PROPOSED PV9 SOLAR ENERGY FACILITY FOR THE HOEKPLAAS FARM NEAR COPPERTON

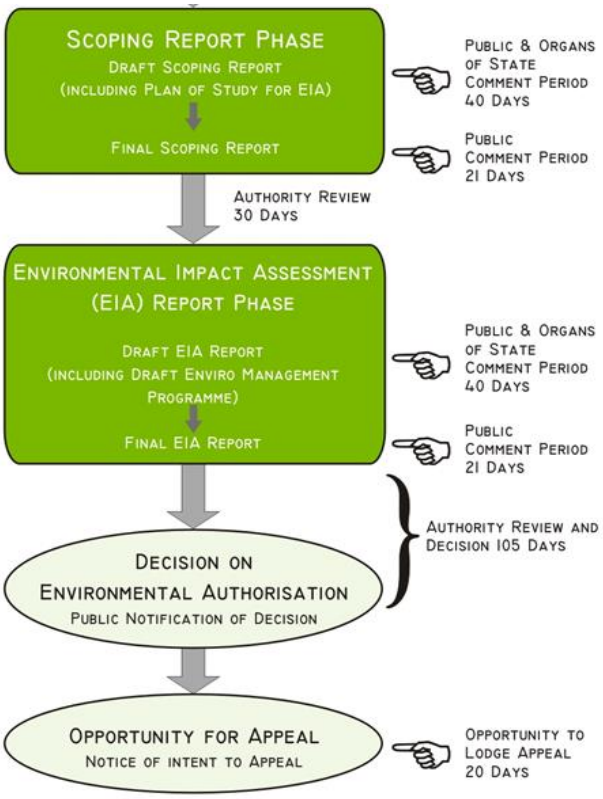
ENVIRONMENTAL IMPACT ASSESSMENT

Non-Technical Summary of the EIA Report

Hoekplaas Solar PV9 (Pty) Ltd proposes to construct a photovoltaic (PV) solar energy facility, namely PV9 on The Farm Hoekplaas No. 146, near Copperton in the Northern Cape to generate energy in a renewable manner. In terms of environmental legislation[1], an Environmental Impact Assessment (EIA) is required which the National Department of Environmental Affairs have to authorise for the proposed PV facility to go ahead. Aurecon South Africa (Pty) Ltd (Aurecon) is undertaking this EIA process to investigate potential environmental and socio-economic issues to facilitate the authority's decision making and to inform the design and operation of the proposed PV facility.

HOW DOES THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS WORK?

An EIA is a process that evaluates the environmental and socio-economic characteristics of proposed project and the consequences of the project on the environment and the people living in area that would be affected by the proposed project activities. Where negative impacts are likely to result the project, measures can be recommended to avoid lessen these impacts to a level where the impacts considered acceptable from an environmental and perspective. Where positive impacts are likely to from the project, measures can be recommended to increase these impacts. The EIA process also provides Interested and Affected Parties (I&APs) an opportunity to comment on the proposed project to be kept informed about decisions that may impact them or the environment. The various stages of the process are shown in the figure to the right.



This is a non-technical summary of the Revised Final EIA Report which includes:

- An introduction to the proposed PV facility and an overview of the legislative framework;
- An overview of the approach to the EIA describing the public participation to date;
- Description of the proposed PV facility and the alternatives considered, as well as the motivation for the proposed facility;
- A description of baseline information of the area and the potential impacts assessed; and
- Recommendations to mitigate potential impacts.

[1] Namely the National Environmental Management Act (Act No 107 of 1998) (as amended) (NEMA)

This non-technical summary cannot replace the comprehensive Revised EIA Report and it is recommended that the Revised Final EIA Report is reviewed for more detailed information.

WHY IS THE PV FACILITY NEEDED?

South Africa currently generates the majority of its required electricity from coal as indicated in Figure 1. South Africa has always been heavily dependent on coal and is currently looking at ways to diversify its power-generating capacity. Concerns on climate change; the on-going exploitation of non-renewable, resources and international pressure to increase renewable energy generation is motivation for diversification in power generation. Renewable energy recognized internationally as a major contributor in reducing the effects of climate change, as well as providing a wide range of environmental, economic and social benefits that can contribute towards long-term global sustainability. South Africa is subject to some of the highest levels of solar radiation in the world which is why the proposed PV facility is expected to contribute positively towards climate change mitigation. The establishment of the proposed PV facility would strengthen the existing electricity grid. Moreover, the project would contribute towards meeting the national energy target as set by the Department of Energy (DoE). The proposed project would also have international significance as they contribute to South Africa being able to meet some of its international obligations by aligning domestic policy with internationally agreed strategies and standards as set by the Kyoto Protocol and United Nations Convention on Biological Diversity, all of which South Africa is a signatory to.

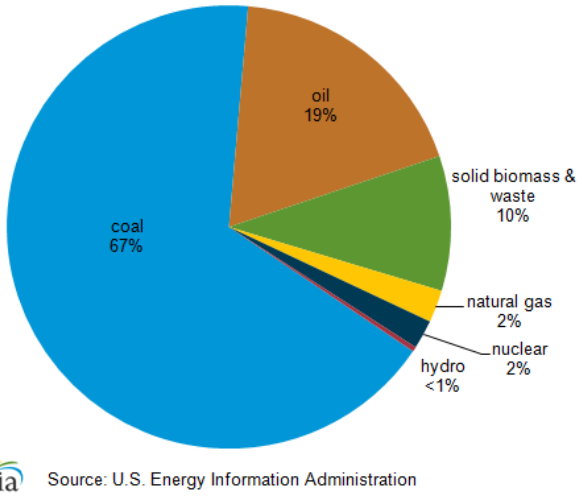


Figure 1 | Total primary energy supply in South Africa during 2010

HOW DOES A TYPICAL PV FACILITY WORK?

Solar panels capture light energy from the sun to generate electricity through a process known as the PV effect, where light energy energises electrons to produce electricity. There are various types of solar panels including, but not limited to, Concentrated photovoltaic (CPV), Concentrated solar power (CSP) and Conventional PV solar cells.

Figure 2 | Example of a PV facility in a landscape similar to Copperton

CPV technology makes use of optics such as lenses or curved mirrors to concentrate sunlight onto a small area of solar PV cells to generate electricity. This technology type converts the concentrated sunlight directly to electricity via the photovoltaic effect and is considered to be more cost effective than conventional PV solar cells. However, it does require active solar tracking to be effective. Similar to CPVs, ***CSP technology*** use mirrors or lenses to concentrate sunlight onto a small area to generate electricity directly via a heat engine, e.g. a steam turbine. ***Conventional PV technology*** on the other hand does not make use of any mirrors or lenses and generates electricity by converting solar radiation energy into a Direct Current (DC) which needs to be converted to an Alternating Current (AC) to connect to the

grid. The conventional PV and CPV technologies require significantly less water per day (19ℓ/MWh) than the CSP system which needs approximately 3,420ℓ/MWh of water per day during the operational period.

WHAT IS PROPOSED AND WHERE?

Mulilo propose to construct a PV facility (PV9) with a generation capacity of approximately 75MW and a footprint of approximately 259ha, on The Farm Hoekplaas No. 146 near Copperton in the Northern Cape. The proposed PV facility would consist of:

- **Transmission line**: 132kV Double Circuit overhead transmission line to connect the facility to the newly constructed Hoekplaas Solar PV10 Substation or an existing Eskom substation which is situated offsite (i.e. Kronos substation).
    - Hoekplaas Solar PV9 will connect to the grid via the F to A routing option. However if Hoekplaas PV10 is awarded an Environmental Authorisation (EA) and Preferred Bidder Status then the connection for PV8 would be A to C
- **Substation:** An onsite 132kV, six bay.
- **Roads**: Access and internal roads for servicing and maintenance of the facility will use routing XYQ if no other projects are awarded an EA and Preferred Bidder Status. If PV5 or PV7 are awarded an EA and Preferred Bidder Status the connection route would be YQ. No route would be required for PV9 in if PV8 or PV10 were awarded an EA and Preferred Bidder Status, as PV9 would then use these access roads
- **Boundary fence:** The facility would have an electrical or barbed wire fence for safety and security.
- **Buildings:** Buildings would likely include an onsite substation, a connection building, operational and maintenance building, guard cabin, an electrical substation and solar resource measuring substation. Shared infrastructure may occur if more than one project is awarded on the farm but cannot be confirmed at this stage.

Multiple PV facilities are proposed for Farm Hoekplaas and shared infrastructure may occur if more than one project is awarded:

- **Stormwater infrastructure:** Including, but not limited to, drainage spines, drainage channels, multiple apron outlets, detention areas and kinetic energy dissipaters.
- **Buildings:** Buildings would likely include an onsite substation, a connection building, operational and maintenance building, guard cabin, an electrical substation and solar resource measuring substation. Shared infrastructure may occur if more than one project is awarded on the farm but cannot be confirmed at this stage.

The following infrastructure can also be shared among the proposed PV facilities and received environmental authorisation in terms of the PV1[2] and PV4[3] projects on farm Hoekplaas:

- **Water supply infrastructure**: It is proposed that potable water would be obtained from the Alkantpan pipeline while negotiating sourcing of water from the local municipality.
- **Buildings:** Buildings would likely include Operations and Maintenance Building, guard cabin, an electrical substation and solar resource measuring substation to monitor the performance of the plant compared to the solar radiation.
- **Laydown areas:** Two laydown areas have been identified and one of these would be used during the construction phases of the proposed PV facility. This laydown area has already received authorisation under the authorised PV1 and PV4 facility

[2] DEA Ref. No. 12/12/20/2501 & NEAS Ref. No. DEAT/EIA/000611/2011
[3] DEA Ref. No. 14/12/16/3/3/2/495 & NEAS Ref. No.: DEA/EIA/0001756/2013

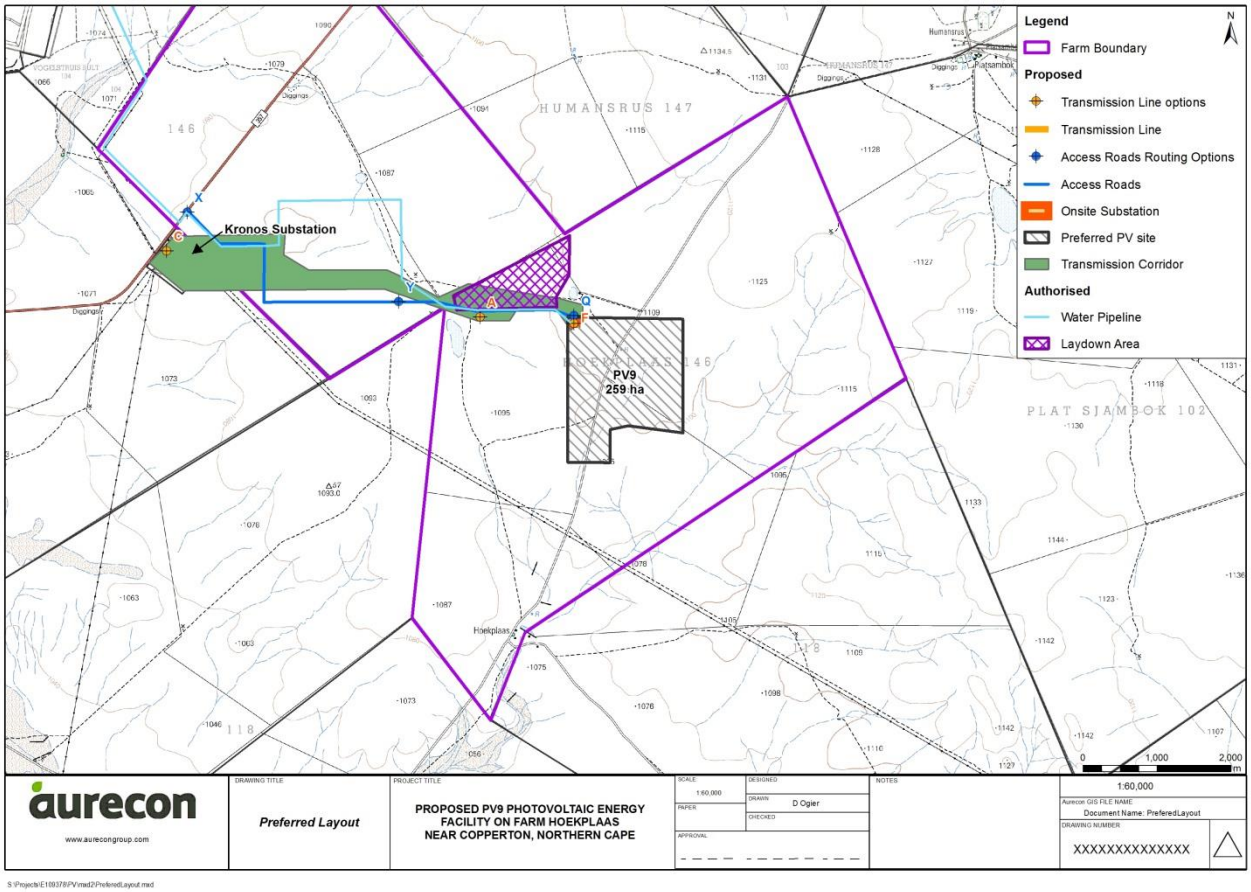


Figure 3 | Layout Alterative 1 (PV9 preferred)

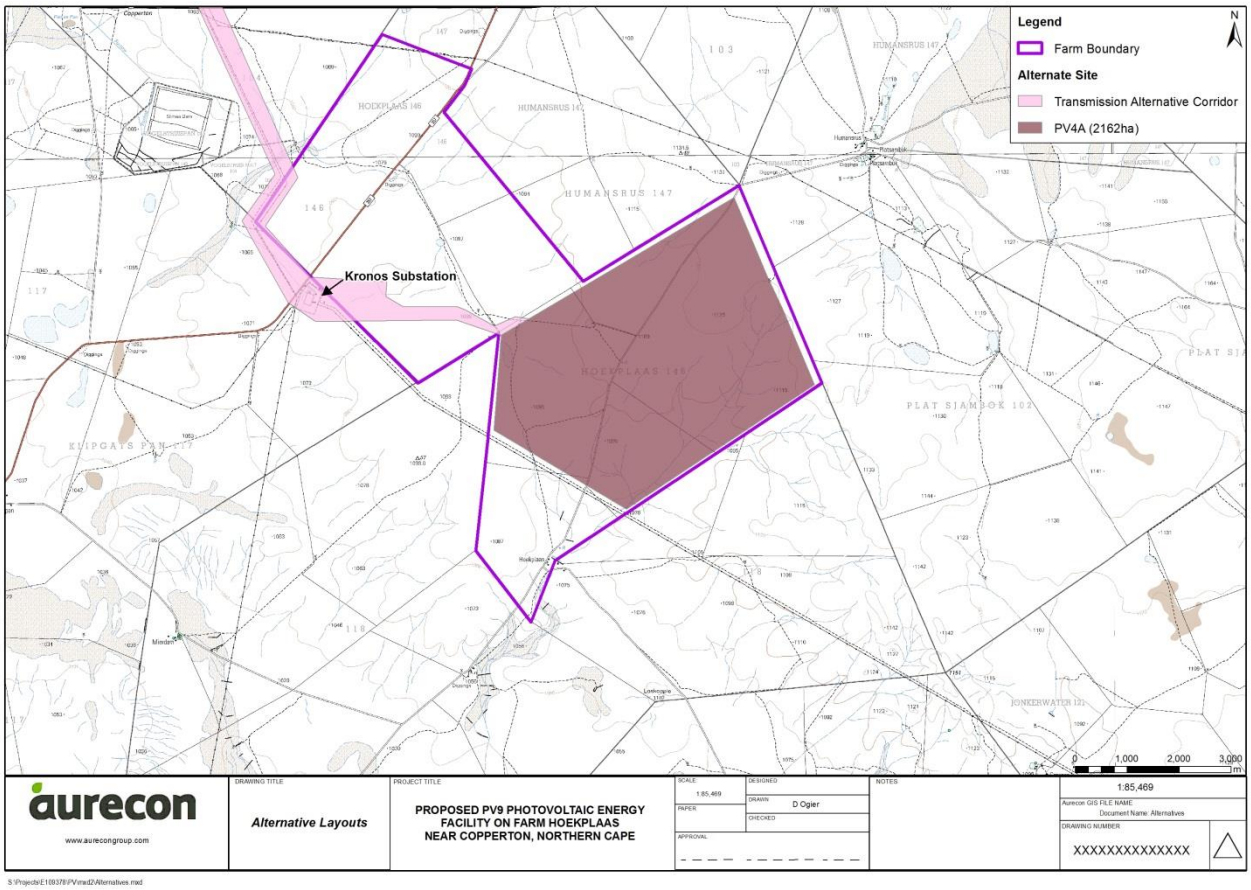


Figure 4 | Layout Alternative 2 (PV9A)

WHAT ALTERNATIVES ARE BEING CONSIDERED?

An important part of an EIA is to consider alternatives to achieve the most environmentally and socially responsible development. A number of project related alternatives were considered in this EIA, as outlined below:

Alternative Type	Description
Location alternatives	• One location for the proposed PV facility, i.e. The Farm Hoekplaas (No. 146)
Activity alternatives	• Solar energy generation via a PV facility • No-go" alternative to solar energy production
Site layout alternatives	• A 75MW PV facility (Layout Alternative 1) (PV9) • One PV facility with a generation capacity of 500MW, (Layout Alternative 2)(PV9A)
Technology alternatives	• Conventional PV vs. CPV technology • Single Axis vs. Fixed Axis PV tracking technology
Routing Alternative	• 132 kV transmission line connecting to the Kronos Substation (Route Alternative 1, preferred) • 132 kV transmission line connecting to the Cuprum Substation (Route Alternative 2)

Furthermore, in terms of the legislation, the alternative of no development have also been considered.

WHAT IMPACTS ARE EXPECTED?

The proposed PV facility and associated infrastructure could potentially result in a range of environmental and socio-economic impacts. The scoping phase identified the potential impacts that could be expected. Based on site specific characteristics, certain impacts would be more significant than others. The following potential impacts were identified:

- Impact on flora
- Impact on avifauna
- Impact on fauna
- Impacts on surface water resources, including sedimentation and erosion
- Impact on hydrology
- Impacts on palaeontology and heritage resources
- Social impacts (positive and negative) including impact on local economy (employment)
- Increased traffic
- Visual impacts
- Impact on agricultural resources
- Storage of hazardous substances on site
- Noise pollution
- Dust pollution
- Impact on energy production
- Impact on climate change
- Impact on surrounding land uses
- Cumulative impacts

During the EIA, a team of specialists assessed the significance of the potential impacts of the alternatives identified. This is done by means of specific methodology developed for assessment of significance of impacts, based on the specific characteristics of the site and the proposed PV facility. The findings are presented in the EIA and briefly described below.

Impact on flora

The study area falls within the Nama Karoo Biome with Bushmanland Basin vegetation type mainly found on site. This vegetation type is considered to be Least Threatened. The overall significance of potential impacts to the flora of the study area and the significance thereof is indicated below:

Layout Alternatives	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low (-)	Low (-)	Medium (-)	Very Low (-)	Low (-)	Low (-)

Layout Alternatives	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Cumulative	Low (-)					

* All alternatives assessed includes associated infrastructure

The following mitigation measures are recommended for the construction phase of all project alternatives:

- All construction activities shall be contained within the PV facility footprints to minimize disturbance outside these areas.
- Protected trees must be avoided or if that is not possible, permits must be obtained for removal and transportation. Any Aloe species, particularly *Aloe claviflora* shall be relocated if affected by the PV facility.

The following mitigation measures are recommended for the operational phase of all project alternatives:

- A rehabilitation plan for the site shall be compiled and implemented with the aid of a rehabilitation specialist.
- Shallow depressions, well defined pans and seasonal watercourses shall be avoided, with buffer zones of at least 30m around pans and from 'Leegte Shrubland'. Roads and transmission lines traversing such areas shall be avoided where possible and if not, physical impacts shall be limited as far as possible.

The following mitigation measures are recommended for the decommissioning phase of all project alternatives:

- All construction activities shall be contained within the PV facility footprint to minimize disturbance outside these areas.
- A rehabilitation plan for the site shall be compiled and implemented with the aid of a rehabilitation specialist.

Impact on avifauna

The broader impact zone of the proposed PV facility is contained within an extensive tract of undulating, remote, arid Bushmanland Karoo, while the immediate vicinity includes 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 following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 &2	Medium-High (-)	Low-Medium (-)	Medium-High (-)	Medium-High (-)	Medium-High (-)	Medium (-)
Cumulative	High (-)					

* All alternatives assessed includes associated infrastructure

Over and above the application of generic best-practice principles, the following mitigation measures are recommended for the construction phase of all project alternatives:

- Pre-construction monitoring shall be undertaken as part of the long term avifauna monitoring programme detailed in Annexure C of the Avifaunal Report.
- The construction footprint shall be kept to the minimum size required for development.
- Construction timeframes shall be reduced as much as possible.
- The entire length of all new lines shall be marked with bird flight diverters to avoid additional cost should this be retro-fitted post-construction based on the findings of the monitoring programme.

The following mitigation measures are recommended for the operational phase of all project alternatives:

- To protect the Martial Eagle nest site located on the western edge of Hoekpaas, it shall be necessary to relocate the nest site to a more distant, less disturbed area (e.g. Jenkins et al. 2007, 2013). The extent and distribution of other renewable energy developments planned for the immediate vicinity probably precludes a short-range relocation, and a dedicated structure, strategically situated off the power line network aggregated around the Kronos substation, may be the best option. The requirements of such an undertaking shall be further investigated during future visits to the site as part of the pre-construction monitoring programme.
- Development shall be excluded from areas / microhabitats identified during the bird monitoring programme as being of particular value to threatened / priority species (e.g. Red Lark, Sclater's Lark).
- Noise and disturbances associated with maintenance activities at the facility shall be kept to the minimum once it becomes operational.
- The length of all new power lines installed shall be kept to the minimum. Where possible transmission lines shall be buried. If lines cannot be buried, all new lines shall be marked with bird flight diverters (Jenkins et al. 2010) along their entire length.
- All new transmission line infrastructure shall be adequately insulated and bird friendly in configuration (Lehman et al. 2007).
- The minimum area shall be used for fencing, given that these may present a collision risk for collision-prone birds.
- A comprehensive impact monitoring programme shall be implemented of which the results shall be used to inform and refine a dynamic approach to mitigation. Details of this are set out in Annexure D.
- Should the results from the monitoring programme show that the cumulative impacts from the multiple renewable energy projects in the Copperton area are causing high negative impacts on bird species on a local and regional scale (i.e. beyond a radius of 10km from Hoekplaas), DEA shall be contacted to discuss the implementation of an integrated mitigation approach by all renewable energy facilities contributing to the cumulative negative impact on avifauna
- Specialist advice shall be sought in devising effective avian deterrents to minimize associated damage should conflict arise with local bird populations due to fouling of critical components, etc.

The following mitigation measures are recommended for the decommissioning phase of all project alternatives:

- Decommissioning timeframes shall be reduced as much as possible.
- Noise and disturbances associated with decommissioning activities shall be kept to the minimum.

Impact on fauna

The removal of vegetation could potentially result in habitat loss. Although any affected fauna would generally be largely mobile and would be able to relocate, this impact was nonetheless assessed. The following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low-Medium (-)	Low (-)	Low (-)	Low (-)	Low (-)	Very Low (-)
Cumulative	Medium (-)					

***** All alternatives assessed includes associated infrastructure

The following mitigation measures are recommended for the construction phase for all project alternatives:

- Compile and implement a vegetation rehabilitation plan with the aid of a rehabilitation specialist, for inclusion in the Construction EMP. The specialist is to recommend species to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal.
- Once construction is complete, disturbed areas shall be rehabilitated and maintained with appropriate local indigenous vegetation.
- The construction phase shall be closely monitored by an ECO who shall identify any areas requiring rehabilitation in the post-construction phase. The restoration of those areas must follow the construction phase.
- Demarcate no-go areas identified during pre-construction monitoring.
- Low-lying depressions and watercourses shall be avoided wherever possible.
- Shallow depressions and well defined pans shall be avoided and buffered by at least 30m.
- All endorheic pans shall be avoided with no construction within 30m of the pan.
- The site shall be cleared in sections as required for construction and not all at once.
- The top 300mm of the soil layer shall be stockpiled for rehabilitation purposes.
- Rehabilitation of completed sections with appropriate local indigenous vegetation shall start immediately and bare soil shall be covered by straw as protection against wind while vegetation re-establishes (or as required by the rehabilitation specialist).

The following mitigation measure is recommended for the operational phase for all project alternatives:

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

Impact on surface water resources

The study area falls within the arid region of South Africa. Average annual rainfall is low (189mm) and as such it is expected that few rivers and low groundwater tables will be found in the area. With few rivers draining the area, apart from the Orange River 42km east of the site, endorheic (inward flowing) pans occur. Pans are an important wildlife habitat, particularly for birds (especially migratory birds), mammal species and invertebrates. A small number of pans are located on the site. Numerous small dry drainage lines cross the area. Furthermore, it has been estimated that the 1:20 year flood peak for Alternative 1 would increase by 24% and for Alternative 2 with 46%. The increased flood peaks would increase the risk of a second breach of a farm dam and inundation of the main farmhouse and farm worker dwellings. The following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1	Medium (-)	Low (-)	Medium-High (-)	Low (-)	Medium (-)	Low (-)
Layout Alt.2	High (-)	Low (-)	Medium-High (-)	Low (-)	Medium (-)	Low (-)
Cumulative	Low – Very Low (-)					

* All alternatives assessed includes associated infrastructure

Potential stormwater mitigation measures in terms of the design of the system (as described in the preliminary Stormwater Management Plan included in **Annexure C**) must be considered and applied where applicable, including the following:

- The increase in flood peak should be reduced to pre-development levels before the runoff leaves the PV facility which could be achieved by using attenuation ponds.

- Discussions should be held with the landowner regarding flood risk implications pre- and post-development. Possible measures to manage flood risk which would require further investigation are:
  - the determination of the 1:100 year floodline for Hoekplaas farm house and other dwelling using a detailed survey;
  - improve the capacity of the spillway channel; and
  - protect the housing with a berm.

The following mitigation measures are recommended for the construction phase for all project alternatives:

- Should denudation be severe, rehabilitation of these areas shall be required and involve the establishment of vegetative cover comparable to surrounding indigenous vegetation. Planting grasses by means of seeds would likely be the easiest and quickest form of mitigation. It is critical that no alien species are used for re-vegetation.
- The area shall be inspected at regular intervals (as determined by the rehabilitation specialist) for the presence of alien species and these removed.
- Ephemeral drainage areas shall not be blocked such that the movement of water is impeded or diverted.
- Denuded areas and stockpiles of aggregates or soil shall be protected in such a way that erosion or sediment inputs to no-go areas during rainfall events are prevented.
- Straw barriers shall be installed in drainage paths to act as a check dam, i.e. to reduce velocity, and as a sediment trap during construction. These erosion barriers shall be placed at intervals of 25-50m apart in the drainage paths to intercept suspended solids from entering the natural drainage paths.
- Packed stone (also known as rip-rap) shall be placed as liners for channel spines (in consultation with an appropriately qualified aquatic specialist). These comprise packed stones with an average diameter of 100mm, packed in the channels as lining material to control flow velocities and hence erosion.
- Earth cut-off channels shall be provided at the boundaries of the facility to direct concentrated surface flow away from the site and reduce the possibility of flooding from runoff origination from outside the site (in consultation with an appropriately qualified aquatic specialist).
- Erosion protection shall be provided at channel outfalls and positions of high flow concentration. These comprise packed stones with an average diameter of 200mm, packed in the drainage path to control flow velocities and hence erosion.
- The sediment and erosion control measures shall remain in place until construction is complete and will require regular monitoring during construction and reinstatement as necessary.

The following mitigation measures are recommended for the operational phase for all project alternatives:

- Design requirements as determined by the Stormwater Management Plan.

The following mitigation measures are recommended for the decommissioning phase for all project alternatives:

- Vegetative cover comparable to surrounding indigenous vegetation shall be restored according to the rehabilitation plan developed by an appropriately qualified rehabilitation specialist. It is critical that no alien species are used for re-vegetation.
- The area shall be inspected for the presence of alien species and these shall be removed. This shall occur on an annual basis (or as determined by the rehabilitation plan) for at least the first three years following decommissioning.

Impact on heritage resources (including palaeontology)

In general the Karoo and Bushmanland area is documented to contain abundant stone artefacts from the Early (ESA) and Middle Stone Age (MSA), while occasional Later Stone Age (LSA) is also present. The site does not have any buildings or structures of heritage value, while the cultural landscape is composed of an ephemeral pan with gum trees, a windmill, water troughs and an old cement dam alongside it. The only fossils recorded from the Dwyka

succession in this region are ice-transported erratic boulders of Precambrian limestone or dolomite that contain small stromatolites (microbial mounds or columns). The following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 Archaeology	Low (-)	Very Low (-)				
Layout Alt.2 Archaeology	Low (-)	Very Low (-)	-	-	-	-
Cumulative - Heritage	Very Low (-)					
Cumulative – Palaeontology	Low (-)					

* All alternatives assessed includes associated infrastructure

The following mitigation measures are required for the construction phase for all project alternatives:

- Buffer zones of 90m shall be applied to all pans.
- All mitigation-worthy archaeological sites that are avoided by the development and are not mitigated shall be protected from incidental damage (for example from vehicles driving over them or through the establishment of power line access tracks).
- The ECO responsible for the development shall be aware of the possibility of important fossils (e.g. mammalian bones, teeth) being present or unearthed on site and should monitor all substantial excavations into superficial sediments as well as fresh (i.e. unweathered) sedimentary bedrock for fossil remains.
- The mitigation worthy archaeological site located within the most western laydown area shall be demarcated as a “no-go” area. Mitigation measures shall be implemented should it be found during construction that the site cannot be avoided.
- In the case of any significant fossil finds (e.g. vertebrate teeth, bones, burrows, petrified wood) during construction, these should be safeguarded - preferably in situ - and reported by the ECO as soon as possible to the relevant heritage management authority (SAHRA. Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) so that any appropriate mitigation (i.e. fossil recording, sampling or collection) by a palaeontological specialist can be considered and implemented, at the developer’s expense.
- The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g. data recording, fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).
- Once the exact alignments of the linear components of the project have been decided on these shall be examined by a heritage specialist and possibly subjected to a walk-down survey.

The following mitigation measures are required for the construction phase of Layout Alternative 1:

- All mitigation-worthy sites falling into areas to be impacted shall have archaeological mitigation in the form of excavation, sampling and analysis carried out. This only affects the centre of the farm (located at a laydown area). Some sites fall within the corridors identified for linear infrastructure and, once the exact layouts have been decided upon, these shall be mitigated if required. An estimate on the amount of time required on site for each archaeological site is indicated in Annexure D of the heritage report. Note that avoiding and protecting these sites is always preferred when feasible, but they are not of such a nature that their protection should be required.

The following mitigation measures are required for the construction phase of Layout Alternative 2:

- All mitigation-worthy archaeological sites that are avoided by the development and are not mitigated shall be protected from incidental damage (for example from vehicles driving over them or through the establishment of power line access tracks).

Impact on local economy (employment) and social conditions

The proposed PV facility would impact on the socio-economic *status quo* through job creation, indirect effects of additional workers onsite, impact of a non-local workforce on society and disruption or damage to adjacent properties. The following impacts are anticipated:

IMPACTS		CONSTRUCTION		OPERATION		DECOMMISSIONING	
		No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2		Low (-)	Low (-)	Low (+)	Low (+)	-	-
Layout Alt.1 & 2 (employment)		Low (+)	Low-Medium (+)	-	-	-	-
Cumulative	**Disruption or damage from non-local workforce**	Medium (-)		-		-	
	Direct Employment and Skills Development	High (+)		-		-	
	Economic Multiplier Effects; Landowner revenue; Diversification of the local economy	-		Medium-High (+)		-	

* All alternatives assessed includes associated infrastructure

The following mitigation measures are recommended for the construction phase for all project alternatives:

- A local employment policy shall be developed, implemented and audited and shall be accompanied by a training programme.
- Contractors shall be responsible for making available to sub-contractors the contact details for all the local businesses offering related goods and services.
- A comprehensive employee induction programme shall address land access protocols, fire management, etc. as discussed in the Life-cycle Environmental Management Plan (LEMP).
- The employee induction programme shall address issues such as HIV/AIDS and TB, as well as alcohol and substance abuse. The induction could also address a code of behaviour for employees that would align with community values.
- Incidences and complaints regarding noise and dust control shall be reported in a log book.

The following mitigation measures are recommended for the operational phase for all project alternatives:

- A local employment policy, as stated by the developer, shall be implemented and audited and accompanied by a training programme.
- A local procurement policy shall be adopted to maximise benefits to the local economy and minimise leakage.

Impact on traffic

Construction vehicles are likely to make use of the existing roads to transport equipment and material to the construction site. These vehicles would include 450 truckloads transporting 900 x 40-foot containers, up to five digger loaders for land clearing and five to ten trucks with cranes to assemble the facility. The following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low (-)	Low (-)	Low (-)	Low (-)	-	-
Cumulative	Medium (-)					

* All alternatives assessed includes associated infrastructure

The following mitigation measures are recommended throughout the project life-cycle for all project alternatives:

- Ensure that road junctions have good sightlines.
- Implement traffic control measures where necessary.
- Transport components overnight as far as possible.
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts, etc. are scheduled.

Impact on visual aesthetics

The general topography of the Copperton 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 facility and associated infrastructure would be visible from many kilometres away. The following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	High (-)	Medium-High (-)	High (-)	High (-)	High (-)	Low (-)
Route Alt.1	Medium (-)	Medium (-)	Medium (-)	Medium (-)	Medium (-)	Low (-)
Route Alt.2	Medium (-)	Medium (-)	Medium (-)	Medium (-)	Medium (-)	Low (-)
Cumulative	Low (-)					

* All alternatives assessed includes associated infrastructure

It must be noted that there are a number of other energy-related projects proposed for the immediate surrounds which would significantly alter the surrounding landscape character.

The following mitigation measures are recommended for the construction phase for all project alternatives:

- Good traffic management measures shall be implemented.
- Local residents shall be kept informed of activities.
- Access roads shall be kept clean, and measures shall be taken to minimise dust from construction traffic on gravel roads.
- Surface material shall be scraped off, conserved and used for rehabilitation. The remainder could be used for site development, and any surplus shall be disposed of in a manner that appears natural.
- If possible, lay-down area(s) should be located outside of direct view of the R357 and shall be screened with shade cloth.
- Site offices and structures shall be limited to single storey and sited carefully to reduce visual intrusion. Colours shall reflect hues of the surrounding vegetation and / or the ground. Roofs shall be grey and non-reflective. Doors and window frame colour shall reference either the roof or wall colours.

- Litter shall be regarded as a serious offence and no contaminants shall be allowed to enter the environment by any means.
- Road construction and management shall take run-off into consideration in order to prevent soil erosion.
- The top 300mm of naturally occurring substrate shall be separated and then spread over finished levels.
- The developer shall be required to ensure that the footprint areas of all impact sites utilised in construction but not in operation, are rehabilitated and re-vegetated.
- The fencing shall be grey in colour and located as close as possible around the PV site. If possible, natural water ways and drainage lines indicated as sensitive should not be fenced in.
- The PV footprint shall maintain a 100m buffer from the R357. The fence shall not be within 50m of the R357.
- No construction works shall to be undertaken at night or during weekends.

The following mitigation measures are recommended for the operational phase for all project alternatives:

- Good management practices and dust control measures shall be adhered to.
- All lighting shall be kept to a minimum within the requirements of safety and efficiency.
- Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, shall be used.
- No naked light sources shall be directly visible from a distance. Only reflected light shall be visible from outside the site.
- Necessary aircraft warning lights shall be installed as per the relevant authority requirements.
- External lighting shall consist of down-lighters shielded in such a way as to minimise light spillage and pollution beyond the extent of the area that needs to be lit.
- Security and perimeter lighting shall be shielded so that no light falls outside the area needing to be lit. Excessively tall light poles shall be avoided.
- Repairs shall be carried out promptly and the site buildings and perimeter fence shall be kept tidy.

The following mitigation measures are recommended for the decommissioning phase for all project alternatives:

- All PV structures, associated structures and fencing shall be removed and recycled.
- Internal roads shall be ripped and then rehabilitated.
- All impacted footprint areas shall be rehabilitated and re-vegetated.

Impact on land capability and erosion potential

The proposed PV facility could result in the loss of agricultural land and degradation of soil resources. Even though the areas directly affected by the proposed developments have low agricultural value and capability, the activities still have the potential to negatively impact the immediate and surrounding soil and land resources. The following impacts are anticipated:

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low (-)	Low (-)	Medium (-)	Very Low (-)	-	-
Route Alt.1 & 2 Transmission lines	Very Low (-)	Very Low (-)	Very Low (-)	Very Low (-)	-	-
Cumulative	Medium (-)					

* All alternatives assessed includes associated infrastructure

The following generic mitigation measures are recommended for the construction phase for all project alternatives:

- A planned phased approach shall be adopted.
- Normal agricultural activities shall continue in unaffected areas.
- Stocking rates shall be temporarily reduced during the construction phase in order to reduce the risk of overgrazing of the remaining land portions.
- Land rehabilitation and re-vegetation shall commence immediately upon completion of construction.
- The soil erosion monitoring and management plan included in the LEMP shall be implemented.

The following mitigation measures are recommended for the operation phase for all project alternatives:

- Initiate land rehabilitation and re-vegetation as soon as possible and continue to monitor land for early signs of degradation and erosion.
- It is recommended that more palatable species form part of the re-vegetation plan to enable faster stocking initiation.
- Rotational grazing of small stock (sheep and goats) shall be permitted within the PV site. It is recommended that the PV site is used as rotational grazing camps. The remaining, un-impacted land can continue to function as un-improved grazing land, its current use.

Noise pollution

Noise will be generated during the construction operation and decommissioning phases of the proposed project. Construction and decommissioning activities are often similar. Potential sources of noise during the construction phase are increased traffic, operation of heavy machinery during the construction period and additional people in the area.

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low (-)	Very Low (-)	Low (-)	Very Low (-)	Low (-)	Very Low (-)
Cumulative	Very Low (-)					

* All alternatives assessed includes associated infrastructure

The following generic mitigation measures are recommended for the construction phase for all project alternatives:

- Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities shall be located well away from noise sensitive areas.
- Stationary noisy equipment such as compressors and pumps shall be encapsulated in acoustic covers, screens or sheds where possible. Portable acoustic shields shall be used in the case where noisy equipment is not stationary (i.e. angle grinders, chipping hammers).
- Vehicles shall avoid unnecessary use of the reverse gear to minimise annoyance caused by reverse sirens. Consideration of alternative safety measures may be necessary when taking such a measure.
- All diesel powered equipment shall be regularly maintained and kept at a high level of maintenance. This shall particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment shall serve as trigger for withdrawing it for maintenance.
- Truck traffic shall be routed away from noise sensitive areas, where possible.
- Noisy operations shall be combined so that they occur where possible at the same time.
- Instruction of employees on low-noise work methods, for example, the handling of structural steel and the use radiotelephony rather than shouting for communication.

- Machines in intermittent use shall be shut down in the intervening periods between work or throttled down to a minimum.
- Construction activities shall be contained to reasonable hours during the day and early evening.
- Night-time activities near noise sensitive areas shall not be allowed. No construction shall be allowed on weekends.
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor shall liaise with local residents and owners on how best to minimise impact, and the local population shall be kept informed of the nature and duration of intended activities.

The following generic mitigation measures are recommended for the operational phase for all project alternatives:

- The design of all major plant components shall incorporate all the necessary acoustic design aspects required to ensure that the generated noise level from the proposed PV facility does not exceed the SANS 10103 maximum equivalent continuous day / night rating level (LRdn) of 70dBA for industrial areas at the project boundary.
- The design shall also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the project boundary. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than what is considered as acceptable in SANS 10103.
- The design process is to consider, inter alia, the following aspects:
  - The position and orientation of buildings on the site.
  - The design of the buildings to minimise the transmission of noise from the inside to the outdoors.
  - The insulation of particularly noisy plant and equipment.
  - All plant, equipment and vehicles are to be kept in good repair.
  - Where possible, very noisy activities shall not take place at night.

Dust

Solar technologies results in negligible emissions since no fuels are combusted. However, air pollution in the form of dust emissions would occur during the construction phase.

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Medium (-)	Low (-)	Medium (-)	Low (-)	Medium (-)	Low (-)
Cumulative	Very Low (-)					

* All alternatives assessed includes associated infrastructure

The following mitigations are provided to address potential dust generation throughout the project lifecycle:

- During construction, 80% of the construction footprint shall remain vegetated and be brush cut to a height of 40-50 cm to ensure foliage are left on shrubs.
- Water sprays shall be applied at the area to be cleared should significant amounts of dust be generated. Moist topsoil would reduce the potential for dust generation when tipped onto stockpiles.
- Ensure travel distance between clearing area and topsoil piles to be at a minimum.
- Ensure exposed areas remain moist through regular water spraying during dry, windy periods.
- Reshape all disturbed areas to their natural contours.
- Cover disturbed areas with previously collected topsoil and replant native species.

Impact on energy production

The proposed PV facility would be able to provide power to assist in meeting the energy demand within South Africa. The potential impact of the proposed project on energy production is considered to be low (+) significance, without or with mitigation measures, and therefore no mitigation measures are recommended.

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	-	-	Low (+)	Low (+)	-	-
Cumulative	Low (+)					

* All alternatives assessed includes associated infrastructure

Storage of hazardous substances

Hazardous substances would be stored on site during the operational phase. These substances may include amongst other things, hydrocarbons (i.e. fuel), curing compounds, shutter oil, and cement. The use of hazardous substances at a site is controlled by various pieces of legislation. Approximately 500ℓ of fuel and 50ℓ of lubrication oil would be stored on site. This volume falls well below the triggers as listed activity in terms of NEMA.

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low (-)	Very Low (-)	Low (-)	Very Low (-)	Low (-)	Very Low (-)
Cumulative	Low (-)					

* All alternatives assessed includes associated infrastructure

The following mitigation measures are proposed in the LEMP:

- The management and protection of the environment would be achieved through the implementation of the LEMP, which *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage.
- Typical mitigation measures include storage of the material in a bunded area, with a volume of 110% of the largest single storage container or 25% of the total storage containers whichever is greater, refuelling of vehicles in designated areas that have a protective surface covering and utilisation of drip trays for stationary plant.

Impact on climate change

The establishment of PV facility would reduce South Africa's future reliance on energy from coal-fired power stations which could in turn reduce the future volume of greenhouse gases emitted to the atmosphere, reducing the greenhouse effect on a regional, national and international scale. Given the number of PV facility proposed across the country, the potential reduction in future greenhouse gas emissions is considered to be of regional extent, low magnitude and long term, and therefore of medium (+) significance.

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	-	-	Low (+)	Low (+)	-	-

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Cumulative	Medium (+)					

* All alternatives assessed includes associated infrastructure

Impact on surrounding land uses

The predominant surrounding land use is agriculture. However a few other land uses exist and the proposed project could impact on these surrounding land uses. Furthermore, Hoekplaas falls within the general astronomy advantage area and is located approximately 13km north of a SKA station. The proposed PV facility could thus potentially impact on the SKA projects. The two major mechanisms that would result in detrimental effects on radio astronomy observations by PV facility are (1) electromagnetic interference generated from the power generation equipment and (2) broadband interference which would result in a complete shutdown of radio astronomy observations.

Based on the information available the potential impact is considered to be of low magnitude, regional extent and long term and therefore of low (-) significance, without mitigation for all alternatives. Note that the confidence in this impact is considered to be Unsure. No difference in significance would result from the proposed alternatives. The confidence level of this impact would change once a detailed impact analysis is undertaken together with the SASPO.

IMPACTS	CONSTRUCTION		OPERATION		DECOMMISSIONING	
	No Mitigation	With Mitigation	No Mitigation	With Mitigation	No Mitigation	With Mitigation
Layout Alt.1 & 2	Low (-)	Low (-)	Low (-)	Low (-)	Low (-)	Low (-)
Cumulative	Additional studies and co-ordination with SASPO					

* All alternatives assessed includes associated infrastructure

Cumulative Impacts

Copperton has some of the highest renewable energy resource levels in the world, with good existing road infrastructure and accessibility to the national grid through Kronos and Cuprum substations. As a result a number of renewable energy facilities are proposed for the Copperton area, with one PV facility already in operation. In addition, the applicant already has environmental authorisations for Hoekplaas PV1 and PV4 and is also proposing PV2, PV3, PV5 PV8, and PV10 on the same farm, each of which has its own inherent impact profile, contributing to the net aggregate impact of the entire proposed development. In order to determine the significance level of anticipated cumulative impacts the various specialists considered all other projects within 20km of the site.

Receptor (VEC)	Project activity	Vector / Impact	Impact on receptor	Cumulative impact	Significance with mitigation
Flora	• Vegetation clearance • Earthworks • Stockpiles • Construction spills and leaks • Construction traffic	• Loss of natural vegetation • Loss of ecological processes • Fragmentation • Alien invasion	Habitat degradation or loss. This may diminish the ability to provide ecosystem services.	If development of renewable facilities continues to grow as planned in the Copperton area this would result in further loss of Bushmanland Basin Shrubland and relevant connections with biodiversity and ecosystem services.	**Low (-)**
Avifauna	• Construction traffic • Operational traffic • Vegetation clearance	• Disturbance • Displacement • Habitat loss • Mortality	Terrestrial and aquatic biodiversity may suffer from habitat degradation or loss. This may diminish the ability to provide ecosystem services.	Resultant loss of biodiversity and ecosystem services.	**High (-)***
Fauna	• Construction traffic • Operational traffic • Vegetation clearance	• Disturbance • Displacement • Habitat loss • Mortality	Terrestrial and aquatic biodiversity may suffer from habitat degradation or loss. This may diminish the ability to provide ecosystem services.	Resultant loss of biodiversity and ecosystem services.	**Low (-)**
Surface water and hydrology	• Design of drainage for access roads • Design of stormwater retention ponds • Design of PV panel technology	• Formation of barriers to drainage areas • Destruction (clearing and levelling) of no-go areas • Erosion and/or sediment inputs to no-go areas • Increased invasion by alien species, • Waste water reticulation and removal • Stormwater run-off impacts • Increased surface water runoff from panel washing activities • Increased flood peaks • Increased surface erosion in denuded area	Impacts on surface water quality in the study area; Modifications of the natural drainage characteristics and changes in drainage flows; risk of flooding.	Resultant widespread water pollution (sedimentation) and modification of the hydrological regime.	**Low (-) to very low (-).**
Palaeontology	• Construction activities • Earthworks	• Loss of Palaeontological resources	Impacts on Palaeontological resources in the study area.	Although there is low palaeontological sensitivity of the bedrocks (Dwyka Group, Precambrian basement rocks) throughout the Copperton region there is potential with the increased numbers of facilities.	**Low (-)**
Heritage	• Construction activities • Earthworks	• Loss of Archaeological resources • Change in Cultural landscape	Impacts on archaeological and cultural resources in the study area.	Loss of any significant LSA sites would impact on knowledge of the wider region.	**Very low (-)**

Receptor (VEC)	Project activity	Vector / Impact	Impact on receptor	Cumulative impact	Significance with mitigation
Social-economic	• Construction traffic • Construction activities • Construction workforce	• Indirect effects of additional workers on site • Impacts of a non-local workforce on society • Disruption or damage to adjacent properties • Impact on local and regional tourism as a result of visual intrusion	Impacts on socio-economic conditions at a regional and/or national scale.	Negative impacts of additional workers on site and non-local workforce in the local communities.	**Medium-high (-)**
	• Construction activities and	• Direct Employment and Skills Development • Economic Multiplier Effects • Landowner revenue • Diversification of the local economy		Significant potential in the contracting and installation sectors, followed by the opportunity to harness further economic benefits through manufacture of the PV components locally (within South Africa).	**High (+)**
	• Operation of facility				**Medium – high (+)**
Traffic	• Construction traffic • Component Transport traffic	• Congestion • Delays • Incidents and accidents • Road damage	Drivers may be negatively impacted by the additional construction traffic using the network roads some of which are in poor condition. Associated air and noise impacts.	Future development is likely to result in additional construction traffic which could have additional negative impacts on the road condition and for vehicle drivers. Future growth would also bring more vehicles onto the existing road network.	**Medium (-)**
Visual	• Construction traffic • Component Transport • Construction activities • Operation of facility	• Hauling and delivery of PV parts and construction materials • Location of access road • Visual disturbance of construction site and laydown area • Movement of construction vehicles with lights • Construction of trenches for cables • Construction of PV facility and buildings • Construction of transmission lines • Completion of site works and fencing • Maintenance visits using existing road access • Visual impact of installation • Site buildings and perimeter fence • Impact of transmission line	Impact of similar renewable energy projects in the area resulting in possible landuse conflicts related to rapid and large scale landscape change.	Change in current landscape to a node for energy development increases.	**Low (-)**

Receptor (VEC)	Project activity	Vector / Impact	Impact on receptor	Cumulative impact	Significance with mitigation
Agriculture	• Vegetation clearance • Earthworks • Stockpiles	• Loss of agricultural potential • Alien invasion • Loss of topsoil	Loss of agricultural potential.	Resultant loss of agricultural productivity, specifically grazing potential.	**Low (-)**
Soil and Groundwater	• Storage of hazardous materials during construction and operation	• Potential contamination of soil and groundwater	Soil and groundwater are important VEC's in the area given the scarcity of water and farming activities. Contamination of these VEC's will affect receptors as it will further reduce an already scarce resource.	Cumulative contamination of soil and groundwater.	**Very low (-)**
Noise	• Construction and operation of the facility	• Noise during construction as a result of traffic, equipment, and plant • Noise generated by equipment during operation	The potential for cumulative noise impacts exist near major roads. Other industrial type noise sources are distant enough from the projects that cumulative impacts are unlikely.	Negative impact of construction and operational noise on receptors.	**Very low (-)**
Dust Pollution	• Dust generated through construction activities	• Increase in dust	Air quality to be impacted by additional dust.	Dust generated during construction would impact on air quality. Dust could also result in a nuisance for nearby receptors.	**Very low (-)**
Energy production	• Operation of facility	• Increased Energy diversification • Harnessing an area with high renewable resource potential	Current deficient electricity supply and increasing demands.	Provision of electricity to the national grid reducing reliance on coal powered stations while strengthening the grid with additional capacity.	**Medium (+)**
Surrounding land uses	• Construction activities and Operation of facility	• Change in predominant land use.	Loss of sense of place and impact on the SKA.	Change land use from agricultural to renewable hub. Interference with SKA where currently few EMF generators exist currently.	**To be determined through additional studies and consultation with SASPO**

PROPOSED WAY FORWARD

Based on the outcome of this EIA, we are of the opinion that the proposed PV facility should be authorised as the incremental local and regional benefits outweigh negative impacts and the proposed project substantially meets the NEMA principles as well as the Need and Desirability criteria. The significance of negative impacts can be reduced with effective and appropriate mitigation. If authorised, the implementation of an LEMP should be included as a Condition of Approval.

The recommendation of this EIA is to authorise the following project alternatives:

Alternative Type	Description
Location	• The Farm Hoekplaas No. 146
Activity	• Solar energy generation via a PV facility
Site layout	• 75MW PV facility (Layout Alternative 1 (PV9))
Technology	• Conventional PV • Single Axis PV tracking technology
Routing	• 132 kV transmission lines connecting to the Kronos Substation (Route Alternative 1)

WHAT IS PUBLIC PARTICIPATION AND HOW DO YOU GET INVOLVED?

Public participation is an important part of the EIA process, as it allows the public to get information about the proposed project, to view documentation, to make input and voice any concerns.

The full Final EIA Report, which included all the PV projects proposed on farm Hoekplaas, was made available for review from **22 November 2013 until 12 December 2013** at the following venues:

- Prieska (Elizabeth Vermeulen) Public Library;
- Ietznietz Guest House in Copperton; and
- Accessible from the Aurecon website (www.aurecongroup.com – please change the current location to "South Africa" and follow the "public participation"- link).

This approach was initially decided on as the impacts for each project is similar and it made the assessment of cumulative impacts easier. However DEA rejected the approach for various reasons contained in a letter dated 21 February 2014 (see Annexure J of this report) and requested separate reports for each of the applications, as well as a 40 day public review period. A request was submitted to DEA on 17 February 2015 to reduce the public review period to 21 days. Approval was obtained on 25 February 2015 (see Annexure B).

Authorities and I&APs are therefore provided with 21-days from **26 March 2015 until 20 April 2015** to review the Revised Final EIA report and are invited to submit comments in writing to the Aurecon team. All comments will be forwarded to DEA to inform their decision-making.

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