Mulilo would investigate options to obtain components either from local or international suppliers. Mulilo have indicated that preference would be given to local suppliers.

2.2.3 Operational phase

The project is expected to last the full period of the PPA which is approximately 20 years. Regular cleaning of the panels to remove dust, dirt, pollen, and bird excretions would be required to ensure that the maximum quantity of sunrays can be captured by the PV panels (Ibrahim, 2010). The frequency of panel cleaning would depend on the site conditions. Panels would be washed with water and a mild, bio-degradable organic, and non-abrasive detergent.

2.2.4 Decommissioning phase

The PV site would be decommissioned at the end of the PPA (20 years from the date of commissioning). The decommissioning is expected to take between six to 12 months. The module components would be removed and recycled as the silicon and aluminum can be re-used in the production of new modules. The decommissioning would be undertaken in a manner similar to that included in **Annexure G** (an extract from Gestamp Solar, 2012).

2.3 CONSIDERATION OF ALTERNATIVES

2.3.1 Introduction

NEMA requires that alternatives are considered during the EIA process. An important function of the Scoping Phase is to screen alternatives to derive a list of feasible alternatives that need to be assessed in further detail in the EIA Phase. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to -

a) the property on which or **location** where it is proposed to undertake the activity;
b) the type of **activity** to be undertaken;
c) the design or **layout** of the activity;
d) the **technology** to be used in the activity;
e) the **operational** aspects of the activity; and
f) the option of not implementing the activity.

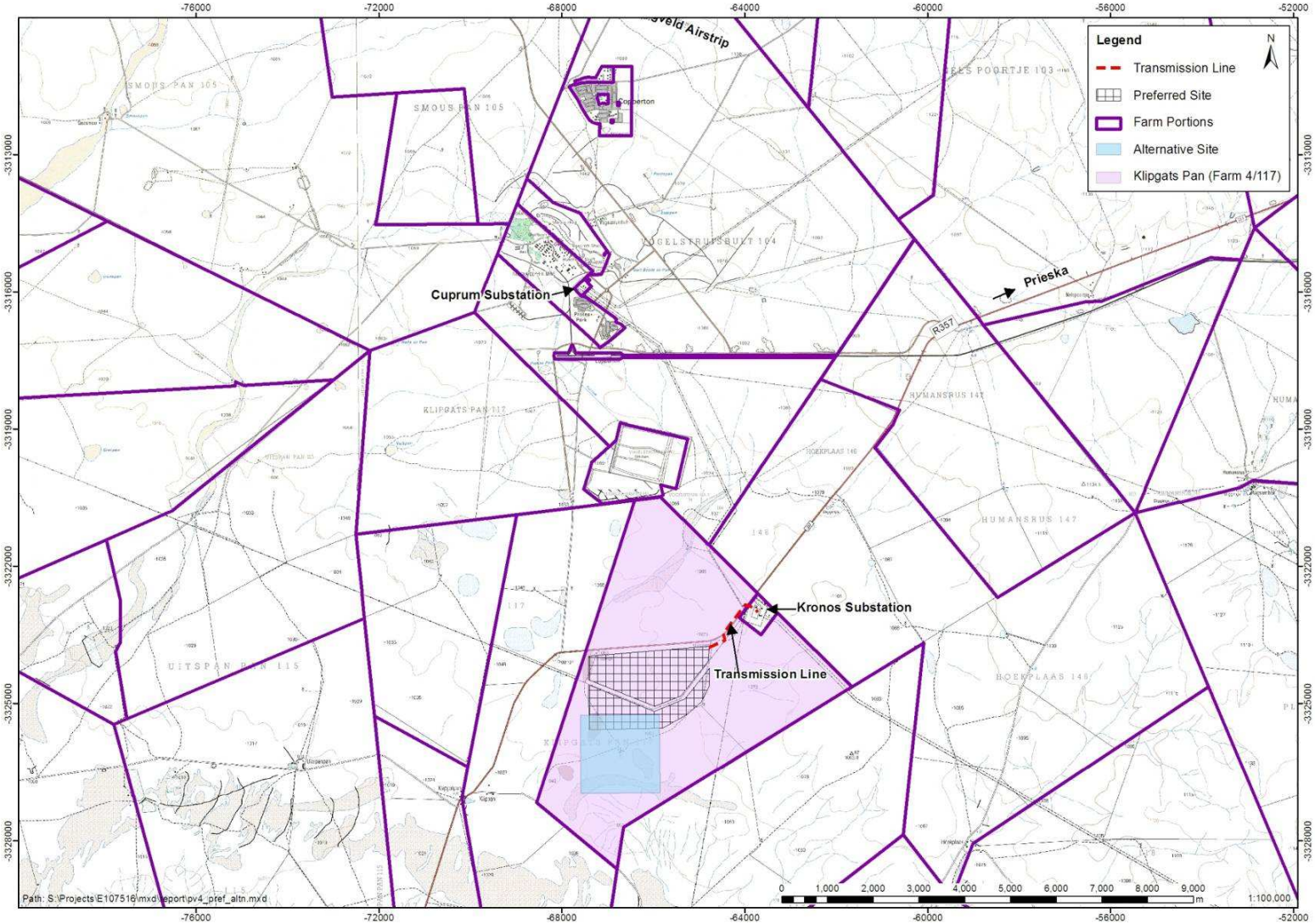


Figure 2-6 Map showing the preferred and alternative locations for the proposed PV plant

The alternatives most pertinent to the proposed project include the following:

- Location alternatives - alternative locations for the entire project proposal or for components of the project proposal;
- Activity (type) alternatives - also referred to as project alternatives. Requires a change in the nature of the proposed activity. This category of alternatives is most appropriate at a strategic decision-making level;
- Layout alternatives - site layout alternatives permit consideration of different spatial configurations of an activity on a particular site; and
- Technology alternatives - technology alternatives permit consideration of different types of technology used in the project.

The above categories of alternatives are the ones most pertinent to this EIA process, and will be explored in detail below. The purpose of this section of the report is to describe all potential alternatives that are assessed in the EIA Phase of the project for further assessment.

2.3.2 Location alternatives

Mulilo has considered the option to develop large scale PV power generation in South Africa over the last three years, given the good solar resource which is available over a large portion of the western part of the country. Aspects that were taken into consideration included, but were not limited to, irradiation levels, distance to the grid, site accessibility, founding conditions, topography, fire risk and current land use. Three potential sites[20] were identified by Mulilo for PV plants in the near vicinity of Copperton, including the proposed project discussed in this document (PV4). The two additional sites are of 100 MW each and located on the farms Struisbult (Farm 104/1) (PV2) and Hoekplaas (Farm 146/RE) (PV3) respectively. Mulilo further had received an Environmental Authorisation for a 20 MW PV plant (PV1) located on the Struisbult farm (Farm 104/1). The locations of these sites, as well as the approved site are given in **Figure 2.6**.

The proposed sites were selected based on the following criteria:

- Solar radiation based on historic satellite data;
- Grid connectivity and close proximity to strong grid access points;
- Availability of flat, level and open land;
- Land use in terms of population numbers and non-arable / low potential agricultural land;
- Potential sensitive receptors and features, such as fauna, flora, heritage, visual and other technical aspects such as the Square Kilometre Array (SKA).

2.3.3 Activity alternatives

As can be seen by the numerous policies and legislation described in **Section 1.2.4** the need for additional energy generation in South Africa is well documented. Furthermore, these policies and legislation also indicate the mixture of renewable and non-renewable energy which South

[20] Please refer to *Proposed Photovoltaic Energy Plant on the Farm Hoekplaas near Copperton in the Northern Cape (DEA Ref. No: 12/12/20/25031 / NEAS Ref. No: DEAT/EIA/0000605/2011)* and *Proposed Photovoltaic Energy Plant on Struisbult Farm near Copperton, Northern Cape* (*DEA Ref. No: 12/12/20/2502 / NEAS Ref. No: DEAT/EIA/0000605/2011),* which is available on the Aurecon website (www.aurecongroup.com – indicate "Current Location" as "South Africa" and follow the Public Participation link) for comment.

Africa wishes to pursue. These strategic documents provide the road map for the activity alternatives available to South Africa. The IRP2010 allows for an additional 14 749 MW of renewable energy in the electricity mix in South Africa by 2030 and based on this requirement for renewable energy Mulilo has identified a number of projects for solar energy generation.

A project for wind power, currently at the EIA Phase[21] (see **Figure 2.6**) is located approximately 9 km to the northeast of the proposed Klipgats Pan PV plant. This indicates that the proposed site could also be suitable for wind power. However, the selection of the site was based on the requirements for solar energy. As such the only activity alternative, other than the no-go alternative, which will be investigated in this project specific EIA is solar energy.

The no-go alternative is the baseline against which all alternatives are assessed. It consists of the *status quo*, and as such will not be explicitly assessed.

2.3.4 Site layout alternatives

Based on information obtained from specialist studies undertaken for the EIA phase of this project, the site location was moved to an area that is less sensitive to the proposed development and this forms the current preferred site (see **Figure 2-6**). The transmission line would cover a distance of approximately 1.66 km. An alternative preferred site has been identified to the immediate south of the discarded preferred site location. The development of these layouts was based on *inter alia* the following criteria:

- Technical constraints
    - Spatial orientation requirements of solar panels and associated infrastructure (e.g. roads); and
    - Layout relative to other existing infrastructure, such as power lines.
- Environmental constraints
    - Topographical constraints, including surface and groundwater;
    - Botanical and avifaunal constraints (presence of sensitive or protected plant communities or avifauna);
    - Location of heritage (archaeology and palaeontology) resources; and
    - Aesthetics.

[21] Proposed Wind Energy Facility near Copperton, Northern Cape (DEA Ref. No. 12/12/20/2099). This document is available for comment on the Aurecon website (www.aurecongroup.com – indicate "Current Location" as "South Africa" and follow the Public Participation link).

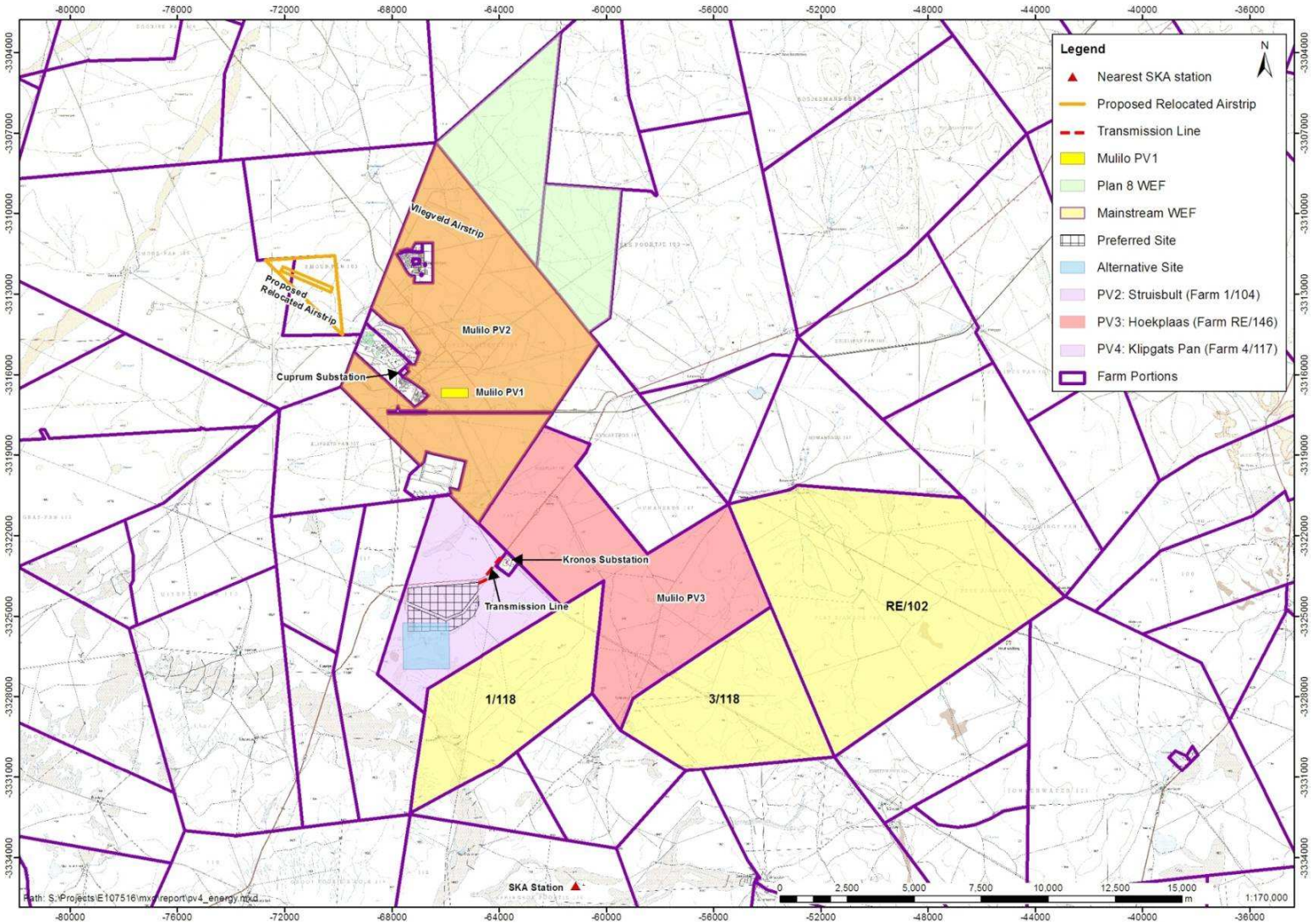


Figure 2-7 Other renewable energy projects (solar and wind) proposed for the Copperton area

2.3.5 Technology alternatives

Various technology alternatives were considered in terms of the following:

- Solar panel type: PV vs. Concentrated PV (CPV);
- Mounting system: trackers vs. fixed mount; and
- Foundation options: isolated concrete bases vs. continues concrete bases vs. concrete pile vs. thrusted supporting structures.

a) Solar panel type

Two solar panel types, i.e. conventional PV solar cells and CPVs, were considered for the proposed solar plant. The CPV technology consists of mega modules that use refractive lenses to concentrate direct sunlight onto smaller cells. These cells are able to generate electricity from a broader light spectrum than conventional PV technology and are thus more effective per ha than conventional PV technology, e.g. a minimum of 1.8 ha is required for CPVs to generate 1 MW of electricity compared to 3-7 ha required by conventional PV technology. The conventional PV technology on the other hand generates electricity by converting solar radiation energy into a DC current which then needs to be converted to an AC current to connect to the grid (see **Figure 2.7**)[22]. Approximately 1 kℓ of water would be required per day for every 10 MW during operation.

Both the conventional PV and CPV solar panels will be considered in this EIA.


Figure 2-8 Photovoltaic solar cells (left)[23] and a CPV system (right)[24] were considered for the proposed PV plant

b) Mounting system

Solar panels can be mounted in various ways to ensure maximum exposure of the PV panels to sunlight. In a fixed axis system the PV panels are installed at a set tilt and cannot move, whereas in a one or two (dual) axes tracking system the panels follow the sun to ensure maximum exposure to sunlight[25]. These systems are illustrated in **Figure 2-9**.

[22] Source: http://en.wikipedia.org/wiki/Photovoltaics#Optimum_orientation_of_solar_panels and http://en.wikipedia.org/wiki/Concentrated_solar_power (Accessed on: 24/10/2011).
[23] Photo of a test solar plant constructed by Mulilo on the town border of Copperton (Taken on: 29/09/2011)
[24] Source: http://gigaom2.files.wordpress.com/2010/04/amonix15.jpg (Accessed on: 13/02/2012)
[25] Source: http://en.wikipedia.org/wiki/Solar_tracker#Tracker_type_selection (Accessed on: 24 October 2011)

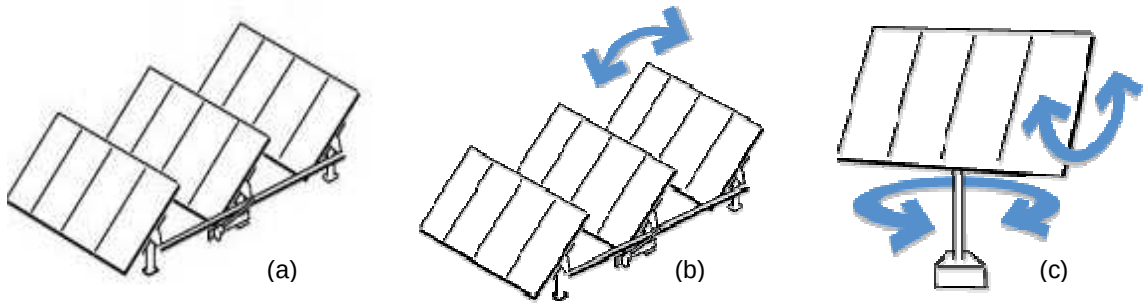


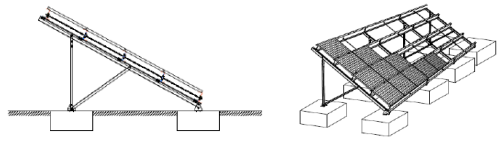
Figure 2-9 Solar panels can be mounted via (a) fixed axis photovoltaic systems, (b) single axis tracking PV systems and (c) dual axis tracking systems[26]

In order for CPVs to be cost efficient and produce the maximum amount of electricity, mega-modules have to be mounted on dual axis tracking systems. Therefore only the dual axis tracking system will be considered in the EIAR for the CPV panels. There is little environmental difference in terms of impacts from the various mounting systems, which could be considered for PV, and as such these will not be considered separately in this EIAR. The selection of the preferred mounting system should rather be based on technical and financial considerations.

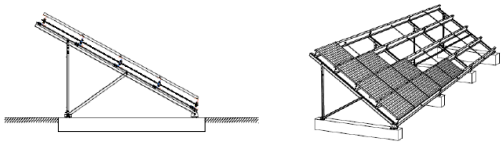
c) Foundation options

There are various methods for anchoring PV panels. However the preferred foundation option would be dependent on the soil characteristics of the area, as these anchoring structures would need to withstand climatic conditions, as well as the response of the soil to these changes, to prolong the lifespan of the panels. A geotechnical assessment would however be required to determine the soil conditions and the type of anchoring required. As this study will only be completed after the EIA Phase, the following anchoring options will be considered (see **Figure** 2-10):

- Isolated concrete bases;
- Continuous concrete bases; and
- Concrete pile;
- Thrusted supporting structures.

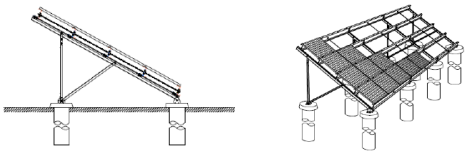


(a) Isolated concrete bases

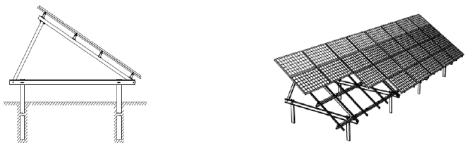


(b) Continuous concrete bases

[26] Source: www.solar-tracking.com/ (Accessed on: 24/10/2011)



(c) Concrete pile



(d) Thrusted supporting structure

Figure 2-10 Illustrations of various anchoring options to be considered for the proposed PV plant (courtesy: Mulilo)

2.3.6 Summary of alternatives

To summarise, the feasible alternatives which are assessed in the EIAR include the following:

- Location alternatives:
  - One location for the proposed Klipgats Pan PV plant; and
  - Electricity distribution via a 1.66 km or 2.14 km 132 kV connection to Kronos substation.
- Activity alternatives:
  - Solar energy generation via a PV plant; and
  - “No-go” alternative to solar energy production.
- Site layout alternatives:
  - Two layout alternatives (preferred and alternative).
- Technology alternatives:
  - Two technology alternative in terms of the solar panel type (PV vs. CPV); and
  - Four foundation options.

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3 THE PUBLIC PARTICIPATION PROCESS

The purpose of this Chapter is to provide an outline of the Public Participation Process, a summary of the process undertaken to date, and the way forward with respect to public participation as part of the EIA Phase of this project.

3.1 INTRODUCTION

Consultation with I&APs forms an integral component of an EIA process (see **Figure 1.2**) and enables *inter alia* directly affected landowners, neighbouring landowners, stakeholders, communities and interested parties to identify the issues and concerns relating to the proposed activity, which they feel should be addressed in the process. The approach to this public participation process, summarised in the Plan of Study for EIA (Chapter 5 of the FSR), has taken cognisance of the DEAT Guideline on Stakeholder Engagement (2002).

Public participation, as required in terms of the EIA Regulations can, in general, be separated into the following phases:

Comment on Draft and Final Reports
During the Scoping and EIA Phases, registered I&APs are provided with an opportunity to comment on draft and final versions of the reports. This is enabled by the lodging of the reports at suitable locations for review and invitations to public meetings/open houses to discuss the content of the relevant report.

Decision and Appeal period
This is the final phase of the public participation process. Once the competent authority has made their decision and issued an Environmental Authorisation, the applicant and I&APs are notified of the decision and have the opportunity to appeal to the national Minister of Water and Environmental Affairs, within the stipulated timeframes.

Progress with respect to these various stages for the current project is discussed in more detail below. It should be noted that the public participation process developed for this investigation meets the minimum requirements of NEMA.

All public participation related information is included in **Annexure B** of the EIAR.

3.2 SUMMARY OF THE PUBLIC PARTICIPATION PROCESS TO DATE

3.2.1 Initiation of the public participation process

The approach adopted for the current investigation was to identify as many I&APs as possible initially, through a suite of activities, as follows:

- Placing advertisements in local newspapers (the Gemsbok);
- Placing a notice board at the site;
- Providing written notice and an Executive Summary to potential I&APs, including surrounding landowners, organs of state, ward councillors and relevant authorities;
- Informing I&APs registered for existing EIAs, being run by Aurecon in the area about the project and providing them with an opportunity to register for this project as well; and
- Requesting potential I&APs to recommend other potential I&APs to include on the database (chain referral process).

The initial database of I&APs was compiled using an existing database for the proposed wind energy facility on an adjacent site, through identification of neighbours and through liaison with the local municipality, personal communication with the landowner and other organisations in the area. The initial database included the landowner, neighbouring landowners, relevant district and local municipal officials, relevant national and provincial government officials, and organisations in the area. This database is augmented via chain referral, and is continually updated as new I&APs are identified throughout the project lifecycle. The current list of I&APs, comprising approximately 56 individuals and organisations, is included in **Annexure B**. The sectors of society represented by I&APs on the database are listed below.

(i) Provincial government (Northern Cape);
(ii) Local government (Siyathemba LM and Pixly ka Seme District Municipality);
(iii) Organised agriculture;
(iv) Business/Commerce;
(v) Industry;
(vi) Scientific and research based organisations
(vii) Local landowners; and
(viii) Local communities and other community based organisations in the project area.

Thereafter, the remainder of the communications was be focused on registered I&APs and on local advertising. Consequently, the initial advertising campaign was broad and thorough and invited the members of the public to register as I&APs.

3.2.2 Public participation related to the Scoping Phase (DSR)

The public participation process was initiated at the Scoping Phase when the I&APs were notified of the DSR and associated comment period in the following way:

- Placement of advertisements in a local newspaper, the Gemsbok, notifying the broader public of the initiation of the EIA and inviting them to register as I&APs from 2 November 2010;
- Erection of a site notice at the entrance to Farm Klipgats Pan on 8 November 2011;
- Lodging the DSR at Prieska (Elizabeth Vermeulen) Public Library, Ietznietz Guest House in Copperton and on the Aurecon website from 8 November 2011. All registered I&APs were notified of the availability of the DSR by means of a letter sent by fax, post and/or e-mail on 7 November 2011. The notification letters also included a copy of the Executive Summary of the DSR in English and Afrikaans;
- I&APs had 40 days, until 5 January 2012, to submit their written comments on the DSR.
- On 6 December 2011 a second notification letter was distributed to I&APs regarding the extension of the comment period from 5 January 2012 to 9 January 2012 due to a delay that occurred during the mailing of the first notification letters; and
- I&APs had 40 days, until 9 January 2012, to submit their written comments on the DSR. Cognisance was taken of all comments when compiling the final report, and the comments, together with the project team and proponent's responses thereto, were included in final report.

3.2.3 Public participation related to the Scoping Phase (FSR)

Based on the comments received on the DSR during the 8 November 2011 to 9 January 2012 public comment period the DSR was updated and called the FSR. The second stage of the PPP involved the lodging of the FSR for review and comment at the same locations as the DSR.

- I&APs were provided with 21 calendar days to comment on the FSR between 18 January 2012 and 7 February 2012.
- Registered I&APs were informed of the FSR public comment period via a letter dated 16 January 2012 which was emailed or posted. An Executive Summary together with an update page in English and/or Afrikaans was also emailed or posted to registered I&APs which highlighted the key changes made to the DSR as a result of the 40 day public comment period.

3.2.4 Issues and concerns raised during the Scoping Phase

Issues were submitted during the DSR comment period from 8 November 2011 until 9 January 2012 and FSR comment period from 18 January 2012 to 7 February 2012. Comments and concerns raised by I&APs (with regards to the proposed activities) have been incorporated into CRR 1 (see **Annexure D** of the FSR) and CRR 2 (see **Annexure B**) which summarise all the issues and concerns raised by I&APs during the Scoping Process, and provide the project team and proponent's response thereto. The issues raised by I&APs to date relates to the processes required in terms of the NHRA and NWA.

3.2.5 Public participation related to the EIA phase (Draft EIAR)

The Draft EIAR has been lodged in Prieska (Elizabeth Vermeulen) Public Library, Ietznietz Guest House in Copperton and on the Aurecon website (www.aurecongroup.com - change "Current Location" to "South Africa" and follow the Public Participation link).

All registered I&APs have been notified of the availability of the Draft EIAR by means of a letter sent by post, fax or e-mail on 10 April 2012. The notification letters also included a copy of the Executive Summary in English and Afrikaans.

I&APs have 40 days, from 10 April 2012 until 22 May 2012, to submit their written comments on the DEIR. Cognisance will be taken of all comments in compiling the final report, and the comments, together with the project team and proponent's responses thereto, will be included in the final report. Where appropriate, the report will be updated.

Comments should be directed to:

Aurecon
Franci Gresse or Louise Corbett
P O Box 494, Cape Town, 8000
Tel: (021) 526 6022
Fax: 086 723 1750
Email: franci.gresse@aurecongroup.com

3.2.6 Public participation related to the EIA phase (Final EIAR)

Based on the comments received during the 40 day public comment period on the DEIAR, the report will be updated in light of the comments received and would be called the Final EIAR. Comments would also be included and responded to in the Comments and Responses Report 3 which will be made available to I&APs.

The Final EIAR will be made available for review at the same locations as the Draft EIAR for a further 21 day public comment period. Any comments received on the Final EIAR will not be included in a Comments and Response Report and will instead be collated and forwarded directly to DEA.

3.3 REVIEW AND DECISION PERIOD

The Final EIAR will be submitted to DEA for their review and decision-making. DEA must, within 60 days, do one of the following:

- Accept the report;
- Notify the applicant that the report has been referred for specialist review;

- Request amendments to the report; or
- Reject the report if it does not materially comply with regulations.

If the report is accepted, DEA must within 45 days:

- Grant authorisation in respect of all or part of the activity applied for; or
- Refuse authorisation in respect of all or part of the activity.

Once DEA issues their decision on the proposed project, all registered I&APs on the project database will be notified of the outcome of the decision within 12 calendar days of the Environmental Authorisation having been issued. Should anyone (a member of public, registered I&AP or the Applicant) wish to appeal DEA's decision, a Notice of Intention to Appeal in terms of Chapter 7 of the EIA Regulations (GN No. 543) in terms of NEMA must be lodged with the Minister of Water and Environmental Affairs within 20 calendar days of the decision being issued and the substantive Appeal must be lodged within 30 days of the Notice.

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4 ASSESSMENT OF POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

This Chapter forms the focus of the EIAR. It contains a detailed assessment of the operational (or long-term) impacts as well as the construction phase impacts on the biophysical and socio-economic environments. A summary table of the assessment of all the potential impacts is also provided.

4.1 INTRODUCTION

This Chapter describes the potential impacts on the biophysical and socio-economic environments, which may occur due to the proposed activities described in Chapter 2. These include potential impacts, which may arise during the operation of the proposed development (i.e. long-term impacts) as well as the potential construction related impacts (i.e. short to medium term). The assessment of potential impacts will help to inform and confirm the selection of the preferred alternatives to be submitted to DEA for consideration. In turn, DEA's decision on the environmental acceptability of the proposed project and the setting of conditions of authorisation (should the project be authorised) will be informed by this chapter, amongst other information, contained in this EIAR.

The potential impacts identified during the Scoping Phase of this project, and updated where necessary, are as follows:

- Operational phase impacts on the biophysical environment:
    - Impact on flora;
    - Impact on avifauna;
    - Impacts fauna; and
    - Impact on freshwater resources
- Operational phase impacts on the social environment:
    - Visual impacts;
    - Impact on energy production;
    - Impact on local economy (employment) and social conditions;
    - Impact on agricultural land; and
    - Impact on surrounding land uses.
- Construction phase impacts on the biophysical and social environments:
    - Disturbance of flora, avifauna and fauna;
    - Sedimentation and erosion of water ways;
    - Impact on heritage resources (including palaeontology);
    - Impact on traffic;
    - Noise pollution;
    - Storage of hazardous substances on site; and
    - Dust impact.

Each of these impacts is assessed in detail in a section below. The baseline and potential impacts that could result from the proposed development are described and assessed.

Mitigation measures are recommended. Finally, comment is provided on the potential cumulative impacts[27] which could result should this development, and others like it in the area, be approved.

Please note that specialists assessments have been completed on the original preferred layout and technology alternatives as presented in the FSR. These layouts and technology alternatives were updated based on specialist input and a DoE emphasis on local procurement. Specialists have provided written confirmation that their assessments are not significantly impacted on by these changes to alternatives, and this confirmation is included in the relevant annexure along with their report. It should however be noted that the Visual Impact Assessment was updated with the revised technology alternative (CPV) due to the significant changes on this aspect resulting from the new preferred technology. The revised layouts and technology alternatives are assessed below.

The methodology used to assess the potential impacts is detailed in **Annexure E** of the FSR. The (+) or (-) after the significance of an impact indicates whether the impact is positive or negative, respectively.

4.2 OPERATIONAL PHASE IMPACTS ON THE BIOPHYSICAL ENVIRONMENT

4.2.1 Impact on flora

The principle vegetation type on Farm Klipgats Pan, which shows some variation, is Bushmanland Basin Shrubland. The main agricultural activity is sheep-farming but despite the very dry conditions the vegetation is in fair condition with only certain areas, such as watering points, more heavily trampled than elsewhere. Two different locations south of the R357 were considered for the proposed solar energy facility that would cover an area of 300 ha. The potential therefore exists for the footprint of the proposed solar energy facility to impact on the vegetation of Farm Klipgats Pan. As such Dr Dave McDonald of Bergwind Botanical Surveys & Tours CC was appointed to undertake a desktop Botanical Impact Assessment. A site visit was conducted by Dr McDonald on the 24 November 2011 to inform the assessment. The study considered locality, topography, geology, climate vegetation types and conservation status. The Botanical Impact Assessment, and comment on the revised layout and technology alternatives, is included in **Annexure C**. The summary below includes findings and recommendations of the specialist.

a) Description of the environment

The Klipgats Pan site falls within the Nama Karoo Biome which covers a large part of the Northern Cape Province. According to the national classification of the vegetation of South Africa (Mucina *et al.* 2006 in Mucina and Rutherford, 2006) the vegetation found at the study site is mainly Bushmanland Basin. Although there are few statutory conservation areas in this

[27] EIA's are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

type, it forms agricultural rangelands and is conserved for its grazing potential. The National Spatial Biodiversity Assessment (Rouget *et al.* 2004) classifies this vegetation type as Least Threatened and it is not listed in the National List of Threatened Terrestrial Ecosystems (Government Gazette No. 34809. 2011).

Klipgats Pan has a very low relief that increases slightly towards the west of the northern part where a low rise of calcrete forms a band that impedes drainage. The drainage system arises on the neighbouring farms, Struisbult and Hoekplaas, towards the north-east and east. On Klipgats Pan it forms a wide and shallow seasonal drainage line. No rare plant species or plant species of special concern were found during the survey. Anderson (2010) found three protected species in a survey of Portion 1 of Farm Vogelstruisbult No. 104 northeast of Klipgats Pan. These species, *Avonia albissima*, *Lithops hallii* and *Ruschia spinosa* may occur at Klipgats Pan, but if so would most likely be in the northwest sector on the calcrete ridges.Two vegetation communities occur across the preferred (1) and alternative (2) sites, namely *Rhigozum trichotomum* (granaatbos) and Asteraceous Shrubland. The *Rhigozum trichotomum* (granaatbos) is a tough woody shrub and is scattered throughout the study area (see **Figure** 4-1) but tends to be concentrated and dominant in areas where there is an accumulation of red sand and surface rocks. The Asteraceous Shrubland is the most extensive vegetation type in the study area and it also has the greatest diversity of species. Since this vegetation indicates a shallow-wash drainage line it is considered to be more ecologically sensitive than the broader vegetation described below as Asteraceous Shrubland.

Figure 4-1 Photographs of the two main vegetation types occurring at Klipgats Pan, i.e. *Rhigozum trichotomum* Shrubland (left) and low shrubland dominated by members of the Asteraceae / daisy family (right) (D. McDonald, 24/11/2011)

The Asteraceous Shrubland is the most extensive vegetation type in the study area. It also has the greatest diversity of species, mainly low shrubs with grasses occurring patchily. Other herbaceous species are also present. This vegetation occurs on shallow sandy-loam soils often with bedrock (mostly as hardpan calcrete) and is not ecologically sensitive. Within the low shrublands are patches where grasses, mainly of the genus *Stipagrostis,* are abundant. However, due to grazing grasses are less abundant than would be the case if the land was not grazed (see **Figure 4-1**).

Towards the northern section of Klipgats Pan Farm the invasive tree specie *Prosopis glandulosa* (mesquite) is present as large trees, concentrated around a windmill (see **Figure 4.2**). This tree species is originally from North and Central America and is particularly invasive in the arid areas of South Africa. *P. glandulosa* could become a serious problem if allowed to spread. No other alien invasive species were recorded.

Figure 4-2 A stand of *Prosopis glandulosa* (mesquite) on Klipgats Pan Farm (D. McDonald, 24/11/2011)

The greater part of Klipgat Pan is not botanically sensitive. However, one important exception is the low-lying drainage area which extends from the northeast corner to the center of the northern part of the farm. This seasonal watercourse may remain dry for long periods but could also flood after heavy rain. It has a higher sensitivity than the surrounding low Asteraceous shrublands and probably also provides a more attractive habitat for small mammals and birds.

b) Impact assessment

The potential impacts of the proposed project on the vegetation on Farm Klipgats Pan would include the loss of vegetation type (plant species) and habitat as well as the loss of ecological processes. If the proposed solar facility is constructed, most of the vegetation over a 300 ha area would be lost. In addition there would also be some loss of vegetation due to trampling and movement of vehicles. Furthermore, findings of the survey indicate that a triangular area in the northwest corner of Klipgats Pan is more sensitive due to the occurrence of the drainage system.

Based on the above, the potential impact of the proposed project on vegetation is considered to be of a low magnitude, local extent and long term, and thus of a **low (-)** significance with and without mitigation for all alternatives.

c) Mitigation measures

The following mitigation measures are recommended:

- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to; and
- Shallow depressions and well defined pans should be avoided, with buffer zones of at least 30 m around pans.

d) Cumulative impacts

Bushmanland Basin Shubland is not a threatened vegetation type and despite the numerous proposed renewable energy projects in the Copperton area, the status of this vegetation type

would not change. Cumulative impacts on this vegetation type due to the Klipgats Pan solar energy project would be of a low magnitude, local extent and long term, and thus of a low (-) significance

4.2.2 Impact on avifauna (birds)

At least 215 bird species are likely to occur in the area, of which 68 are endemic or near endemic species, 18 red listed species and five species are red listed endemics. The expected impacts of solar energy facilities on avifauna are related to footprint impacts associated with:

- Habitat destruction;
- Disturbance by construction and maintenance activities and possibly by the operation of the facility;
- Displacement or disturbance of sensitive species; and
- Mortality caused by collision with the associated power line network and electrocution of avifauna.

In addition, some bird species may interfere with the efficient running of the proposed PV installation. As such an avifaunal study was undertaken by Dr Andrew Jenkins of Avisense Consulting. A desktop review of relevant literature and a site visit on 7 January 2012 informed the avifaunal study. The avifaunal study, and comment on the revised layout and technology alternatives, is included in **Annexure C**. The findings and recommendations of the avifauna study are summarised below.

a) Description of the environment

The broader impact zone of the proposed PV facility is contained within an extensive tract of undulating, remote, arid environment, while the immediate vicinity features degraded natural veld with some anthropogenic influences. The broader area could support over 200 bird species, including up to 18 red-listed species, 68 endemics, and five red-listed endemics. The birds of greatest potential relevance and importance are likely to be local populations of endemic, and possibly red-listed passerines, seasonal species, locally resident of passing raptors and possibly over-flights of commuting wetland birds (see **Table 4.1**).

Table 4.1 List of priority bird species that could potentially occur on site (Avisense Consulting, 2012)

Common name	Scientific name	SA conservation status & Global conservation status	Regional endemism	Estimated importance of local population
Ludwig's Bustard	*Neotis ludwigii*	SA: Vulnerable Global: Endangered	Near-endemic	Moderate-High
Kori Bustard	*Ardeotis kori*	SA: Vulnerable	-	Moderate
Tawny Eagle	*Aquila rapax*	SA: Vulnerable	-	Low
Martial Eagle	*Polemaetus bellicosus*	SA: Vulnerable Global: Near-threatened	-	Moderate-High
Secretarybird	*Sagittarius serpentarius*	SA: Near-threatened Global: Vulnerable	-	Moderate
Lanner Falcon	*Falco biarmicus*	SA: Near-threatened	-	Moderate

Common name	Scientific name	SA conservation status & Global conservation status	Regional endemism	Estimated importance of local population
Greater Flamingo	*Phoenicopterus ruber*	SA: Near-threatened	-	Low
Lesser Flamingo	*Phoenicopterus minor*	SA: Near-threatened	-	Low
Red Lark	*Calendulauda burra*	SA: Vulnerable Global: Vulnerable	Endemic	Low
Sclater's Lark	*Spizocorys sclateri*	SA: Near-threatened	Endemic	Moderate

Other potential birds include over-flights of commuting wetland birds such as flamingos. Pigeons, crows, weavers, sparrows and some raptor species may perch, roost, forage or even nest on or around the facility and cause fouling problems. It should be noted that the site is on the southern edge of a recent range expansion by Sociable Weaver (*Philetarius socius).* The huge communal grass nests built by this species may require active management if any are attached to critical infrastructure of the development.

Surveys of large raptors nesting on the steel pylons supporting Eskom's transmission lines in the area place regularly active Martial Eagle nests within about 3-4 km east of the proposed development area (on tower 512 of the Hydra-Kronos 400 kV line), and within about 18 km to the west (on tower 392 of the Aries-Kronos 400 kV line) .

Greater Kestrels have been found breeding in Pied Crow (*Corvus alba)* nests on 132 kV power poles, and Southern Pale Chanting Goshawk (*Melierax canorus)* nests have been found in trees along drainage lines within/close proximity to the proposed development area. An adult Martial Eagle was seen perched on the 132 kV power poles just outside the development area on 7 January 2012. Densities of regional endemics such as Northern Black Korhaan (*Afrotis afraoides)*, Karoo Korhaan (*Eupodotis vigorsii)*, Sabota Lark (*Calendulauda sabota)*, Eastern Clapper Lark (*Mirafra fasciolata)*, Spike-heeled Lark (*Chersomanes albofasciata)* and Rufous-eared Warbler (*Malcorus pectoralis)* may be particularly high in the area. In addition one Ludwig's Bustard (*Neotis ludwigii)* collision victim was found under a 132 kV power line in the vicinity.

Overall, the avifauna of the development site itself is entirely replaceable, at best replicating that which occurs across huge areas of the Bushmanland. Given the nomadic nature and huge space requirements of birds in this semi-arid environment, and given that the area directly affected by the proposed development is relatively small and homogeneous in nature, it is unlikely to support any significant populations of any priority species.

b) Impact Assessment

The potential impacts of the proposed project on birds include habitat loss, disturbance and displacement of sensitive species by maintenance activities and possible operation of the facility, collision with power lines and electrocution on the required powerline.

Habitat loss – destruction, disturbance and displacement

Given the considerable space requirements of commercially viable facilities the most significant potential impact on birds of any solar energy generation facility is the displacement or exclusion of threatened, rare, endemic or range-restricted species from critical areas of habitat. The effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, and allowing for the possible cumulative effects of multiple facilities in one area.

Also, powerline service roads or servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, and to prevent vegetation from intruding into the legally prescribed clearance gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, and retention of cleared servitudes can have the effect of altering bird community structure along the length of any given power line.

Collision with power lines

Power lines pose a significant collision risk to birds, affecting a particular suite of collision prone species. Collision prone birds are generally either:

(i) large species and/or species with high ratios of body weight to wing surface area (wing loading), which confers low manoeuvrability (cranes, bustards, vultures, gamebirds, waterfowl, falcons);
(ii) species which fly at high speeds (gamebirds, pigeons and sandgrouse, swifts, falcons);
(iii) species which are distracted in flight - predators or species with aerial displays (many raptors, aerial insectivores, some open country passerines[28]);
(iv) species which habitually fly in low light conditions; and
(v) species with narrow fields of forward binocular vision.

Electrocution on power infrastructure

Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. Electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components.

Other effects

Vertical, reflective surfaces may confuse approaching birds with the result that birds are killed in collisions with such surfaces. Solar installations generally feature large areas of reflective panelling. It is possible that nearby or overflying birds may be disorientated by the reflected light, and consequently be displaced from an area more extensive than just the developed footprint of the facility.

Conversely, certain bird species may be attracted to the solar arrays. The possibility also exists that waterbirds would mistake the reflective surface for an expanse of water, and attempt to land on the panels, incurring injury and/or being disorientated in the process. Other species may seek to benefit from the installations, using the erected structures as prominent perches,

[28] Perching birds and songbirds.

sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure in response to changes in the distribution of preferred foods (plants growing under the paneling, other animals attracted to the facility). Such scenarios might be associated with fouling of critical components in the solar array, bringing local bird populations into conflict with the facility operators. Under these circumstances, specialist advice should be sought in devising effective avian deterrents to minimize associated damage.

Specific impacts of the proposed site are most likely to be manifested in the following ways:

- Disturbance and displacement of resident/breeding raptors (especially Martial Eagle and possibly Lanner Falcon) from nesting and/or foraging areas and /or mortality of these species in collisions with new power lines or by electrocution when perched on power infrastructure.
- Disturbance and displacement of resident/breeding Karoo endemics (including Sclater's Lark and possibly even Red Lark).
- Disturbance and displacement of seasonal influxes of large terrestrial birds (especially Ludwig's Bustard and Kori Bustard) from nesting and/or foraging areas and /or mortality of these species in collisions with new power lines while commuting between resource areas.
- Injury or mortality of wetland birds (especially flamingos) using possible flight lines in and out of resource areas in the broader vicinity, in collisions with the PV infrastructure or associated new power lines.

Generally, however, the anticipated impacts on birds of the proposed development are not considered to be of any great significance. There would be some habitat loss for Karoo endemic species (although the general area at the site is already somewhat degraded and disturbed by past mining activities), some species (Karoo endemics, large terrestrial species, raptors) may be displaced from a broader area either temporarily or more permanently by the disruptive, reflective properties of the solar panels. There is also a possibility that some species (large terrestrial species, raptors, commuting wetland birds) may be killed in interactions (collisions, electrocutions) with the new power infrastructure, but again, numbers affected are likely to be low.

Based on the above the potential impact on birds due to habit loss and displacement is considered to be of low to medium magnitude, local extent and long term and therefore **low to medium (-)** significance without mitigation for all alternatives. With the implementation of mitigation measures this is anticipated to reduce to **low (-)** significance.

Based on the above the potential impact on birds due to mortality is considered to be of medium magnitude, regional extent and long term duration and therefore **low to medium (-)** significance without mitigation for all alternatives. With the implementation of mitigation measures this is anticipated to reduce to **low (-)** significance.

c) Mitigation measures

The following mitigation measures are recommended.

- Minimize the footprint of the development;

- Minimize noise and disturbance associated with maintenance activities at the plant once it becomes operational;
- Use bird-safe structures (ideally with critical air gaps greater than 2 m), should above-ground power lines be used. Exclude birds physically from high risk areas of live infrastructure and comprehensively insulate such areas to avoid bird electrocution;
- Minimise the length of any above-ground power lines and mark all new lines with bird flight diverters. Mark above-ground lines for their entire length as there is currently insufficient data to indicate high risk areas. Recommendations from bird monitoring could indicate high risk areas to remain marked in the future. Where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line; and
- Instituting a comprehensive impact monitoring scheme, and using the results of this scheme to inform and refine a dynamic approach to mitigation.

d) Cumulative impacts

All the potential impacts identified above are likely to be enlarged should there be additional renewable energy projects in the area. Therefore the potential impact on birds is considered to be of medium-high magnitude, local extent and long term and therefore of medium-high (-) significance, without mitigation. With the implementation of mitigation measures for each potential project proposed in the area, this is anticipated to reduce to low-medium (-) significance.

4.2.3 Impact on fauna

Animals likely to be found on site and the surrounding environment are likely to include small antelope, mongoose, Black-backed Jackals, Caracal, snakes, etc. Various faunal species, or evidence of these animals, were observed during a site visit on 29 September 2011, namely Black Korhaan, Meerkat, Pied Crow, Steenbok and various pipits and larks. The farmer also indicated that Black-backed Jackal, Aardvark, Aardwolf, Brown Hyaena and Small Spotted Cat (also called the Black-Footed Cat) occur in the area. The International Union for Conservation of Nature (IUCN) Red List lists the Black Footed Cat as Vulnerable and the Brown Hyena is listed as Near Threatened (IUCN, 2011). The Black-footed Cat is a specialist of open, short grass areas with an abundance of small rodents and ground-roosting birds, and hence is likely to breed and feed in the area. The Brown Hyena is more likely to be an occasional visitor to the area as its presence would have been noticed by local farmers due to its relatively large size and it is likely the local farmers would have tried to kill any hyena based on common negative perceptions of this animal.

Black-footed cats are threatened primarily by habitat degradation by grazing and agriculture, as well as by poison and other indiscriminate methods of pest control (IUCN, 2011). Brown Hyena are often shot, poisoned, trapped and hunted with dogs in predator eradication or control programmes, or inadvertently killed in non-selective control programmes (IUCN, 2011).

Vegetation is generally accepted to be a proxy for biodiversity- the distribution of threatened species and communities is closely aligned with areas where indigenous vegetation has been extensively cleared (Department of the Environment, Water, Heritage and the Arts, 2008). As

the vegetation types on site are generally of fair condition and are widespread it is unlikely that other animals occurring within these vegetation types would be rare or endangered.

a) Impact assessment

The proposed project would have a footprint of approximately 300 ha or 11.42 % of the site. The density of the proposed project would also be very high, with project components, and in solar panels, located close together. The entire 300 ha would be cleared which would result in the disturbance of animals and / or habitats. However due to the mobility of fauna the impact is likely to be limited. Operation and maintenance of the proposed project would entail very few or rare on site activities and as such disturbance of animals and / or habitats are likely to be very limited. Existing human activities in the area are likely to have habituated most animals to the presence of humans and as such it is anticipated that any disturbance would result in animals leaving an area for a short period, if at all, and returning once the disturbance has passed. As such the potential impact of the proposed project on fauna is considered to be of low magnitude, local extent and long term (and therefore of **low (-)** significance, with or without mitigation for all alternatives.

b) Mitigation measures

The following mitigation measure is recommended:

- Small ground level openings, 20-30 cm in height, should be allowed for in the electrical fence to facilitate the movement of small mammals and reptiles through the site.

c) Cumulative impacts

Although a number of energy projects are proposed for the area, these are widely spaced apart and are unlikely to result in cumulative impacts on animals.

4.2.4 Impact on surface water resources

The study area falls within the D54D quaternary catchment and the Lower Orange water management area (part of the Hartbees River system). The site is generally flat to gently sloping, with drainage areas and a few endorheic (inward flowing) pans which contribute to the biodiversity of the area. These pans are an important wildlife habitat, particularly for birds (especially migratory birds), mammal species and invertebrates. Since the proposed solar energy facility would either pipe or truck water in from outside sources, water use of the water resource at the site would be insignificant. However, the additional water spilled to the soil surface from washing of solar panels has the potential to elevate soil erosion and / or alter soil chemistry. As such MacKenzie Ecological and Development Services was appointed to undertake an Aquatic Ecology Impact Assessment. A site visit was conducted on 8-10 November 2011. The study considered the aquatic ecology, delineation of riparian zones or wetlands, climate, geology and soils. The Aquatic Ecology Impact Assessment, and comment on the revised layout and technology alternatives, is included in **Annexure C**. The summary below includes findings and recommendations of the specialist.

Furthermore, SiVest SA (Pty) Ltd was also appointed to carry out a desktop study of the surface hydrology of the proposed site for the proposed project. In the absence of a comprehensive

geotechnical investigation, conclusions were drawn from a previous geotechnical investigation carried out on the adjacent property in August 2010.

a) Description of the environment

Numerous ridges and valley lines are located on the site, with all the valley lines draining in a westwards direction towards the adjacent Uitspan Pan farm. The area also includes pans that are typical endorheic[29] (see **Figure 4-3**) and ephemeral (seasonal) to various degrees. *P. glandulosa* (mesquite), an invasive alien plant, already exists on the farm and is associated with areas of elevated wetness and inundation i.e. is preferentially associated with wetland and riparian areas. *P. glandulosa* is a deep-rooted tree that utilises groundwater. *P. glandulosa* alters the species composition in its vicinity (by excluding indigenous flora) and promotes open, more erodible, sub-canopy areas. Due to its provision of shade, these areas also tend to get highly trampled by livestock which exacerbates potential erosion.

It is expected that the existing drainage valley line would host a 1:100 year flood. Modelling would be required to determine where the floodline lies as there is evidence of previous flooding along this drainage line.

Climate

The study area occurs in the Northern Cape near the town of Copperton. The area has an arid continental climate with a summer rainfall regime. Mean annual precipitation (MAP) is approximately 176 mm with peaks in late summer, usually in March. The region typically experiences hot days and cold nights with the average summer temperature of approximately 33 ºC and the average winter night time temperatures of approximately 1 ºC. Most of the rainfall is confined to summer and early autumn.

Figure 4-3 A typical endorheic pan with an unvegetated centre characterised by open sediments and boulders (J. MacKenzie, 8/11/2011)

[29] A class of wetland, DWA 2005

Geology

Soils are generally base-rich, weakly structured and shallow. They drain freely, usually with less than 15% clay and have characteristic high levels of salt (Mucina and Rutherford, 2006).

b) Impact assessment

The footprint of the proposed solar facility would result in the loss of 300 ha on the Farm Klipgats Pan. The proposed facility has the potential to change the water balance in the immediate vicinity since average annual rainfall is so low and panel washing activities would introduce additional water (which supersedes rainfall) to the runoff surface. Additional water to a cleared surface has the potential to erode surface substrates (presumably bare soil in this case), but would also result in a change in vegetation composition as vegetation (including alien species) would readily colonise the area due to elevated and regular soil moisture availability

Also, since the medium for washing would be water mixed with a mild detergent, the potential exists for altered water quality to nearby areas, depending on how runoff is dealt with and the exact dilution and chemical nature of the mix.

Consequently the overall impact of the proposed project on the study area's aquatic ecology is considered to be of medium magnitude, local extent and long term and therefore of **medium (-)** without mitigation, for all alternatives. With the implementation of mitigation measures the significance of the impact would reduce to **low (-)** for all alternatives.

In terms of stormwater management, the three potentially different methods of fixing the PV panels to the ground would determine the impact of surface stormwater and how it should be managed. The Fixed Axis System and Single Axis System are structures close to the ground and would require some bulk earthworks and clearing of existing vegetation to construct the terraces. The Dual Axis System would not require any bulk earthworks and removal of vegetation and minimal stormwater measures would be required.

The clearance of vegetation would increase the total volume of stormwater run-off emanating from the cleared area and may result in soil erosion. The volume of stormwater runoff from the site would also increase due to the large area covered by the impermeable surface area of the solar panels. Local scouring or erosion could occur beneath the solar panels where water falls directly from the solar panels on soil (without plant cover). Gravel access roads may also be vulnerable to erosion by stormwater run-off.

Considering the above, the potential impact of stormwater is considered to be of medium intensity, local extent, long term and therefore of **medium (-)** significance, without mitigation, for all alternatives. With the implementation of mitigation measures this impact would reduce to **very low (-)** for all alternatives.

c) Mitigation measures

This impact has both a quantity and quality component, and the severity of each depends on factors which are not exactly known, i.e. the potential of falling water to erode soils would depend on the nature of the application and the erodability of the substrate, and the alteration to soil chemistry would depend on the dilution and chemical nature of the washing medium.

The following mitigation measure is recommended:

- Monitoring, together with the development of an environmental management plan as operation proceeds will be the most effective strategy;
- Monitor both soil chemistry and erosion and mitigate if required;
- Implement erosion control measures should there be evidence of erosion;
- Should soil chemistry be affected (this is likely to be an increase in salinity), the nature of the washing mixture could be changed, or acceptable waste treatment employed;
- Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared, or where panel washing occurs;
- Install composting toilets that does not require water, septic tanks or soak-aways;
- Stormwater channels and "mitre" chutes should be constructed to direct the stormwater flows and minimize and control erosion. Each catchment covered by the site should have a separate drainage system and associated detention pond;
- Gravel roads should be graded and shaped with a 2 % crossfall back into the slope, allowing stormwater to be channelled in a controlled manor towards the natural drainage lines;
- Where roads intersect natural, defined drainage lines, suitably sized pipe culverts or drive through causeways should be installed or constructed;
- The minor storm design period should be used to determine the size of the earth channels. A return period of 1:5 years is applicable which approximates to an average intensity of 29 mm/hour; and
- The major storm occurrence (i.e. 1:25 year, 1:50 year & 1:100 year) should be used to calculate culverts in defined drainage lines and determine flood levels where necessary. The intensities for each occurrence are: 1:25 year – 45 mm/hour, 1:50 year – 52 mm/hour and 1:100 year – 60 mm/hour respectively.

d) Cumulative impacts

A number of other renewable energy applications are proposed in the general area, including a number of PV projects. Although these sites are distributed fairly widely, many would ultimately impact on the same drainage systems. However, since the proposed project will either pipe or truck water in from outside sources in order to wash the solar panels, water use of the water resource at the site will be insignificant. Monitoring, together with the development of an environmental management plan as operation proceeds, will be the most effective strategy to limit any cumulative impacts on the surrounding environment. Furthermore, with the implementation of the proposed mitigation measures it is considered unlikely that stormwater would significantly impact on these drainage systems. As such the cumulative impact is considered to be of low magnitude, local extent and long term and therefore of low (-) significance.

4.3 OPERATIONAL PHASE IMPACTS ON THE SOCIAL ENVIRONMENT

4.3.1 Visual impacts

The area surrounding the site is located at some 1 100 – 1 200 m above mean sea level. The area is gently undulating to flat, with a very gradual slope east to west. The landscape is

covered in shrubs with a few sparse trees. Any tall structures, such as existing powerlines, are visible for many kilometres. The potential therefore exists that the proposed PV plant and associated infrastructure would be visible from many kilometres away. As such Mrs Karen Hansen, a private consultant, was appointed to undertake a Visual Impact Assessment (VIA) to determine potential visual impacts of the proposed project. The site was assessed, and also general areas of the locality from where the site appeared to be likely to be visible during the months of November and December 2011. The VIA on the updated site layout is contained in **Annexure C**.

The VIA included a desktop survey of various maps and aerial photography. Terrain analysis software, Global Mapper, was also used to start the visual envelope definition process. A photographic survey of the site and parts of the surrounding areas was carried out and used to determine the extent of the visibility of the site. The findings and recommendations of the study are provided below.

e) Description of the environment

The overall landscape is defined as wide open, flat, remote, sparsely populated land, typical of the rural open plains of the Karoo. The landscape is covered in grasslands and scrub with few scrubs on site and few trees, apart from those planted around Copperton and the farmhouses. The dominant land use is agriculture with pasture mainly for sheep, goats and a few cattle.

The town of Copperton, a small settlement consisting of about 42 single storey houses and an estimated 1.5 km^2 in extent, is situated close to the mine. The disused copper mine is situated approximately 4 km to the north of the proposed site and occupies about 4.5 km^2. The remaining built structures consist of a tall mineshaft, a large, tall concrete shed, concrete storage tanks and unused lighting pylons. Existing vertical elements in the landscape are the lines of transmission pylons leading to and from existing substations, telegraph poles, the mine shaft and other tall and bulky remnant mine buildings. These bring some industrial character into this rural area.

Alkantpan is situated 13 km from the site, south west of Copperton and consist of a high security area with low concrete bunkers and low observation buildings. A few scattered farmsteads are within 5 km of the site, although not all are still regularly inhabited.

A landscape may be valued for many reasons, which may include landscape quality, scenic quality, tranquillity, wilderness value, or consensus about its importance either nationally or locally, and other conservation interests and cultural associations. The site landscape appears to have some value for its grazing. However the site does not have a strong or identifiable sense of place, although it would be valued to a degree for scenic remoteness. The 5 km viewshed considered for the proposed development includes transportation corridors, local places of habitation and work and includes the development site and peripheral areas, including Kronos, and the R357 and local gravel roads.

f) Impact assessment

The proposed development would consist of an extensive installation of PV panels installed south of the R357 in a rural area. Both the preferred and alternative sites are for a 100 MW plant that would occupy 300 ha. The development includes security fencing, internal roads,

single storey buildings, a transmission line and a sub-station. The proposed sites are situated 10 km from the settlement of Copperton, and 7 km from the abandoned mine.

The proposed development is a semi-industrial land use and would be located in an agricultural landscape, although there are industrial uses in the vicinity. The preferred site is located adjacent to the R357 and the alternative site approximately 1.5 km to the south of the R357. It would be especially visible to users of the R357 road. Furthermore, the preferred layout would consist of modules of 15.4 m high and 22 m wide or of approximately 4 m in height.

The degree to which the proposed project would be visible is determined by the height of the infrastructure and extent of the area under development. Visibility is moderated by the distance over which this would be seen, the weather and season conditions and some back-grounding effect from the environment. Factors affecting visibility are the open quality of the site and the surrounding land uses and land cover.

Visual exposure refers to the visibility of the site in terms of the capacity of the surrounding landscape to offer screening. This is determined by the topography, tree cover, built form, etc. In the case of both the proposed layout alternatives the visual exposure is high as there is little screening offered by the landscape.

The Zones of Visual Influence or Theoretical Visibility (i.e. the affected area) for the proposed project is considered to be high as it would influence the view and act as a visual focus. These zones or viewsheds are recorded in **Figure 4-4**.

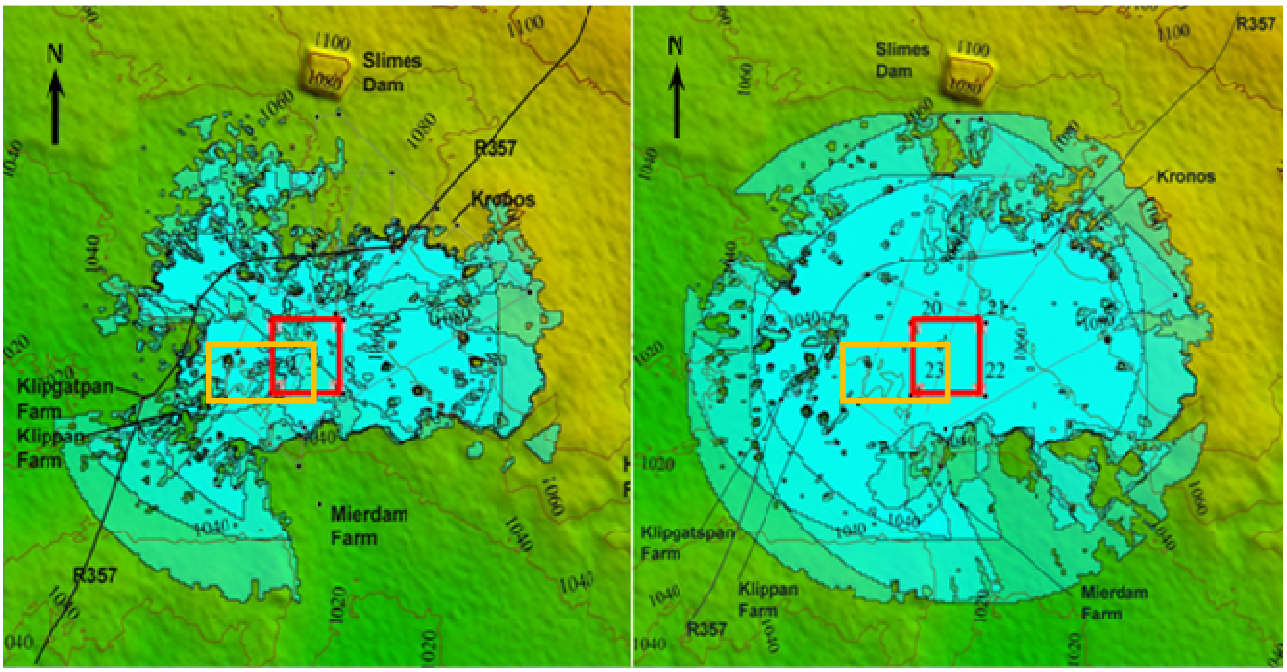

Figure 4-4 Maps showing the visual envelope calculated at a radius of 5 km with 4 m (left) and 15.4 m (right) high panels (K. Hansen, 2012[30])

[30] Note that these maps are the same for the preferred (orange) and alternative (red) layouts as no significance difference results for the location alternatives