl*	LC	No	Perennial	Dwarf shrub
AIZOACEAE	*Galenia secunda (L.f.) Sond.*	LC	No	Perennial	Dwarf shrub
AIZOACEAE	*Trianthema parvifolia E.Mey. ex Sond. var. parvifolia*	LC	No	Annual	Herb
AMARANTHACEAE	*Sericocoma avolans Fenzl*	LC	No	Perennial	Dwarf shrub
ANACARDIACEAE	*Searsia burchellii (Sond. ex Engl.) Moffett*	LC	No	Perennial	Shrub
ANACARDIACEAE	*Searsia populifolia (E.Mey. ex Sond.) Moffett*	LC	No	Perennial	Shrub
APOCYNACEAE	*Microloma sagittatum (L.) R.Br.*	LC	No	Perennial	Climber
ASTERACEAE	*Dicoma capensis Less.*	LC	No	Perennial	Herb
ASTERACEAE	*Eriocephalus pauperrimus Merxm. & Eberle*	LC	No	Perennial	Shrub
ASTERACEAE	*Euryops dregeanus Sch.Bip.*	LC	No	Perennial	Dwarf shrub
ASTERACEAE	*Geigeria filifolia Mattf.*	LC	No	Annual (occ. perennial)	Herb
ASTERACEAE	*Geigeria vigintisquamea O.Hoffm.*	LC	No	Annual	Herb
ASTERACEAE	*Helichrysum herniarioides DC.*	LC	No	Annual	Herb
ASTERACEAE	*Ifloga molluginoides (DC.) Hilliard*	LC	No	Annual	Herb
ASTERACEAE	*Osteospermum rigidum Aiton var. rigidum*	LC	No	Perennial	Shrub
ASTERACEAE	*Senecio niveus (Thunb.) Willd.*	LC	No	Perennial	Dwarf shrub
ASTERACEAE	*Senecio sisymbriifolius DC.*	LC	No	Annual	Herb
CAMPANULACEAE	*Wahlenbergia psammophila Schltr.*	LC	No	Annual	Herb
CAPPARACEAE	*Cleome oxyphylla Burch. var. oxyphylla*	LC	No	Perennial	Herb
CAPPARACEAE	*Maerua gilgii Schinz*	LC	No	Perennial	Shrub
EBENACEAE	*Diospyros acocksii (De Winter) De Winter*	LC	No	Perennial	Shrub
EUPHORBIACEAE	*Euphorbia virosa Willd.*		No	[No lifecycle defined]	[No lifeform defined]
FABACEAE	*Indigastrum argyroides (E.Mey.) Schrire*	LC	No	Annual	Herb
LAMIACEAE	*Stachys burchelliana Launert*	LC	No	Annual	Shrub
LOPHIOCARPACEAE	*Lophiocarpus polystachyus Turcz.*	LC	No	Perennial	Dwarf shrub
MALVACEAE	*Hermannia minutiflora Engl.*	LC	No	Perennial	Dwarf shrub
MALVACEAE	*Hermannia stricta (E.Mey. ex Turcz.) Harv.*	LC	No	Perennial	Dwarf shrub
MESEMBRYANTHEMACEAE	*Mesembryanthemum crystallinum L.*	LC	No	Annual	Succulent
MESEMBRYANTHEMACEAE	*Psilocaulon articulatum (Thunb.) N.E.Br.*	LC	No	Perennial (occ. annual)	Succulent
MESEMBRYANTHEMACEAE	*Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.*	LC	No	Perennial (occ. annual)	Shrub
MESEMBRYANTHEMACEAE	*Psilocaulon subnodosum (A.Berger) N.E.Br.*	LC	No	Perennial (occ. annual)	Succulent

Family	Species	Threat status	SA Endemic	Lifecycle	Growth forms
MOLLUGINACEAE	*Pharnaceum brevicaule (DC.) Bartl.*	LC	No	Perennial	Herb
MOLLUGINACEAE	*Suessenguthiella scleranthoides (Sond.) Friedrich*	LC	No	Annual	Herb
NEURADACEAE	*Grielum humifusum Thunb. var. parviflorum Harv.*	LC	No	Annual	Herb
PORTULACACEAE	*Anacampseros filamentosa (Haw.) Sims subsp. tomentosa (A.Berger) Gerbaulet*	LC	No	Perennial	Herb
PORTULACACEAE	*Avonia albissima (Marloth) G.D.Rowley*	LC	No	Perennial	Herb
RUBIACEAE	*Kohautia cynanchica DC.*	LC	No	Annual (occ. perennial)	Herb
SANTALACEAE	*Thesium lineatum L.f.*	LC	No	Perennial	Dwarf shrub
SAPINDACEAE	*Pappea capensis Eckl. & Zeyh.*	LC	No	Perennial	Shrub
SCROPHULARIACEAE	*Aptosimum procumbens (Lehm.) Steud.*	LC	No	Perennial	Herb
SCROPHULARIACEAE	*Jamesbrittenia aridicola Hilliard*	LC	No	Annual	Herb
SCROPHULARIACEAE	*Manulea schaeferi Pilg.*	LC	No	Annual	Herb
SCROPHULARIACEAE	*Selago divaricata L.f.*	LC	No	Perennial	Dwarf shrub
VISCACEAE	*Viscum capense L.f.*	LC	No	Perennial	Parasite
ZYGOPHYLLACEAE	*Augea capensis Thunb.*	LC	No	Perennial	Dwarf shrub
ZYGOPHYLLACEAE	*Sisyndite spartea E.Mey. ex Sond.*	LC	No	Perennial	Shrub
ZYGOPHYLLACEAE	*Zygophyllum dregeanum Sond.*	LC	No	Perennial	Dwarf shrub

APPENDIX B

Reptile species occurring in the region of the study area

Order	Suborder	Family	Subfamily	Biological Name	Common Name	Endemism
Chelonii	Pleurodira	Testudinae		*Psamobates tentorius*	Tent Tortoise	E
		Pelomedusidae		*Pelomedusa subrufa*	Marsh or Helmeted Terrapin	
Squamata	Serpentes (Ophidia)	Tryphlopidae		*Typhlops schinzi*	Beaked Blind Snake	E
		Leptotyphlopidae		*Leptotyphlops occidentalis*	Western Thread Snake	E
		Colubridae	Boadontinae	*Lamprophis fuliginosus*	Brown House Snake	
				Pseudoaspis cana	Mole Snake	
				Prosymna frontalis	South-western Shovel-snout	
			Psammophinae	*Dipsina multimaculata*	Dwarf Beaked Snake	E
				Psammophis notostictus	karoo Sand or Whip Snake	
				Psammophis leightoni	Cape, Namib and Fork-marked Sand Snake	
			Atractaspidinae	*Xenocalamus bicolor*	Bicoloured Quill-snouted Snake	
				Dasypeltis scabra	Common or Rhombic Egg Eater	
				Telescopus semiannulatus	Eastern Tiger Snake	
				Telescopus beetzii	Namib Tiger Snake	E
		Elapidae	Najinae	*Aspidelaps lubricus*	Coral Snake	
				Naja nivea	Cape Cobra	E
				Naja nigricollis	Black-necked Spitting Cobra	
			Viperinae	*Bitis arietans*	Puff Adder	
				Bitis cornuta	Many-horned Adder	E
				Bitis caudalis	Horned Adder	
	Sauria (Lacertillia)	Scincidae	Acontiinae	*Acontias lineatus*	Striped Legless Skink	E
			Lygosomatiinae	*Mabuya occidentalis*	Western Three-striped Skink	
				Mabuya striata	Striped Skink	
				Mabuya sulcata	Western Rock Skink	
				Mabuya variegata	Variegated Skink	
		Lacertidae		*Meroles suborbitalis*	Spotted Desert Lizard	E

Order	Suborder	Family	Subfamily	Biological Name	Common Name	Endemism
				Nucras tessellata	Striped Sandveld Lizard	
				Pedioplanis laticeps	Cape Sand Lizard	E
				Pedioplanis lineoocellata	Spotted Sand Lizard	E
				Pedioplanis namaquensis	Namaqua Sand Lizard	
				Pedioplanis undata	Western Sand Lizard	
		Cordylidae	Gerrhosaurinae	*Angolosaurus skoogi*	Desert Plated Lizard	
			Cordylinae	*Cordylus polyzous*	Karoo Girdled Lizard	E
			Cordylinae	*Platysaurus capensis*	Cape Flat Lizard	E
		Agamidae		*Agama aculeata*	Ground Agama	
				Agama anchietae	Anchieta's Agama	
				Agama atra	Southern Rock Agama	E
		Chamaeleonidae		*Chamaeleo namaquesis*	Namaqua Chamaeleon	
		Gekkonidae		*Chrondrodactylus angulifer*	Giant Ground Gecko	E
				Colopus wahlbergii	Kalahari Ground Gecko	E
				Lygodactylus bernardi	Bernard's Dwarf Gecko	
				Pachydactylus laevigatus	Button-scaled Gecko	
				Pachydactylus rugosus	Rough-scaled Gecko	E
				Pachydactylus serval	Western Spotted Gecko	E
				Ptenopus garrulus	Common Barking Gecko	E

APPENDIX C

Amphibian species occurring in the region of the study area

FAMILY	SPECIES		Endemic Status	Revised Status	Recorded
Bufonidae	*Vandijkophrynus gariepensis*	Karoo Toad	2	NL	
Microhylidae	*Phrynomantis annectens*	Marbled rubber frog	1	NL	
Pipidae	*Xenopus laevis*	Common Platanna	0	NL	
Petropedetidae	*Cacosternum boettgeri*	Boettger's Caco	1	NL	
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	0	NT	
Pyxicephalidae	*Tomopterna tandyi*	Tandy's Sand Frog	0	NL	
Pyxicephalidae	*Amietia angolensis*	Common River Frog			

Species list for the region spanning South Africa, Lesotho and Swaziland. Endemic status:

0 indicates no endemism to southern Africa

1 indicates endemism to southern Africa;

2 indicates endemism to the region (South Africa, Lesotho and Swaziland).

The relevant IUCN status categories are:

Critically Endangered (CR)

Endangered (EN)

Vulnerable (VU)

Near Threatened (NT)

Data Deficient (DD)

Least Concern (LC)

All species without a category are shown as Not Listed (NL)

Shaded species indicate species known to occur within the study area

APPENDIX D

Mammal species occurring in the region of the study area

Family	Subfamily	Biological Name	Common Name
MACROSCELIDIDAE (Sengis/Elephant Shrews)		*Macroscelides proboscideus*	Round-eared Sengi
		Elephantulus rupestris	Western Rock Sengi
		Elephantulus intufi	Bushveld Sengi
SORICIDAE (Shrews)		*Crocidura cyanea*	Reddish-grey Musk Shrew
NYCTERIDAE (Slit-faced Bats)		*Nycteris thebiaca*	Egyptian Slit-faced Bat
RHINOLOPHIDAE (Horseshoe Bats)		*Rhinolophus clivosus*	Geoffrey's Horseshoe Bat
		Rhinolophus darlingi	Darling's Horseshoe Bat
		Rhinolophus denti	Dent's Horseshoe Bat
VESPERTILIONIDAE (Vesper Bats)	VESPERTILIONINAE	*Cistugo seabrai*	Angolan Hairy Bat
		Neoromicia capensis	Cape Serotine Bat
		Pipistrellus rueppelli	Ruppell's Pipistrelle
MOLOSSIDAE (Free-tailed Bats)		*Sauromys petrophyilus*	Flat-headed Free-tailed Bat
		Tadarida aegyptiaca	Egyptian Free-tailed Bat
CERCOPITHECIDAE (Baboons and Monkeys)		*Papio cynocephalus ursinus*	Savanna Baboon
		Cercopithecus pygerythrus	Vervet Monkey
MANIDAE (Pangolins)		*Manis temminckii*	Ground Pangolin
LEPORIDAE (Hares and Rabbits)		*Lepus capensis*	Cape Hare
		Lepus saxatillis	Scrub Hare
		Pronolagus saundersiae	Hewitt's Red Rock Rabbit
		Pronolagus rupestris	Smith's Red Rock Rabbit
SCIURIDAE (Squirrels)		*Xerus inauris*	Southern African Ground Squirrel
MYOXIDAE (Dormice)		*Graphiurus ocularis*	Spectacled Dormouse
PEDETIDAE (Springhares)		*Pedetes capensis*	Springhare
BATHYERGIDAE (Rodent Moles / Mole Rats)		*Cryptomys hottentotus*	Common (African) Mole-rat
HYSTRICIDAE (Porcupine)		*Hystrix africaeaustralis*	Cape Porcupine
PETROMURIDAE (Dassie Rat)		*Petromus typicus*	Dassie Rat
MURIDAE (Rats and Mice)		*Saccostomus campestris*	Pouched Mouse
		Malacothrix typica	Gerbil Mouse
	GERBILLINAE	*Desmodillus auricularis*	Cape Short-tailed Gerbil

Family	Subfamily	Biological Name	Common Name
		Gerbillurus paeba	Hairy-footed Gerbil
		Gerbillurus vallinus	Brush-tailed Hairy-footed Gerbil
		Tatera leucogaster	Bushveld Gerbil
		Tatera brantsii	Highveld Gerbil
		Michaelamys namaquensis	Namaqua Rock Mouse
		Rhabdomys pumilio	Four-striped Grass Mouse
		Mus minutoides	Pygmy Mouse
		Mus musculus	House Mouse
		Thallomys paedulcus	Acacia Rat
		Thallomys nigricaudatus	Black-tailed Tree Rat
		Mastomys natalensis	Natal Multimammate Mouse
		Mastomys coucha	Southern Multimammate Mouse
		Parotomys brantsii	Brants's Whistling Rat
		Parotomys littledalei	Littledale's Whistling Rat
		Petromyscus collinus	Pygmy Rock Mouse
		Petromyscus monticularis	Brukkaros Pygmy Rock Mouse
CANIDAE		*Vulpes chama*	Cape Fox
		Otocyon megalotis	Bat Eared Fox
		Canis mesomelas	Black-backed Jackal
MUSTELIDAE		*Mellivora capensis*	Honey Badger
		Ictonyx striatus	Striped Polecat
HERPESTIDAE		*Galerella pulverulenta*	Small Grey Mongoose
		Cynictis penicillata	Yellow Mongoose
		Suricata suricatta	Suricate (Meerkat)
VIVERRIDAE		*Genetta genetta*	Small Spotted Genet
HYAENIDAE		*Parahyaena brunnea*	Brown hyaena
PROTELIDAE		*Proteles cristatus*	Aardwolf
FELIDAE		*Felis silvestris lybica*	African Wild Cat
		Felis nigripes	Small Spotted Cat

Family	Subfamily	Biological Name	Common Name
		Caracal caracal	Caracal
ORYCTEROPODIDAE		*Orycteropus afer*	Aardvark
PROCAVIIDAE		*Procavia capensis*	Rock Dassie (Hyrax)
RHINOCEROTIDAE		*Diceros bicornis*	Hook-lipped (Black) Rhinoceros
BOVIDAE		*Tragelaphus strepsiceros*	Greater Kudu
RUMINANTIA		*Antidorcas marsupialis*	Springbok
		Oreotragus oreotragus	Klipspringer
		Raphicerus campestris	Steenbok
		Sylvicapra grimmia	Common Duiker

APPENDIX E
Details of Specialist

Appointment of specialist

Hudson Ecology Pty Ltd was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Solar Thermal Plant near Pofadder in the Northern Cape. The consulting services comprise an assessment of potential impacts on the flora, fauna, vegetation and ecology in the study area by the proposed project.

Details of specialist

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Summary of expertise

Adrian Hudson is the owner, director and senior ecologist Hudson Ecology Pty Ltd. In this role, he provides assessments which encompass all aspects of terrestrial and wetland ecological studies including (but not limited to) baseline ecological assessments, ecological impact assessments and biodiversity management plans. He also has considerable experience in conservation, and conducted studies in veld management, stocking rates (wildlife and domestic) for a number of companies and organisations. Projects, unless otherwise requested by the client, are conducted according to the IFC Performance standard 6 criteria and Adrian Hudson is, therefore, au fait with the requirements and criteria of the Standard. Adrian has reviewed a number of projects throughout Africa for IFC Performance Standard 6 compliance, including Hassai Gold Mine in Sudan and Konkola North Copper mine in Zambia.

Adrian Hudson is a qualified ecologist and ornithologist who holds a Master's of Science degree in Ecology from the North West University and is currently completing his PhD in Ecology at the same institution. Adrian is currently still closely associated with the university as a supervisor for Honours and Masters degree students, lecturing of short courses at the university and co-authoring of scientific articles with faculty members of the university. Adrian is a member of the Zoological Society of Southern Africa and the International Society of Conservation Biology. Adrian is also a member of the Department of Environmental Affairs and Tourism (South African Government Department) roster of experts on ecology and desertification and a reviewer for a number of internationally accredited scientific journals. He is also accredited with authorship of a number of articles published in scientific journals.

Before founding Hudson Ecology Pty Ltd. in September 2014, Adrian worked for 18 years for a diverse range of organizations, including Natal Parks Board, North West University, United Nations Environmental Program /Global Environment Facility, ECOSUN cc and Golder Associates Africa Pty Ltd. In these roles, Adrian was responsible for anti- poaching, lecturing, research and consulting respectively. Thus far Adrian has worked as a consulting ecologist on more than 90 projects in 20 countries, including projects in Angola, South Africa, Lesotho, Swaziland, Namibia, Botswana, Mozambique, Zambia, Tanzania, Central African Republic, Democratic Republic of Congo, Sudan, Guinea, Guinea-Bissau, Uzbekistan and Liberia.

Independence

Hudson Ecology Pty Ltd and its Directors have no connection with Abengoa. Hudson Ecology Pty Ltd is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. Adrian Hudson is an independent consultant to Savannah Environmental (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work. The percentage work received directly or indirectly from the proponent in the last twelve months is approximately 0% of turnover.

Scope and purpose of report

The scope and purpose of the report are reflected in the Terms of reference section of this report

Conditions relating to this report

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APPENDIX F

CONTROL SHEET FOR SPECIALIST REPORT

The table below lists the specific requirements for specialist studies, according to the 2014 EIA Regulations (South Africa, 2014)

Activity	Yes	No	Comment
Details of: i the peson who prepared the report; and	√		
ii the expertise of that person to carry out the specialist study or specialised process	√		
	√		
ii. the expertise of that person to carry out the specialist study or specialised process	√		
A declaration that the person is independent in a form as may be specified by the competent authority	√		
An indication of the scope of, and the purpose for which, the report was prepared	√		
A description of the methodology adopted in preparing the report or carrying out the specialised process	√		
A description of any assumptions made and any uncertainties or gaps in knowledge	√		
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	√		
Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	√		
A description of any consultation process that was undertaken during the course of carrying out the study	√		
A summary and copies of any comments that were received during any consultation process	√		
Any other information requested by the competent authority	√		

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