Report No: 5949a/107516

PROPOSED PHOTOVOLTAIC ENERGY PLANT ON STRUISBULT FARM NEAR COPPERTON, NORTHERN CAPE

(DEA Ref. No. 12/12/20/2502 & NEAS Ref. No. DEAT/EIA/0000606/2011)

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT
APRIL 2012

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GLOSSARY OF TERMS

Environment	The surroundings (biophysical, social and economic) within which humans exist and that are made up of i. the land, water and atmosphere of the earth; ii. micro-organisms, plant and animal life; iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing;
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action.
Environmental Impact Report Assessment (EIAR)	A report assessing the potential significant impacts as identified during the Scoping phase.
Environmental impact	An environmental change caused by some human act.
Environmental Management Programme (EMP)	A document that provides procedures for mitigating and monitoring environmental impacts, during the construction, operation and decommissioning phases.
Photovoltaic (PV)	Method to convert solar radiation into direct current electricity[1].
Public Participation Process	A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, programme or development
Scoping	A procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined in detail
Scoping Report	A report describing the issues identified
Wetland	"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils." (SA Water Act of1998).

[1] http://en.wikipedia.org/wiki/Photovoltaics (Accessed on: 21/10/2011)

ABBREVIATIONS

BID	Background Information Document
CRR	Comments and Response Report
DEA	Department of Environmental Affairs (previously Department of Environmental Affairs and Tourism)
DEA&DP	Department of Environmental Affairs and Development Planning
DEANC	Department of Environmental Affairs and Nature Conservations
DEAT	Department of Environmental Affairs and Tourism
DM	District Municipality
DME	Department of Minerals and Energy
DSR	Draft Scoping Report
EAP	Environmental Assessment Practitioner
EAPSA	Environmental Assessment Practitioner of South Africa
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
GN	Government Notice
ha	Hectares
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IEC	International Electro-technical Commission
IEIM	Integrated Environmental Information Management
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt
LM	Local Municipality
MW	Megawatts
NEAS	National Environmental Authorisation System
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No. 25 of 1999)
NIRP	National Integrated Resource Plan
NWA	National Water Act (No 36 of 1998)
PPA	Power Purchase Agreement
PV	Photovoltaic
REFIT	Renewable Energy Feed-In Tariffs
SAHRA	South African Heritage Resources Agency
SACNSP	South African Council for Natural Scientific Professions
SDF	Spatial Development Framework
ToR	Terms of Reference
VIA	Visual Impact Assessment
WMA	Water Management Area

Updating of the Draft EIAR to the Final EIAR

Minor changes have been made to the Draft Environmental Impact Assessment Report (Draft EIAR) to update the document to the Final Environmental Impact Assessment Report (Final EIAR), as well as address comments raised by I&APs. Information that has been added is underlined, while removed / deleted information is indicated by a 'strikethrough', i.e. '~~report~~'.

1 INTRODUCTION AND BACKGROUND

The purpose of this Chapter is to introduce the project and describe the relevant legal framework within which the project takes place. Other applicable policies and guidelines are also discussed. The Terms of Reference, scope of and approach to the Environmental Impact Assessment are described and assumptions and limitations are stated.

1.1 INTRODUCTION

Mulilo Renewable Energy (Pty) Ltd (Mulilo) proposes to construct a photovoltaic (PV) solar energy plant on a farm, near Copperton in the Northern Cape. Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the requisite environmental process as required in terms of the National Environmental Management Act (No. 107 of 1998), as amended, on behalf of Mulilo.

This Environmental Impact Assessment (EIA) is for a proposed 100-300 MW PV plant on the farm Struisbult (Farm No. 104 Portion 1, also known as Vogelstruisbult) near Copperton (see **Figure 1.1**). The plant would have a footprint of 300-900 ha and connect to the Cuprum substation by means of a new 132 kV distribution line.

In terms of the National Environmental Management Act (No. 107 of 1998) (as amended) (NEMA), the proposed development triggers a suite of activities, which require authorisation from the competent environmental authority before they can be undertaken. As this proposed project triggers a number of listed activities in terms of NEMA, it accordingly requires environmental authorisation. Since the project is for the generation of energy, and energy projects are dealt with by the national authority, the competent authority is the national Department of Environmental Affairs (DEA). DEA's decision will be based on the outcome of this EIA process.

The EIA Phase is the last phase in the EIA process. Accordingly, this EIA Report (EIAR)[2] aims to collate, synthesise and analyse information from a range of sources to provide sufficient information for DEA to make an informed decision on whether or not the potential environmental impacts associated with the proposed project are acceptable from an environmental perspective (the EIA process and sequence of documents produced as a result of the process are illustrated in **Figure 1.2**). Accordingly the EIAR:

- Outlines the legal and policy framework;
- Describes the Public Participation Process undertaken to date;
- Describes strategic and planning considerations;
- Describes the proposed project and its alternatives;
- Describes the assessment methodology used; and
- Assesses potential impacts and possible mitigation measures.

[2] Section 31 of EIA Regulation No. 543 of NEMA lists the content required in an EIAR.

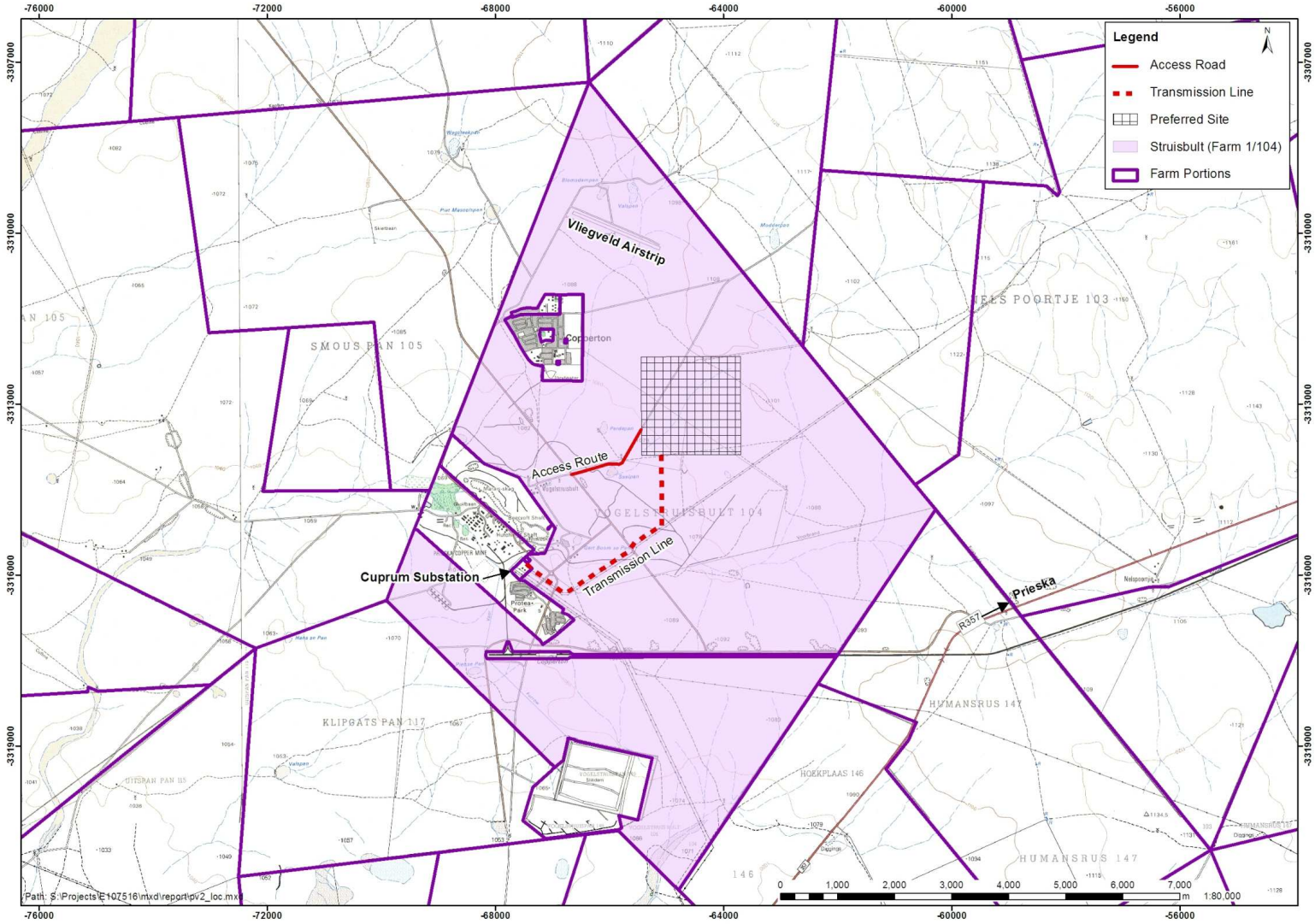

Figure 1.1 Location of the proposed PV plant near Copperton, Northern Cape (2922 CD)

1.2 LEGAL REQUIREMENTS

1.2.1 National Environmental Management Act, No. 107 of 1998

NEMA, as amended, establishes the principles for decision-making on matters affecting the environment. Section 2 sets out the National Environmental Management Principles which apply to the actions of organs of state that may significantly affect the environment. Furthermore, Section 28(1) states that "every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring". If such pollution or degradation cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution or degradation.

Mulilo has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA. In developing the EIA process, Aurecon has been cognisant of this need, and accordingly the EA process has been undertaken in terms of NEMA and the EIA Regulations promulgated on 18 June 2010[3].

In terms of the EIA regulations, certain activities are identified, which require authorisation from the competent environmental authority, in this case DEA, before commencing. Listed activities in Government Notice (GN) No. 545 require Scoping and EIA whilst those in GN No. 544 and 546 require Basic Assessment (unless they are being assessed under an EIA process). The activities being applied for in this EIA process are listed in **Table 1.1**.

Table 1.1 Listed activities in terms of NEMA GN No. 544, 545 and 546, 18 June 2010, to be authorised for the proposed PV plant

NO.	LISTED ACTIVITY
GN No. R544, 18 June 2010	
10	The construction of facilities or infrastructure for the transmission and distribution of electricity - • outside urban areas or industrial complexes with a capacity of more than 33 , but less than 275 kilovolts; or • inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.
GN No. R545, 18 June 2010	
1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.
GN No. R546, 18 June 2010	
14	The clearance of an area of 5 hectares or more of vegetation where 75 % or more of the vegetation cover constitutes indigenous vegetation (a) in the Northern Cape (i) All areas outside urban areas.

[3] GN No. R 543, 544, 545, 546 and 547 in Government Gazette No. 33306 of 18 June 2010.

Since the proposed project is based in the Northern Cape, DEA will work closely with the provincial Department of Environmental Affairs and Nature Conservation (DEANC), to ensure that the provincial environmental concerns are specifically identified and addressed.

Further information on the EIA approach is provided in **Section 1.4**.

1.2.2 National Heritage Resources Act, No. 25 of 1999

In terms of the National Heritage Resources Act (No. 25 of 1999) (NHRA), any person who intends to undertake "*any development … which will change the character of a site exceeding 5 000 m^2 in extent*", *"the construction of a road…powerline, pipeline…exceeding 300 m in length"* or *"the rezoning of site larger than 10 000 m^2 in extent…"* must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken.

Section 38(8) of the NHRA specifically excludes the need for a separate HIA where the evaluation of the impact of a development on heritage resources is required in terms of an EIA process. Accordingly, since the impact on heritage resources would be considered as part of the EIA process outlined here, no separate HIA would be required. SAHRA or the relevant provincial heritage agency would review the EIA reports and provide comments to DEA, who would include these in their final environmental decision. However, should a permit be required for the damaging or removal of specific heritage resources, a separate application would have to be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity, if Mulilo obtains authorisation and makes the decision to pursue the proposed project further.

1.2.3 Astronomy Geographic Advantage Act, No. 21 of 2007

The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.

Chapter 2 of the act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following:

- Restrictions on use of radio frequency spectrum in astronomy advantage areas;
- Declared activities in core or central astronomy advantage area;
- Identified activities in coordinated astronomy advantage area; and
- Authorisation to undertake identified activities.

On 19 February 2010, the Minister of Science and Technology (the Minister) declared the whole of the territory of the Northern Cape province, excluding Sol Plaatjie Municipality, as an astronomy advantage area for radio astronomy purposes in terms of Section 5 of the Act and on

20 August 2010 declared the Karoo Core Astronomy Advantage Area for the purposes of radio astronomy.

The area consists of three pieces of farming land of 13 407 ha in the Kareeberg and Karoo Hoogland Municipalities purchased by the National Research Foundation. The Karoo Core Astronomy Advantage Area will contain the MeerKAT radio telescope and the proposed core planned Square Kilometre Array (SKA) radio telescope that will be used for the purposes of radio astronomy and related scientific endeavours. South Africa, along with Australia, has been shortlisted to host the world's largest telescope, the SKA. South Africa's bid proposes that the core of the telescope be located in an arid area of the Northern Cape, with about three antenna stations in Namibia, four in Botswana and one each in Mozambique, Mauritius, Madagascar, Kenya and Zambia[4]. A final decision on the location is expected to be made in early 2012 by the SKA Board of Directors.

The proposed plant falls outside of the Karoo Core Astronomy Advantage Area, but inside the general astronomy advantage area.

The Minister may still declare that activities prescribed in Section 23(1) of the Act may be prohibited within the area, such as the construction, expansion or operation of any fixed radio frequency interference sources and the operation, construction or expansion of facilities for the generation, transmission or distribution of electricity. It should be noted that solar energy facilities are unlikely to cause radio frequency interference. While the Minister has not yet prohibited these activities it is important that the relevant astronomical bodies are notified of the proposed project and provided with the opportunity to comment on the proposed project.

1.2.4 National Water Act, No. 36 of 1998

The National Water Act (NWA) (No. 36 of 1998) provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.

In terms of Section 21 (c) and (i)[5] of the NWA any activity which takes place within 500 m radius of the boundary of any wetland is excluded from the General Authorisation for these water uses and as such, must be licenced. Should the proposed development occur within 500 m radius of a wetland (including ephemeral pans such as are found on site) it may be necessary to submit a water use license application to the Department of Water Affairs (DWA). If a water use licence application is required it would fall outside of the scope of this EIA and would be addressed by Mulilo as part of their broader project planning. Comment will also be sought from DWA as part of the Scoping and EIA process.

[4] http://www.ska.ac.za/bid/index.php (Accessed on: 19/10/11)
[5] (c) impeding of diverting the flow of water in a watercourse; (i) altering the bed, banks, course or characteristics of a watercourse.

1.2.5 Conservation of Agricultural Resources Act, No. 43 of 1983

The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) makes provision for the conservation of the natural agricultural resources of South Africa through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of the water sources, protecting vegetation, and combating weeds and invader plants. Regulation 15 of CARA lists problem plants (undesired aliens, declared weeds, and plant invaders). Plants listed in this regulation must be controlled by the landowner.

As part of the EIA process, recommendations have been made to ensure that measures are implemented to maintain the agricultural production of land, prevent soil erosion, and protect any water bodies and natural vegetation on site. Mulilo together with the relevant landowners should also ensure the control of any undesired aliens, declared weeds, and plant invaders listed in the regulation that may pose as a problem as a result of the proposed PV plant.

1.2.6 Other applicable legislation and policies

This section provides an overview of the policy and legislative context in which the development of renewable energy projects takes place in South Africa. The following policies and legislative context are described:

- White Paper on the Energy Policy of the Republic of South Africa (1998);
- White Paper on Renewable Energy (2003);
- National Energy Act (2008);
- National Electricity Regulation Act (2006);
- Integrated Energy Plan for the Republic of South Africa (2003);
- Integrated Resource Plan (2011);
- National Integrated Resource Plan for Electricity (2002);
- Independent Power Producer (IPP) Procurement Process; and
- Policies regarding greenhouse gas and carbon emissions.

a) White Paper on the Energy Policy of the Republic of South Africa (1998)

As required by the Constitution of the Republic of South Africa (Act No. 108 of 1996), the White Paper on the Energy Policy of the Republic of South Africa (1998) was published by the Department of Minerals and Energy in response to the changing political climate and socio-economic outlook. Key objectives are identified in terms of energy supply and demand, as well as co-ordinated with other social sectors and between energy sub-sectors.

The White Paper commits to government's focused support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications. With the aim of drawing on international best practice, specific emphasis is given to solar and wind energy sources, particularly for rural and often off-grid areas.

While considering the larger environmental implications of energy production and supply, the White Paper looks into the future to adopting an integrated resource planning approach,

integrating the environmental costs into economic analysis. It is with this outlook that the renewable energy, including wind energy, is seen as a viable, attractive and sustainable option to be promoted as part of South Africa's energy policy towards energy diversification.

b) White Paper on Renewable Energy (2003)

Published by the Department of Minerals and Energy (DME) in 2003, the White Paper on renewable Energy supplements the above-mentioned Energy Policy which identified the medium- and long-term potential for renewable energy as significant. The White Paper sets out the vision, policy principles, strategic goals and objectives in terms of renewable energy. At the outset the policy refers to the long term target of "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013."* The aim of this 10-year plan is to meet this goal via the production of mainly biomass, wind, solar and small-scale hydro sources. It is estimated that this would constitute approximately 4 % of projected energy demand for 2013.

The White Paper presents South Africa's options in terms of renewable energy as extensive and a viable and sustainable alternative to fossil fuel options. A strategic programme of action to develop South Africa's renewable energy resources is propose, particularly for power generation and reducing the need for coal-based power generation. The starting point will be a number of initial investments spread across both relatively low cost technologies, such as biomass-based cogeneration, as well as technologies with larger-scale application, such as solar water heating, wind and small-scale hydro.

Addressing environmental impacts and the overarching threats and commitments to climate change, the White Paper provides the platform for further policy and strategy development in terms of renewable energy in the South African energy environment.

c) National Energy Act (No. 34 of 2008) and Electricity Regulation Act (No. 4 of 2006)

South Africa has two acts that direct the planning and development of the country's electricity sector:

i. The National Energy Act (No. 34 of 2008); and
ii. The Electricity Regulation Act (ERA) (No. 4 of 2006).

In May 2011, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an Independent Power Producer (IPP) Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy[6].

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) (see **Section 1.5.6.f**) has been developed by the DoE and sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the

[6] http://www.eskom.co.za/c/73/ipp-processes/ (Accessed on: 29/10/11)

technologies and projects listed in the IRP and all IPP procurement programmes will be undertaken in accordance with the specified capacities and technologies listed in the IRP[7].

d) IPP Procurement Process

South Africa aims to procure 3 725 MW capacity of renewable energy by 2016 (the first round of procurement). This 3 725 MW is broadly in accordance with the capacity allocated to renewable energy generation in IRP2010.

On 3 August 2011, DoE formally invited interested parties with relevant experience to submit proposals for the finance, operation and maintenance of renewable energy generation facilities adopting any of onshore wind, solar thermal, solar photovoltaic, biomass, biogas, landfill gas or small hydro technologies for the purpose of entering, *inter alia*, an Implementation Agreement with DoE and a Power Purchase Agreement with a buyer (Eskom)[8] in terms of the ERA. This Request for Qualification and Proposals (RFP) for new generation capacity was issued under the IPP Procurement Programme. The IPP Procurement Programme has been designed to contribute towards the target of 3 725 MW and towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa[9].

In terms of this IPP Procurement Programme, Bidders will be required to bid on tariff and the identified socio-economic development objectives of DoE. The tariff will be payable by the Buyer should the project be selected. Although earlier information was that the 2009 Renewable Energy Feed In Tariff would act as an upper limit on price, the actual caps are set out in **Table 1.2**[10]. A bid will be 'non-compliant' and automatically rejected during the qualification phase if the price cap is exceeded. Bid Responses which are submitted must be accompanied by a Bid Guarantee in the form of a bank guarantee for an amount equal to R 100 000 per MW of the proposed installed capacity[11].

The generation capacity allocated to each technology is set out in **Table 1.2**

Table 1.2 Generation capacity and price cap per each technology

Technology	MW	Price cap (per MWh)
Onshore wind	1 850	R 1 150
Concentrated solar thermal	200	R 2 850
Solar photovoltaic	1 450	R 2 850
Biomass solid	12.5	R 1 070
Biogas	12.5	R 800
Landfill gas	25	R 600
Small hydro	75	R 1 030
Small projects[12]	100	As above
TOTAL	**3 725**	

[7] http://www.eskom.co.za/c/73/ipp-processes/ (Accessed on: 29/10/11)
[8] http://www.ipp-renewables.co.za/wp-content/uploads/2011/08/Tender_Notice.png (Accessed on: 30/10/11)
[9] http://www.ipp-renewables.co.za/ (Accessed on: 30/10/11)
[10] http://www.nortonrose.com/knowledge/publications/54959/south-africa-renewable-energy-ipp-request-for-proposals (Accessed on: 30/10/11)
[11] http://www.ipp-renewables.co.za/wp-content/uploads/2011/08/Tender_Notice.png (Accessed on: 30/10/11)
[12] Small projects are less than 5 MW.

Each project procured in terms of this IPP Procurement Programme will be required to achieve commercial operation by not later than 2016.

The submission and selection dates for projects for the RFP are given in **Table 1.3**.

Table 1.3 Bid submission dates, selection of preferred bidders and signing of agreements[13]

Submission no.	Submission date	Preferred bidder selection date	Signing of agreements date
First	4 November 2011	25 November 2011	19 June 2012
Second	5 March 2012	14 May 2012	13 December 2012
Third	20 August 2012	29 October 2012	31 May 2013
Fourth	4 March 2013	14 May 2013	13 December 2013
Fifth	13 August 2013	21 October 2013	26 May 2014

The selection process to determine the preferred bidders will be based on both price and other economic development criteria in a 70 %/ 30 % ratio respectively (Creamer, T. 2011). If the maximum MW allowance for any particular technology has been allocated during any particular window, then the subsequent bidding opportunities will not be opened for that technology.

IPPs that wish to connect to Eskom's network will be required to apply for a connection, pay a connection charge and sign a connection and use-of-system agreement[14]. All IPPs will be provided non-discriminatory access to Eskom's network, subject to the IPP's obtaining its required approvals such as EIA's and a generating and trading licence from NERSA.

e) Integrated Energy Plan for the Republic of South Africa

Commissioned by DME in 2003, the Integrated Energy Plan (IEP) aims to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic developments, ensuring security of supply and minimising the associated environmental impacts.

The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP concluded that, based on energy resources available in South Africa, coal would be the primary fuel source in the 20 year planning horizon, which was specified as the years 2000 to 2020, although other cleaner technologies continue to be investigated as alternatives in electricity generation options. Therefore, though the next two decades of energy generation are anticipated to remain coal-based, alternative technologies and approaches are available and need to be contextually considered.

[13] http://www.ipp-renewables.co.za/?page_id=524 (Accessed on: 30/10/11)
[14] http://www.eskom.co.za/c/article/150/independent-power-prodicers-ipp/ (Accessed on: 30/10/11)

f) Integrated Resource Plan

The Integrated Resource Plan (IRP) is a National Electricity Plan, which is a subset of the Integrated Energy Plan. The IRP is also not a short or medium-term operational plan but a plan that directs the expansion of the electricity supply over the given period.

The IRP, indicating the schedule for energy generation programmes, was first gazetted on 31 December 2009. A revised schedule was gazetted on 29 January 2010 and the schedule has once again been revised and the final IRP (IRP2010-2030) was gazetted on 6 May 2011.

Developed for the period of 2010 to 2030, the primary objective of the IRP2010, as with its predecessors, is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. While promoting increased economic development through energy security, the IRP2010 aims to achieve a "*balance between an affordable electricity price to support a globally competitive economy, a more sustainable and efficient economy, the creation of local jobs, the demand on scarce resources such as water and the need to meet nationally appropriate emission targets in line with global commitments*".

As can be seen by **Table 1.4** below the current final IRP provides for an additional 14 749 MW (shaded in grey) of renewable energy in the electricity mix in South Africa by 2030.

The final IRP2010 reflects both the consultation process on the draft IRP2010 currently being undertaken with stakeholders and the further technical work undertaken in this period. It is noted that *"given the rapid changes in generation technologies and pricing, especially for "clean" energy sources, the IRP will have to be reviewed on a regular basis, for instance every two years, in order to ensure that South Africa takes advantage of emerging technologies. This may result in adjustments in the energy mix set out in the balanced revised scenario within the target for total system capacity."*

Table 1.4 Policy adjusted scenario of the IRP2010 as gazetted on 6 May 2011

	Total generating capacity in 2030		Capacity added (including committed) from 2010-2030		New (uncommitted) capacity options from 2010-2030	
Technology	**MW**	**%**	**MW**	**%**	**MW**	**%**
Coal	41 074	45.9	16 383	29.0	6 250	14.7
OCGT	7 330	8.2	4 930	8.7	3 910	9.2
CCGT	2 370	2.6	2 370	4.2	2 370	5.6
Pumped Storage	2 912	3.3	1 332	2.4	0	0
Nuclear	11 400	12.7	9 600	17.0	9 600	22.6
Hydro	4 759	5.3	2 659	4.7	2 609	6.1
Wind	9 200	10.3	9 200	16.3	8 400	19.7
CSP	1 200	1.3	1 200	2.1	1 000	2.4
PV	8 400	9.4	8 400	14.9	8 400	19.7
Other	890	1.0	465	0.8	0	0
Total	**89 532**	**100**	**56 539**	**100**	**42 539**	**100**

g) National Integrated Resource Plan for Electricity

The National Integrated Resource Plan (NIRP) for Electricity is a long-term electricity capacity plan which defines the need for new generation capacity for the country. The National Energy Regulator of South Africa (NERSA) published NIRP1 in 2002, which was replaced by NIRP2 in 2005. The outcome of the NIRP2 determined that coal would remain the major fuel for generating electricity over the next 20 years and that additional energy generation facilities would be required from 2007 onwards. The NIRP is replaced by the Integrated Resource Plan (IRP), described in **Section 1.2.4.f** above.

h) Policies regarding greenhouse gas and carbon emissions

Gases that contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH_4), water vapour, nitrous oxide, chlorofluorocarbons (CFCs), halons and peroxyacylnitrate (PAN). All of these gasses are transparent to shortwave radiation reaching the earth's surface, but trap long-wave radiation trying to leave the earth's surface. This action leads to a warming of the earth's lower atmosphere, resulting in changes in the global and regional climates, rising sea levels and extended desertification. This in turn is expected to have severe ecological consequences and a suite of implications for mankind.

Electricity generation using carbon based fuels is responsible for a large proportion of carbon dioxide (CO_2) emissions worldwide. In Africa, the CO_2 emissions are primarily the result of fossil fuel burning and industrial processes, such coal fired power stations. South Africa accounts for some 38 % of Africa's CO_2 emissions. The global per capita CO_2 average emission level is 1.23 metric tonnes. In South Africa however, the average emission rate is 2.68 metric tonnes per person per annum. The International Energy Agency (2008) estimates that nearly 50% of global electricity supplies will need to come from renewable energy sources in order to halve CO_2 emissions by 2050 and minimise significant, irreversible climate change impacts

The United Nations Framework Convention on Climate Change (UNFCCC) has initiated a process to develop a more specific and binding agreement on the reduction of greenhouse gas (GHG) emissions. This led to negotiations with a particular focus on the commitments of developed countries, and culminated in the adoption of the Kyoto Protocol in 1997, which came into effect in February 2005. Using the above framework to inform their approach, the Kyoto Protocol has placed specific legal obligations in the form of GHG reduction targets on developed countries and countries with 'Economies in Transition'. The developed countries listed in Annex 1 of the UNFCCC are required to reduce their overall emissions of six GHGs by at least 5 % below the 1990 levels between 2008 and 2012. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly. More recently under the Copenhagen Accord 2010, countries representing over 80 % of global emissions have submitted pledges on emission reductions. South Africa's commitment is to reduce GHG emissions 34 % by 2020 and 42 % by 2025.

The Kyoto Protocol, to which South Africa is a signatory, was informed by the principles of sustainable development which resulted in related policies and measures being identified to promote energy efficiency while protecting and enhancing the 'sinks and reservoirs' of greenhouse gases (forests, ocean, etc.). Other methods/approaches included encouraging

more sustainable forms of agriculture, in addition to increasing the use of new and renewable energy and the adoption/implementation of advanced and innovative environmentally sound technologies. South African policies are being informed by the Kyoto Protocol (which is valid until 2012) and its partial successor the Copenhagen Accord 2010 and associated sustainable development principles whereby emphasis is being placed on industries for 'cleaner' technology and production.

1.3 TERMS OF REFERENCE AND SCOPE OF THE EIA

In October 2011, Mulilo appointed Aurecon to undertake an EIA process, in terms of NEMA, for the proposed PV plant near Copperton in the Northern Cape.

This EIA process specifically excludes any upgrades of existing Eskom infrastructure (i.e. the existing grid) that may be required but does include new connections to the grid.

1.3.1 Guidelines

This EIA process is informed by the series of national Environmental Guidelines[15] where applicable and relevant:

- Integrated Environmental Information Management (IEIM), Information Series 5: Companion to the NEMA EIA Regulations of 2010 (DEA, 2010);
- Implementation Guidelines: Sector Guidelines for the EIA Regulations (draft) (DEA, 2010);
- IEIM, Information Series 2: Scoping (Department of Environmental Affairs and Tourism (DEAT), 2002);
- DEAT. 2002. IEIM, Information Series 3: Stakeholder Engagement (DEAT, 2002);
- IEIM, Information Series 4: Specialist Studies (DEAT, 2002);
- IEIM, Information Series 11: Criteria for determining Alternatives in EIA (DEAT, 2004);
- IEIM, Information Series 12: Environmental Management Plans (DEAT, 2004);
- Integrated Environmental Management Guideline Series, Guideline 4: Public Participation, in support of the EIA Regulations. Unpublished (DEAT, 2005); and
- Integrated Environmental Management Guideline Series, Guideline 7: Detailed Guide to Implementation of the Environmental Impact Assessment Regulations. Unpublished (DEAT, 2007).

The following guidelines from the Department of Environmental Affairs and Development Planning (Western Cape) (DEA&DP) were also taken into consideration:

- DEA&DP. 2011. Guideline on Alternatives, EIA Guideline and Information Document Series. (DEA&DP, October 2011);
- DEA&DP. 2011. Guideline on Need and Desirability, EIA Guideline and Information Document Series. (DEA&DP, October 2011); and

[15] Note that these Guidelines have not yet been subjected to the requisite public consultation process as required by Section 74 of R385 of NEMA.

- DEA&DP. 2011. Guideline on Public Participation, EIA Guideline and Information Document Series. (DEA&DP, October 2011).

1.4 APPROACH TO THE PROJECT

As outlined in **Figure 1.2** there are three distinct phases in the EIA process, as required in terms of NEMA, namely the Initial Application Phase, the Scoping Phase and the EIA Phase. This report covers the third phase, *viz.* the EIA Report Phase.

1.4.1 Initial Application Phase

The Initial Application Phase entailed the submission of an EIA Application Form to notify DEA of the project, on 3 October 2011. Acknowledgement of receipts of the EIA Application Form was received from DEA on 19 October 2011. The Application Form and DEA's letters of acknowledgement were included in the Scoping Report.

1.4.2 The Scoping Phase

Scoping is defined as a procedure for determining the extent of, and approach to, the EIA Report Phase and involves the following key tasks:

- Involvement of relevant authorities and Interested and Affected Parties (I&APs);
- Identification and selection of feasible alternatives to be taken through to the EIA phase;
- Identification of significant issues/impacts associated with each alternative to be examined in the EIA Report; and
- Determination of specific terms of reference for any specialist studies required in the EIA Report (Plan of Study for the EIA Report).

The Scoping Phase involved a desktop review of relevant literature, including a review of previous environmental studies in the area. These included, *inter alia*, the following:

- Pixley ka Seme Integrated Environmental Management Program (IEMP)(African EPA, 2007);
- Pixley ka Seme District Municipality Spatial Development Framework (SDF) (2007);
- Siyathemba IEMP (African EPA, 2007);
- Vegetation Map of South Africa (Mucina & Rutherford, 2006);
- Proposed Solar Farm, Prieska. Draft Environmental Impact Assessment Report (EIAR) (DJ Environmental Consultants, 2010);
- Proposed Construction of a Wind Farm and Photovoltaic (PV) Plant near Prieska, Northern Cape Province of South Africa. Draft Scoping Report (SiVEST, 2011);
- Proposed Wind Energy Facility near Copperton, Northern Cape: Final Scoping Report. Report No. 5357A/ 106563 (Aurecon, 2011); and
- Proposed Wind Energy Facility near Copperton, Northern Cape: Draft Environmental Impact Report. Report No. 5748/106563 (Aurecon, 2012).

Other tasks undertaken included:

- 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 2011;
- Erection of a site notice at the entrance to Farm Struisbult on 8 November 2011;
- Lodging the Draft Scoping Report (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 until 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. 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;
- The Final Scoping Report (FSR) was made available to the public for review and comment until 7 February 2012 at the same locations as the DSR from 18 January 2012. Registered I&APs were informed of the FSR public comment period via a letter dated 16 January 2012 which was emailed and/or posted. An Executive summary together with an update page in English and/or Afrikaans was also emailed and/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;
- The FSR outlined the full range of potential environmental impacts and feasible project alternatives and how these were derived. Moreover, it included a Plan of Study for EIA, which outlined the proposed approach to the current EIA Phase, including the requisite specialist investigations to be undertaken; and
- The FSR and associated Plan of Study for EIA was submitted to DEA on 16 January 2011 and accepted on 24 February 2011 (see **Annexure A** for a copy of the acceptance letter).

An inception field trip was held on 28 and 29 September 2011 with the Aurecon EIA team and various landowners. The purpose of the field trip was to gain an understanding of the key aspects such as:

- Biophysical aspects, including:
    - Terrestrial fauna and flora especially avifauna;
    - Surface water resources;
    - Ecological sensitive area; and
    - Vegetation types on site.

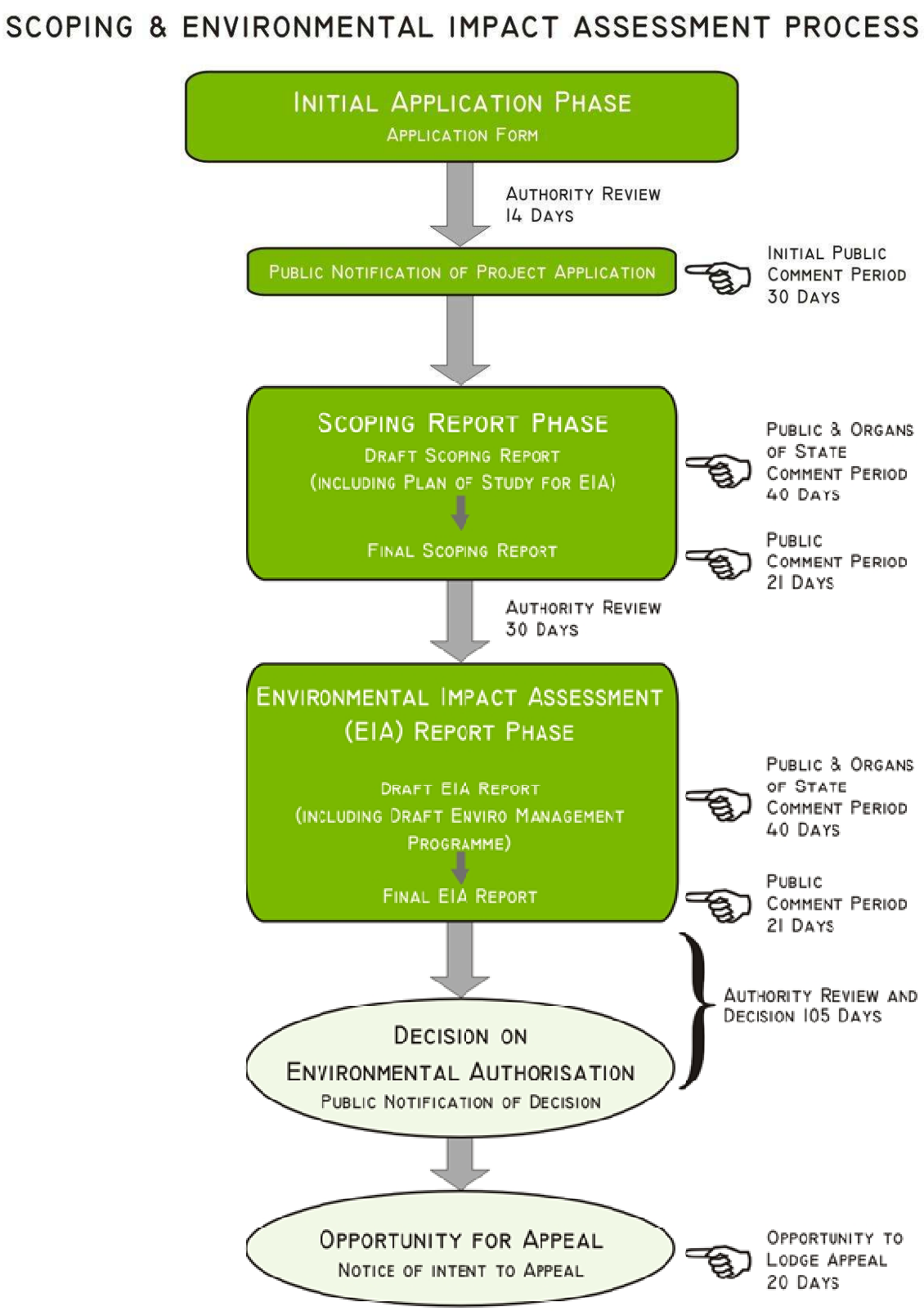

Figure 1.2 The EIA process in terms of NEMA

- Socio-economic aspects, including:
    - Heritage issues;
    - Land use, including agricultural potential
    - Visual aesthetics including the location of the project in terms of roads, topography and proximity to houses;
    - Location of local communities;
    - Dust;
    - Employment opportunities; and
    - Tourism.

The information gathered during the site visit was used in refining the Plan of Study for the EIA process and Terms of Reference (ToR) for the specialist studies which were undertaken during the EIA Phase.

1.4.3 The EIA Phase

The Scoping Phase is followed by the EIA Phase, during which the specialist investigations are undertaken and a comprehensive EIAR documents the outcome of the impact assessments.

This report covers the third and final phase of the EIA process, namely the EIA Phase. The purpose of the EIAR is to describe and assess the range of feasible alternatives identified during the Scoping process in terms of the potential environmental impacts identified. The ultimate purpose is to provide a basis for informed decision making, firstly by the applicant with respect to the option(s) they wish to pursue, and secondly by the environmental authority regarding the environmental acceptability of the applicant's preferred option.

The approach to the EIA Phase entailed undertaking further review of relevant literature and specialist studies. The results of this have been used to describe and assess the significance of the identified potential impacts associated with the proposed project. This EIA Report synthesises the key issues arising out of the PPP to date, to provide a balanced view of the proposed activities and the implications for the environment.

1.4.4 The public participation process

Consultation with the public forms an integral component of this investigation and enables I&APs (e.g. directly affected landowners, national, provincial and local authorities, environmental groups, civic associations and communities), to identify their issues and concerns, relating to the proposed activities, which they feel should be addressed in the EIA process. To create a transparent process and to ensure that I&APs are well informed about the project, as much information as is available has been included upfront to afford I&APs numerous opportunities to review and comment on the proposed project. A summary of the public participation process is provided in **Chapter 3**.

Currently there are 59 I&APs registered on the project database (see **Annexure B** for a list of current I&APs). To date comment was received from the ~~DWA, SAHRA and a mining company with a prospecting permit on a nearby property~~ Department of Agriculture, Forestry & Fisheries

(DAFF), Department of Environment and Nature Conservation, Eskom and the South African Civil Aviation Authority (SACAA) on the Draft EIAR which has been included in Comments Response Report 3 (CRR 3) included in **Annexure B** of the ~~Draft~~ Final EIAR.

1.4.5 Authority involvement

Authority consultation represents the first stage of the public consultation process. An EIA Application Form was submitted to DEA to notify the Department of the proposed project. DEA Acknowledged receipt of the EIA Application Form and issued a reference number for the proposed project.

As indicated earlier, DEA will fulfil the role of the competent environmental authority for this project and will make a decision in light of the information presented in the final EIAR. However, given that the project is located in the Northern Cape Province, DEA will work closely with DEA&NC in the decision-making process.

Where the need arises, Focus Group meetings will be arranged with representatives from the relevant national and provincial departments and local authorities. The purpose of these meetings will be to ensure that the authorities have a thorough understanding of the need for the project and that Aurecon has a clear understanding of the authority requirements. It is anticipated that beyond providing key inputs into the EIA, this authority scoping process will ultimately expedite the process by ensuring that the final documentation satisfies the authority requirements and that the authorities are fully informed with respect to the nature and scope of the proposed solar energy facility.

There are other authorities who have a commenting role to play in the EIA process. Their comments on the EIA Report will help to inform DEA's decision making. These authorities include:

- SiyaThemba Local Municipality;
- Pixley ka Seme District Municipality;
- South African Heritage Resources Agency;
- Northern Cape Provincial Heritage;
- Northern Cape DEANC;
- Department of Energy (Northern Cape): Regional Energy Director;
- Department of Agriculture (Northern Cape);
- Department of Agriculture, Forestry and Fisheries; and
- Department of Water Affairs.

DEA accepted the FSR on 24 February 2012 (refer to **Annexure A** for a copy of the letter from DEA).

1.4.6 Decision making

The Final EIAR, together with all I&AP comments on the Draft 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.

1.5 ASSUMPTIONS AND LIMITATIONS

1.5.1 Assumptions

In undertaking this investigation and compiling the EIAR the following has been assumed:

- The strategic level investigations undertaken by the Department of Energy regarding South Africa's proposed energy mix prior to the commencement of the EIA process are technologically acceptable and robust.
- The information provided by the applicant and specialists is accurate and unbiased.
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed PV plant and connection to the grid. The project does not include any infrastructure upgrades which may be required from Eskom to allow capacity in the local grid for the proposed project.

1.5.2 Gaps in knowledge

This EIA Report has identified the potential environmental impacts associated with the proposed activities. However, Mulilo is undertaking further work on the proposed project and investigations in parallel with this EIA process from a technical feasibility perspective. As such the nature and significance of the impacts presented in this report could change, should new information become available, or as the project description is refined. The purpose of this section is therefore to highlight gaps in knowledge when the EIA Phase of the project was undertaken and includes the lack of the exact source of water.

The planning for the proposed facility is at a feasibility level and therefore some of the specific details are not available to the EIA process. This EIA process forms a part of the suite of feasibility studies, and as these studies progress, more information will become available. This

will require the various authorities, and especially DEA, to issue their comments and ultimately their environmental decision to allow for the type of refinements that typically occur during these feasibility studies and detailed design phase of projects. Undertaking the EIA process in parallel with the feasibility study does however have a number of benefits, such as integrating environmental aspects into the layout and design and therefore ultimately encouraging a more environmentally sensitive and sustainable project.

1.6 INDEPENDENCE

The requirement for independence of the environmental consultant is aimed at reducing the potential for bias in the environmental process. Neither Aurecon nor any of its sub-consultants are subsidiaries of Mulilo nor is Mulilo a subsidiary to Aurecon. Furthermore, all these parties do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

The Project Director, Mr Andries van der Merwe ~~Mr Brett Lawson~~, Project Manager, Miss Louise Corbett, and the Project Staff, Miss Franci Gresse, are appropriately qualified and registered with the relevant professional bodies. Mr van der Merwe is a certified Environmental Engineer registered with the Engineering Council of South Africa (PrEng). ~~Mr Lawson is a certified Environmental Assessment Practitioner of South Africa (EAPSA), and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNSP)~~. Miss Corbett is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNSP). Aurecon is bound by the codes of conduct for the Environmental Assessment Practitioner of South Africa (EAPSA) and SACNSP.

1.7 DETAILS AND EXPERTISE OF THE EAPS WHO COMPILED THE EIAR

As noted above, the Project Director, Mr Andries van der Merwe ~~Mr Brett Lawson~~ is appropriately qualified and registered with the relevant professional bodies. Mr van der Merwe is a certified Environmental Engineer registered with the Engineering Council of South Africa (PrEng). Mr van der Merwe has a B Eng (Civil) degree and over 13 years' experience in the field of impact assessments. ~~Mr Lawson is a certified EAPSA, and is registered as a Professional Natural Scientist with SACNASP. Mr Lawson has an MA degree in Environmental and Geographical Science, and has over 15 years in the field of impact assessment, as well as many years' experience in Nature Conservation.~~ Miss Louise Corbett is an Environmental Practitioner with six years' experience in the field. Miss Corbett has a BSc Honours degree in Environmental and Geographical Science and is also a Professional Natural Scientist with SACNASP. Miss Franci Gresse is an Environmental Practitioner with over three years' experience in the field. Miss Gresse has a BSc Honours degree in Conservation Ecology. Aurecon and the above environmental assessment practitioners (EAPs) are bound by the codes of conduct for EAPSA and SACNASP. The CV summaries of the key Aurecon staff were

included in the Plan of Study for EIA in Chapter 5 of the Scoping Report or can be requested from Aurecon, should further detail be required.

1.8 STRUCTURE OF THE SCOPING REPORT

Table 1.5 presents the structure of the EIAR as well as the applicable sections that address the required information in terms of NEMA. Specifically, Section 31 of the EIA Regulations requires that the following information is provided:

Table 1.5 NEMA requirements for EIA Reports and location in this EIAR

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
	Section 31(2) of Regulation 543	
(a)	Details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an EIA;	**Section 1.7** (summaries of EAP CVs provided in Chapter 5 of FSR)
(b)	a detailed description of the proposed activity;	Chapter 2
(c)	a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is: (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken;	Chapter 2
(d)	a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	Chapter 2 and 4
(e)	details of the public participation process conducted in terms of subregulation (1), including- (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties;	Chapter 3 and **Annexure B**
(f)	a description of the need and desirability of the proposed activity;	Chapter 2
(g)	a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	Chapter 4
(h)	an indication of the methodology used in determining the significance of potential environmental impacts;	**Annexure E**
(i)	a description and comparative assessment of all alternatives identified during the environmental impact assessment process;	Chapter 6
(j)	a summary of the findings and recommendations of any specialist report	Chapter 4

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
	or report on a specialised process;	
(k)	a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	Chapter 4
(l)	an assessment of each identified potentially significant impact, including- (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated;	Chapter 4
(m)	a description of any assumptions, uncertainties and gaps in knowledge;	Section 1.5
(n)	a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Chapter 5, Section 5.5.2
(o)	an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Chapter 4,
(p)	a draft environmental management programme containing the aspects contemplated in regulation 33;	**Annexure D**
(q)	copies of any specialist reports and reports on specialized processes complying with regulation 32;	**Annexures C**
(r)	any specific information that may be required by the competent authority; and	**Annexure F**
(s)	any other matters required in terms of sections 24(4)(a) and (b) of the Act.	
	Section 31(3) of Regulation 543	
	The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by Section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 31(2)(g), exist.	Chapter 2 and Chapter 4

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2 THE PROPOSED ACTIVITY

This chapter considers the need for the proposed project, describes the components of the proposed project that could have an impact on the environment, then summarises the suite of alternatives that were proposed for further consideration in the Scoping Report.

2.1 THE NEED FOR THE PROPOSED ACTIVITY

The 2011 DEA&DP Guideline for Need and Desirability[16] highlights the obligation for all proposed activities which trigger the environmental regulations to be considered in light of (amongst others) the National Framework for Sustainable Development[17], the spatial planning context, broader societal needs and financial viability. This information allows the authorities to contemplate the strategic context of a decision on the proposed activity. This section seeks to provide the context within which the need and desirability of the proposed activity should be considered.

The need for renewable energy is well documented and reasons for the desirability of solar energy include:

- Utilise resources available to South Africa;
- Meeting nationally appropriate emission targets in line with global climate change commitments;
- Enhancing energy security by diversifying generation; and
- Creating a more sustainable economy.

2.1.1 Utilise resources available to South Africa

As illustrated in **Figure 2.1** South Africa is subject to some of the highest levels of solar radiation in the world with an average daily solar radiation that varies between 4.5 and 6.5 kWh/m^2. This in comparison to the ± 3.6 kWh/m^2 received by parts of the United States and ± 2.5 kWh/m^2 for Europe and the United Kingdom (DME, 2003), indicates that South Africa has considerable solar resource potential which should be utilised. South Africa generates most of its required electricity from coal of which there is a ready supply of at the local level. However, national government is on the verge of augmenting the existing generation capacity of thermal and nuclear power plants with renewable energy power generation, thereby creating a framework that will lead to an increase in the supply of clean energy for the nation.

[16]DEA&DP (2011) Guideline on Need and Desirability, NEMA EIA Regulations Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP), October 2011.
[17]Republic of South Africa (2008) People – Planet – Prosperity: A National Framework for Sustainable Development in South Africa**.** Pretoria: Department of Environmental Affairs (DEA), Republic of South Africa [Internet]. Available from: http://www.environment.gov.za [Accessed on: 29/03/2011].

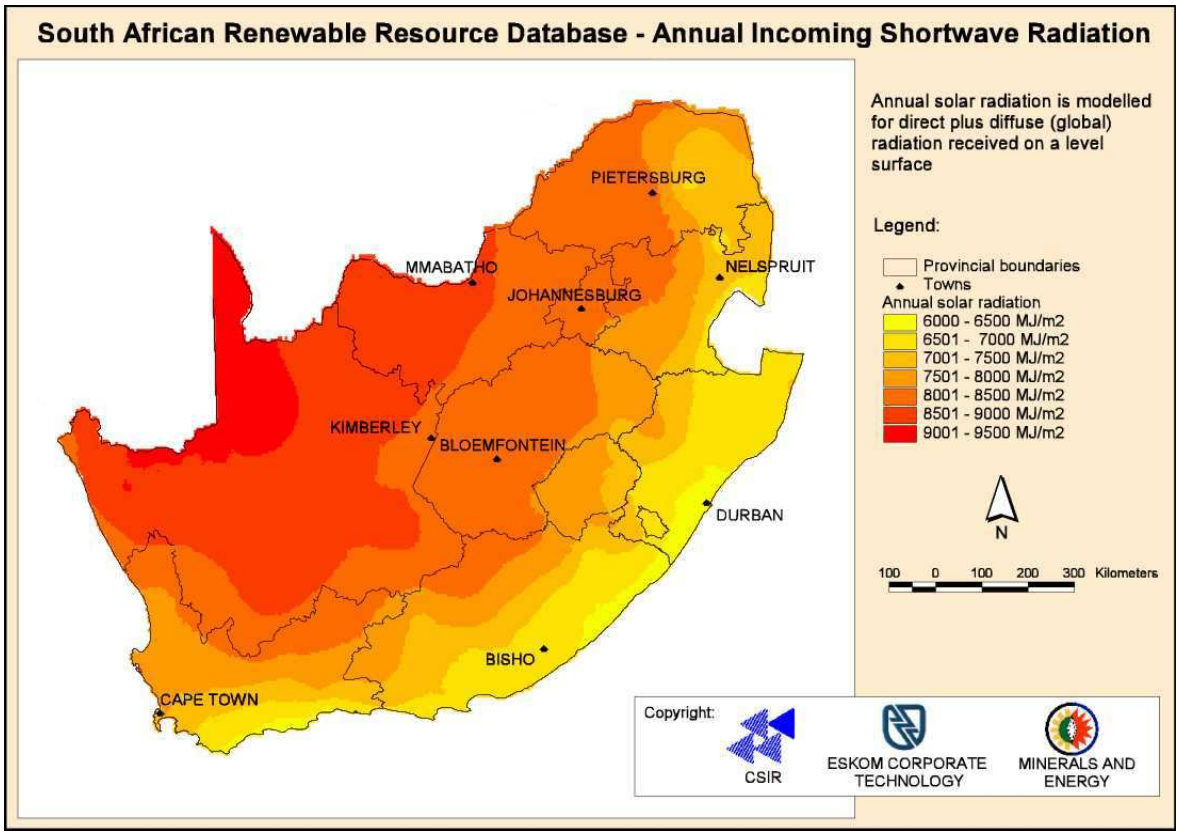


Figure 2.1 Annual solar radiation for South Africa (DME, 2003)

2.1.2 Meeting nationally appropriate emission targets in line with global climate change commitments

The proposed PV plant is considered to be of national importance in anticipation of its contribution to electricity supply and reduced reliance on fossil energy sources. The final IRP2 allows for an additional 14 749 MW of renewable energy in the electricity blend in South Africa by 2030. While there are a number of renewable energy options (including, *inter alia,* wind, solar, and hydropower) being pursued in South Africa, many more renewable energy projects are required to meet the targets set by the draft IRP2. Consequently, based on this requirement for renewable energy, Mulilo has identified various projects for PV solar energy generation.

Targets for the promotion of renewable energy now exist in more than 58 countries, of which 13 are developing countries. The South African Government has recognised the country's high level of renewable energy potential and presently has in place targets of 10 000 GWh of renewable energy by 2013 (to be produced mainly from biomass, wind, solar and small-scale hydro). This amounts to approximately 4 % (1 667 MW) of the total estimated electricity demand (41539 MW) by 2013.

Due to concerns such as climate change, and the on-going exploitation of non-renewable, resources, there is increasing international pressure on countries to increase their share of

renewable energy generation. The proposed Struisbult PV project is expected to contribute positively towards climate change mitigation.
Solar energy is a source of "green" electricity as for every 1 MWh of "green" electricity used instead of traditional coal powered stations, one can:

- Save 1 290 liters of water;
- Avoid 8.22 kg of Sulphur Dioxide (SO_2)emissions;
- Avoid 1000 kg of Carbon Dioxide (CO_2) emissions including transmission losses;
- Avoid 142 kg of ash production; and
- Contribute to social upliftment.

2.1.3 Enhancing energy security by diversifying generation

The establishment of the proposed Struisbult PV plant will strengthen the existing electricity grid for the area. Moreover, the project will contribute towards meeting the national energy target as set by the Department of Energy (DoE), of a 30 % share of all new power generation being derived from independent power producers (IPPs). Renewable energy is recognized internationally as a major contributor in protecting the climate, nature and the environment, as well as providing a wide range of environmental, economic and social benefits that can contribute towards long-term global sustainability. Should the proposed PV plant identified by Mulilo be acceptable, it is considered viable that long term benefits for the community and society in the Copperton / Prieska area will be realized as highlighted above. The proposed project will also have international significance as it contributes 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 United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and United Nations Convention on Biological Diversity (UNCBD) all of which South Africa is a signatory to.

2.1.4 Creating a more sustainable economy

The Northern Cape, and particularly the Copperton area, has large tracts of land which are very dry and the farmers do their best to earn a living from the land. The towns are generally small and operate on a survival socio-economic level. The need to improve the quality of life for all, and especially for the poor, is critical in South Africa. It is expected that the proposed project will contribute directly to the upliftment of the individuals and the societies in which they live.

Skills development and the transfer thereof will be one of the top priorities and local community involvement will be enhanced as far as possible. Up to 900 job opportunities could be created during the construction (installation) phase depending on the procurement method and the primary contractor.

Additional potential benefits include:

- Reducing the demand on scarce resources, such as water;
- Local economic development; and
- Local skills development.

Table 2.1 Specific questions as detailed in the Need and Desirability Guideline

NEED (TIMING) Question	Response
1. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP?	*The area proposed is currently zoned as Agricultural land. However the farmer has signed a lease agreement with Mulilo for the site. The portion leased has relatively low agricultural potential. Furthermore the additional income will safeguard the economic sustainability of the farm.* *Even though the IDP does not specifically allow for renewable energy projects, solar energy was identified as one of the LMs strong points which should be developed. Other needs that were identified include sustainable developments (economically, socially and environmentally) and job creation.* *The proposed PV plant would create job opportunities for a wide skill level. In addition, Mulilo has committed to developing a training strategy to train and employ people from the local community.*
2. Should development, or if applicable, expansion of the town/ area concerned in terms if this land use (associated with the activity being applied for) occur at this point in time?	*Yes. The activity is in line with the Pixley ka Seme District Spatial Development Framework which recognises the need for sustainable land management, job creation and the development of new skills.*
3. Does the community/ area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority but within specific local context it could be inappropriate).	*Yes. The proposed PV plant would not only be a source of income for the landowner, but it would create job opportunities for the local community as the construction and operation of the PV plant require a wide range of skill levels.* *Secondary economic impacts may include an increase demand on the service industry through the demand for accommodation and other services.*
4. Are there necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	*It is anticipated that water requirements during the construction and operational phases would be met via the Alkantpan pipeline. However, the applicant still needs to confirm whether sufficient capacity is available.* *Estimated water requirements:* • *Construction Phase: 100 MW would require roughly 36 000 kℓ over a period of 6 months to a year.* • *Operational Phase: 1 kℓ of water per day is required for 10 MW, therefore 100 MW would require 10 kℓ per day.* *The establishment of the proposed Struisbult*

	PV plant would strengthen the existing electricity grid for the area resulting in a positive impact on the available electrical services.
5. Is this development provided for in the infrastructure planning of the municipality, and if not, what will the implication be on the infrastructure planning of the municipality (priority and placements of services)?	*No. It should be noted that once the proposed PV plant is operational, there would be a very limited requirement for municipal services.*
6. Is this project part of a national programme to address an issue of national concern or importance?	*Yes. The establishment of the proposed Struisbult plant would strengthen the existing electricity grid for the area. Moreover, the project would contribute towards meeting the national energy target as set by the DoE, of a 30 % share of all new power generation being derived IPPs.*
DESIRABILITY (PLACING) **Question**	**Response**
1. Is the development the best practicable environmental option (BPEO) for this land/ site?	*Copperton is a very arid region and farmers are struggling to make a living from the land. The area being proposed for the PV plant has moderate to low agricultural potential (grazing) and the income generated by the landowner from the proposed PV facility would greatly assist in future agricultural developments and the viability of the property.*
2. Would the approval of this application compromise the integrity of the existing approved and credible Municipal IDP and SDF as agreed to by the relevant authorities.	*No. The activity is in line with the Siyathemba IEMP and Pixley ka Seme District SDF which recognizes the need for:* • *Sustainable developments;* • *New skills development; and* • *Economic development.* *The proposed PV plant would not only be a source of income to the farmer, but it would also create job opportunities for the local community as the construction and operation of the PV plant would require a wide range of skill levels.*
3. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified from in terms of sustainability considerations?	*No. According to the Siyathemba IEMP land degradation, especially from overgrazing, is one of the key issues that need attention. The proposed development would provide additional income to the landowner which could be used for sustainable agricultural development practices on his farm.*
4. Do location factors favour this land use (associated with the activity applied for) at this place?	*Yes. The sites were selected based on the following criteria:* • *Solar resource potential based on historic satellite data;* • *Grid connectivity and close proximity to strong grid access;*

	• *Flat, level, and open land; and* • *Unpopulated and non-arable or low arable potential land.* *Desktop studies furthermore assessed potential sensitivities of fauna, flora, heritage, visual and other technical aspects.* *The area proposed has low agricultural significance and is in close proximity to Eskom's existing transmission lines.*
5. How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/ natural environment)?	*Potential impacts associated with the proposed PV plant are discussed in Chapter 4 of the EIAR.*
6. How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?	*Potential impacts associated with the proposed PV plant are discussed in Chapter 4 of the EIAR.*
7. Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	*The socio-economic impacts are assessed and discussed in Chapter 4 of the EIAR.*
8. Will the proposed land use result in unacceptable cumulative impacts?	*Potential cumulative impacts associated with the proposed PV plant are discussed in Chapter 4 of the EIAR.*

2.2 DESCRIPTION OF THE PROPOSED ACTIVITY

2.2.1 Description of the site

Mulilo proposes to construct a PV plant to generate approximately 100 MW (preferred alternative) or 300 MW (alternative) on the farm Struisbult (Farm No. 104 Portion 1), also known as Vogelstruisbult, near Copperton in the Northern Cape. The site consists of the farm Struisbult (Farm 104/1). This portion is owned by the Request Trust, who has entered into a long term agreement with Mulilo for the proposed project. The corner point co-ordinates, moving in a clockwise manner, starting at the top left corner, are given in **Table 2.2**

Table 2.2 Co-ordinates of corner points of the site

Latitude	Longitude
29°54'49.42"S	22°18'41.88"E
29°54'49.25"S	22°20'26.25"E
29°56'2.41"S	22°21'31.55"E
29°57'24.09"S	22°19'14.07"E
29°56'15 .62"S	22°18'14.42"E
29°55'51.51"S	22°18'14.40"E
29°55'49.89"S	22°18'42.43"E

The proposed PV plant would cover an area of approximately 300 ha (preferred alternative) or 900 ha (alternative), and is currently used for cattle grazing. Struisbult Farm borders Copperton on the eastern side of the town and covers approximately 6 194 ha. The location of the proposed site, including the alternative site location, is indicated in **Figure 2.5**.

In terms of associated infrastructures, the following would be required:

- Upgrade of existing internal farm roads and construction of new roads to accommodate the construction vehicles and access the site.
- Construction of a 132 kV transmission line to connect the proposed PV plant with Eskom's grid via the Cuprum substation (see **Figure 2.4**) for an example of a 132 kV line).
- Electrical fence to prevent illegal trespassing and the possible theft of panels, as well as keeping livestock from roaming between the solar arrays and causing accidental damage.
- Other infrastructure includes an office, connection centre and a guard cabin.

Please note that Mulilo has obtained verbal confirmation on grid connectivity and capacity from Eskom. Indicative quotes have been applied for from Eskom regarding grid connectivity and capacity. Furthermore, the exact connection routes (including pylon positions) to the transmission network are exceedingly difficult to determine as this is done by Eskom. Pylon positions can therefore only be estimated at this stage. These pylons would be spaced between 240 m to 360 m apart depending on site conditions.

Figure 2.2 Example of an existing 132 kV transmission line onsite (taken 29/09/2011)

The proposed PV plant would convert shortwave radiation (sunlight) directly into electricity via cells through a process known as the Photovoltaic Effect. The PV cells are made of silicone which acts as a semi-conductor. The cells absorb light energy which energizes the electrons to produce electricity. Individual solar cells can be connected and packed into standard modules behind a glass sheet to protect the cells from the environment while obtaining the desired currents and voltages. These modules are grouped together to form a panel and can last more

than 30 years due to the immobility of parts, as well as the sturdiness of the structure. However, the Power Purchase Agreement (PPA) is only valid for a period of 20 years after which the plant would most likely be decommissioned and the site rehabilitated.

Grid-connected PV Power Systems (PVPS) are made up of a variety of components, which aside from the PV modules, include conductors, fuses, disconnect controls, trackers, and power conditioning units (i.e. inverters). The PVPS requires transmission infrastructure to feed electricity into the grid, unlike the Stand-alone PV Power System that requires batteries to store electricity for use later[18]. The electricity is generated from solar energy which is transformed by the PV modules arranged in arrays).

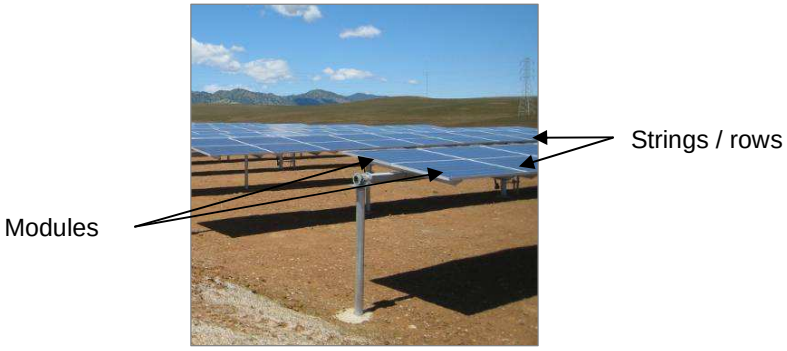


Figure 2.3Typical layout of panel structures

The maximum power point tracker (MPPT) ensures that power coming from the PVs are maximised by determining the current that the inverter should draw from the PV panel[19]. The inverter converts the direct current (DC) to an alternating current (AC) to allow the electricity to be fed into the grid. **Figure 2.4** below illustrates the components of the process of generating electricity from solar energy (sun) and fed into the grid.

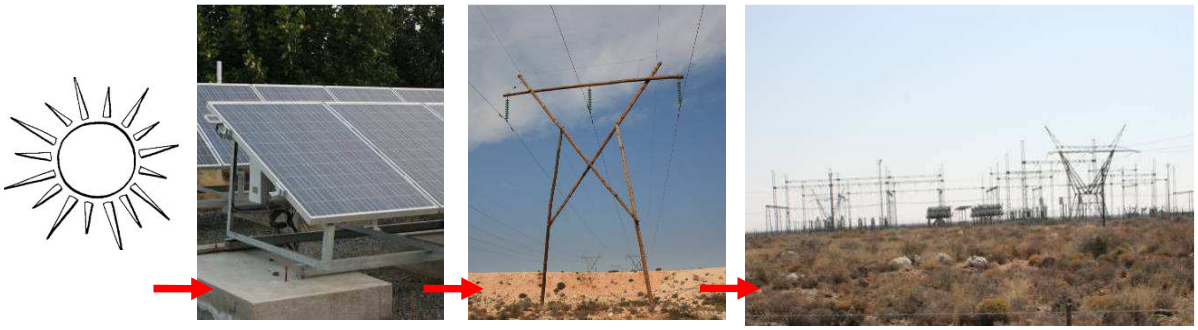


Figure 2.4 Basic PV system layout

[18] Source: http://en.wikipedia.org/wiki/Stand-alone_photovoltaic_power_system (Accessed on: 28/10/2011)
[19] Source: http://en.wikipedia.org/wiki/Maximum_power_point_tracker (Accessed on: 28/10/2011)

2.2.2 Construction phase

The proposed facility would be constructed over a period between 18 and 30 months. During the construction phase ~~between~~ a maximum of 200 ~~and 900~~ individuals (amounting to a total of 900 person months employment created over the construction period) would be employed onsite depending on the procurement method used as well as the primary contractor. If non-locals are employed they would be housed in temporary dwellings on site or in accommodation within Copperton and Prieska. An estimate of the anticipated workforce flow of the 24 month construction period is provided in **Figure 2.4**.

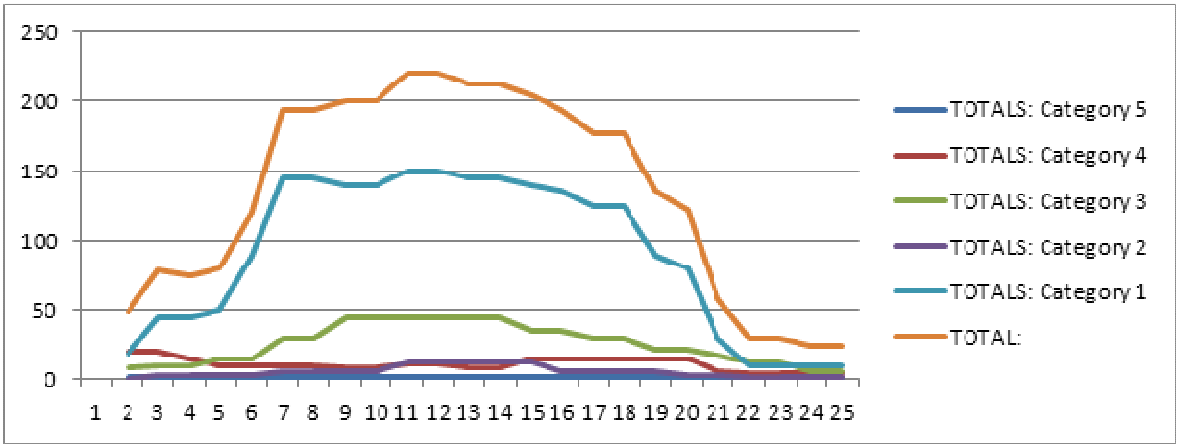


Figure 2.5 Estimated workforce flow for the 24 month construction period (Courtesy: Mulilo)

Category's:	Level
Senior Management	**5**
Engineers, Quantity Surveyors	**4**
Artisans, Foremen, Technicians	**3**
Junior staff	**2**
Civil works operator and labourer	**1**

It is estimated that between 65 and 75% (130 – 150 category 1 and 2 workers) would be sourced locally and provided with the necessary training. This workforce would already have accommodation in the area and would be transported by bus to and from the site on a daily basis or housed at Copperton. The remaining 25 – 35% (50 – 70 high level staff {category 3, 4, and 5}) will be housed within the locally available accommodation in the towns and surrounding farm areas (guest houses, etc.). A construction camp housing between 10 and 30 members of potentially all staff categories may be required for the duration of the construction period. The footprint of the construction camp would be approximately 1 – 1.5 ha in extent and would be located within the temporary laydown area.

Between two and five digger loaders/ bulldozers would be required for land clearing and five to ten trucks with cranes for the assembly of the facility. Approximately 450 truck deliveries conveying ± 900 40-foot container loads would be required to construct the PV plant. These deliveries would be distributed over the construction period.

Site clearance would take place in sections that are limited to the actual footprint required for construction. As soon as construction is completed within a section, rehabilitation would start immediately.

The construction period laydown footprint (located within the proposed 300 ha (preferred) and 450 ha (alternative) sites) would be approximately 200 m x 100 m and the permanent laydown area approximately 100 m x 50 m. The need for cut and fill areas and / or borrow pits at the PV site, along roads and at sub-station / transformer sites would only be known after the final design has been completed.

2.2.3 Operational phase

The project is expected to last the full period of the PPA which is approximately 20 years. Regular cleaning, usually on a quarterly basis, 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.

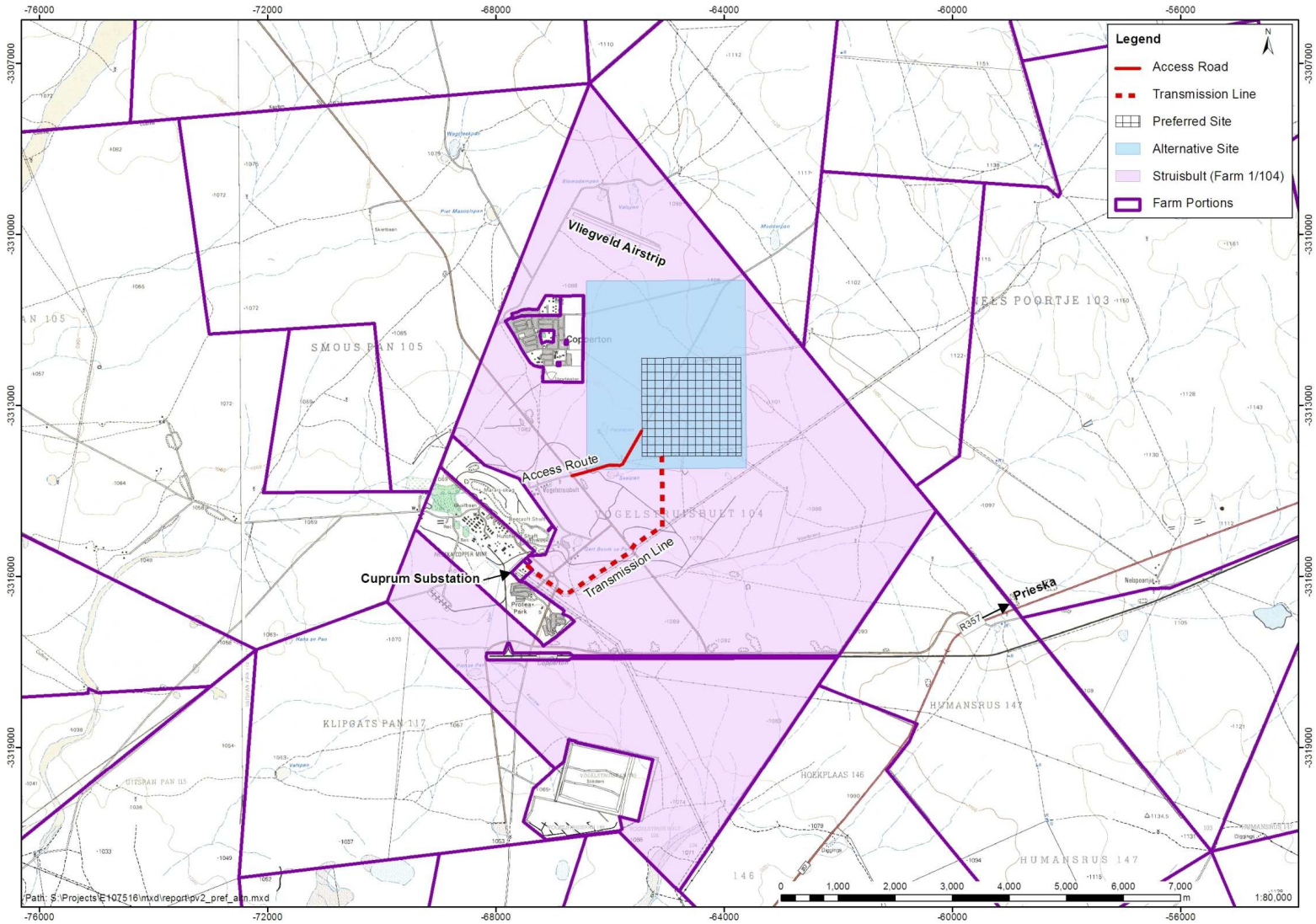


Figure 2.6 Map showing the preferred and alternative locations for the proposed PV plant

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 (PV2). 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; and
- Potential sensitive receptors and features, such as fauna, flora, heritage, visual and other technical aspects such as the Square Kilometre Array (SKA).

Originally Mulilo proposed to install a plant with an electricity generation output of 300 MW with a footprint area of 900 ha on Struisbult (also known as Vogelstruisbult). However recent changes to the bidding process in terms of the National Energy Regulator Act (No. 40 of 2004) and REFIT (see **Section 1.2.5.f**) has resulted in a reduction of the plant size to 100 MW[21] and a

[20] Please refer to *Proposed Photovoltaic Energy Plant on the Farm Klipgats Pan near Copperton in the Northern Cape (DEA Ref. No: 12/12/20/2501 / NEAS Ref. No: DEAT/EIA/0000611/2011)* and *Proposed Photovoltaic Energy Plant on Farm Hoekplaas near Copperton, Northern Cape* (*DEA Ref. No: 12/12/20/2503 / 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.

[21] Note that even though the IRP1 only allows for one 75 MW solar plant per farm portion, the decision was made to request authorisation for a 100 MW sites. This would allow Mulilo to increase the electricity output of the plant without having to go through a second environmental authorisation process should the decision be made to increase the allowable output per farm portion.

footprint area of 300 ha for the preferred alternative (the alternative being considered remains 300 MW).

The route for the proposed 132 kV transmission line to the Cuprum Substation was determined to follow the existing Eskom 132 kV powerlines located on Struisbult to limit the visual impact and area of disturbance (see **Figure 2.5**). The transmission line would cover a distance of approximately 4.2 km.

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 Africa wishes to pursue. These strategic documents provide the road map for the activity alternatives available to South Africa. The IRP2 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 on an adjacent portion of Struisbult farm, for wind power, is currently at the EIA Phase[22] (see **Figure 2.6**). 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 layout was moved to an area that is less sensitive to the proposed development and this forms the current preferred site (see **Figure 2.5**). A second alternative layout was also considered. 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);
    - Heritage; and
    - Aesthetics.

[22] 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).

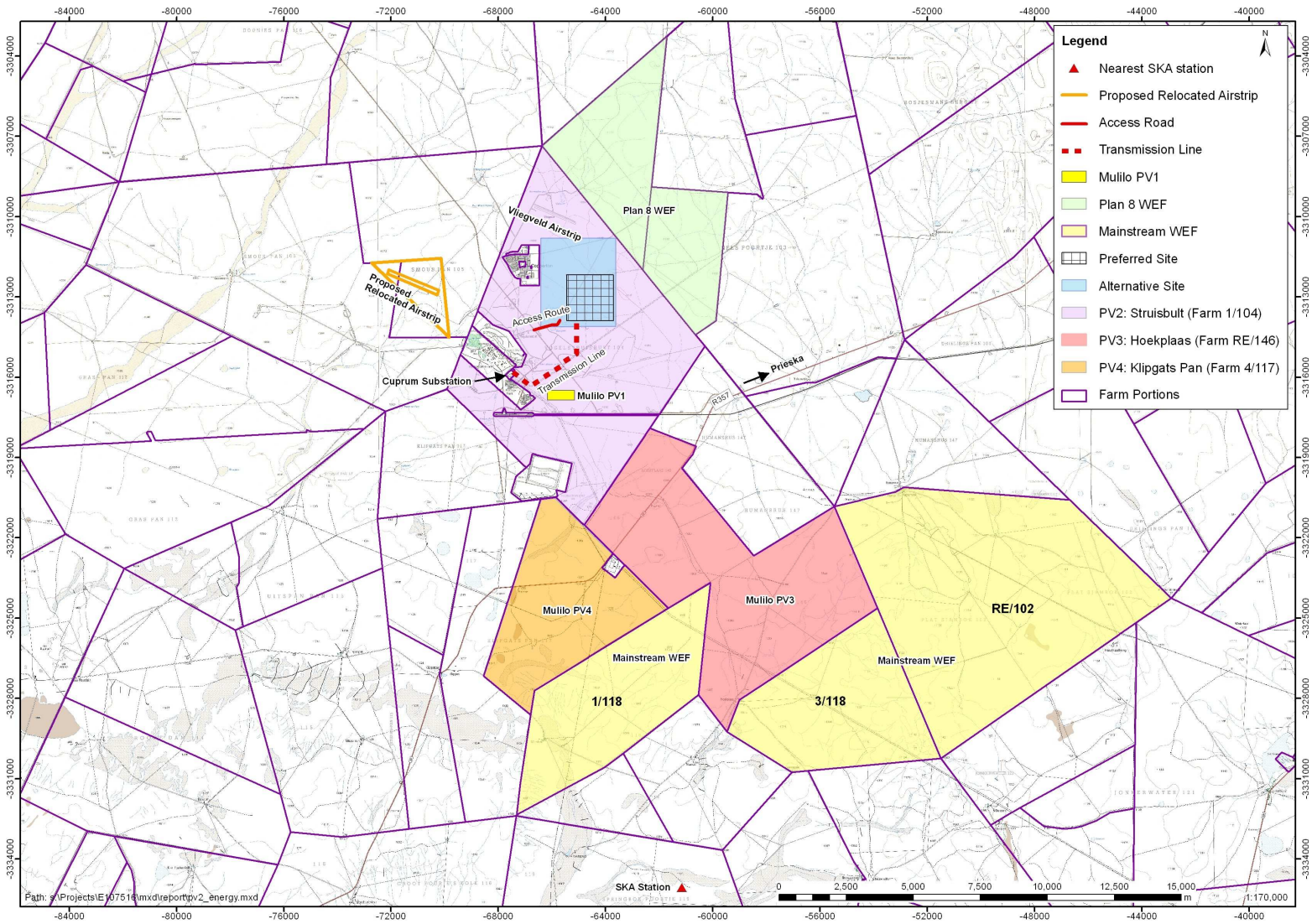


Figure 2.7 Other renewable energy projects (solar and wind) proposed for the Copperton area

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. Conventional PV technology on the other hand consists of panels without refractive lenses and as a result is less effective. In general PV technology 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 2.4**)[23]. Approximately 1 kℓ of water would be required per day for every 10 MW during operation.

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

Figure 2.8 Photovoltaic solar cells (left)[24] and a CPV system (right)[25] 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,

[23] 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).
[24] Photo of a test solar plant constructed by Mulilo on the town border of Copperton (Taken on: 29/09/2011)
[25] Source: http://gigaom2.files.wordpress.com/2010/04/amonix15.jpg (Accessed on: 13/02/2012)

whereas in a one or two (dual) axes tracking system the panels follow the sun to ensure maximum exposure to sunlight[26]. These systems are illustrated in **Figure 2.8.**

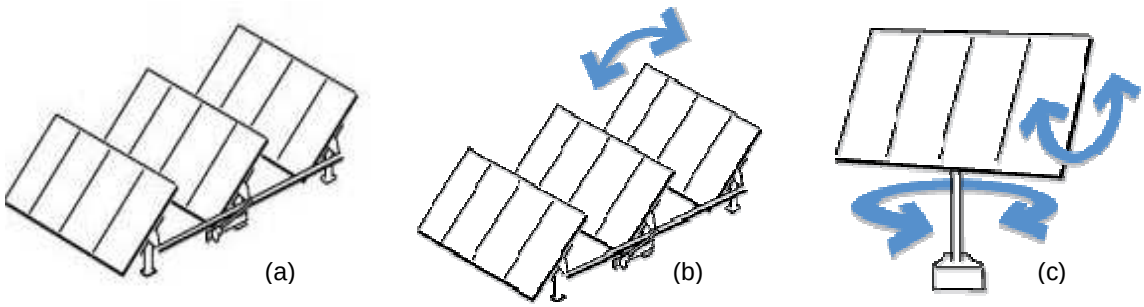


Figure 2.9 Solar panels can be mounted via (a) fixed axis photovoltaic systems, (b) single axis tracking PV systems and (c) dual axis tracking systems[27]

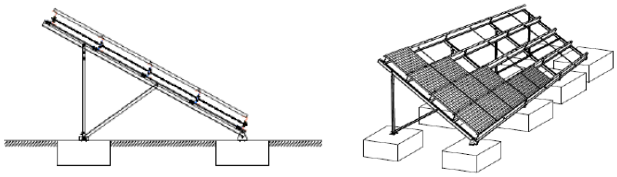
In order for CPVs to be cost efficient and produce the maximum amount of electricity, mega-modules have to be mounted on dual axis tracking systems. Therefore only the dual axis tracking system will be considered in the EIAR for the CPV panels. There is little environmental difference in terms of impacts 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

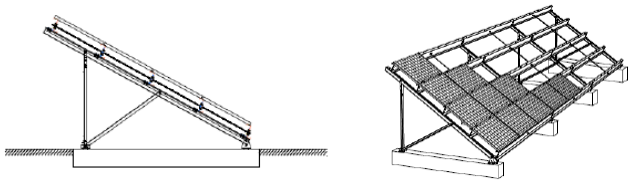
There are various methods for anchoring PV panels. However the preferred foundation option would be dependent on the soil characteristics of the area, as these anchoring structures would need to withstand climatic conditions, as well as the response of the soil to these changes, to prolong the lifespan 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 2.9**):

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

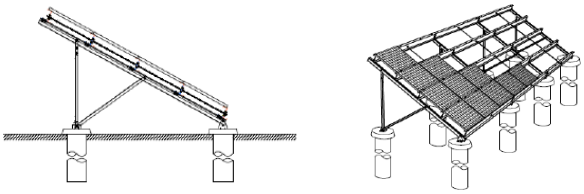
[26] Source: http://en.wikipedia.org/wiki/Solar_tracker#Tracker_type_selection (Accessed on: 24 October 2011)
[27] Source: www.solar-tracking.com/ (Accessed on: 24/10/2011)



(a) Isolated concrete bases



(b) Continuous concrete bases



(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 Struisbult PV plant; and
  - Electricity distribution via a 4.2 km 132 kV connection to Cuprum substation.
- Activity alternatives:
  - Solar energy generation via a PV plant; and
  - "No-go" alternative to solar energy production.
- Site layout alternatives:
  - Two layout alternatives (100 MW with 300 ha footprint and 300 MW with 900 ha footprint).
- Technology alternatives:
  - Two technology alternatives in terms of the solar panel type (PV and 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 59 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 2011;
- Erection of a site notice at the entrance to Farm Struisbult 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;

- 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; and
- 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. A comment was also received regarding a prospecting permit on a nearby farm portion.

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

The Draft EIAR was lodged at the 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 were notified of the availability of the Draft EIAR by means of a letter sent by post, fax or e-mail on 2 March 2012. The notification letters also included a copy of the Executive Summary in English and Afrikaans.

I&APs had 40 days, from 5 March 2012 until 16 April 2012, to submit their written comments on the Draft EIAR. Cognisance was taken of all comments in compiling the final report, and the comments, together with the project team and proponent's responses thereto, have been included in the final report. Where appropriate, the report has been updated.

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

The report has been updated in light of the comments received during the 40 day public comment period on the Draft EIAR and is called the Final EIAR. Comments on the Draft EIAR have been included and responded to in the CRR 3 which has been made available to I&APs. Comments on the Final EIAR 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

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 but will instead be collated and forwarded directly to DEA.

3.3 REVIEW AND DECISION PERIOD

The Final EIAR will be submitted to 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.

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 (generally long-term impacts) as well as the potential construction related impacts (generally 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 aquatic ecology
- 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.

Please note that specialists assessments have assessed 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 however assessed below.

The methodology used to assess the potential impacts is detailed in **Annexure E**. 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 dominant vegetation type on Farm Struisbult comprises of the communities Bushmanland Basin Shrubland and Bushmanland Arid Grassland. The main agricultural activity on the farm is cattle and sheep-farming. The potential exists for the footprint of the proposed solar energy facility to impact on the vegetation of Farm Struisbult. As such Dr Dave McDonald of Bergwind Botanical Surveys & Tours CC was appointed to undertake a Botanical Impact Assessment. A site visit was conducted by Dave McDonald on the 25 November 2011 in order 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 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.* 2005; Mucina *et al.* 2006 in Mucina & Rutherford, 2006) two vegetation types are found in the study area namely Bushmanland Arid Grassland and Bushmanland Basin Shrubland. The National Spatial Biodiversity Assessment (Rouget *et al.* 2004) classifies these vegetation types as Least Threatened and it is not listed in the National List of Threatened Terrestrial Ecosystems (Government Gazette No. 34809. 2011).

Struisbult Farm has a low relief with shallow undulations in the landscape and watercourses forming shallow depressions. A major drainage line, beyond the proposed footprint, is found in the eastern side of Struisbult but. In a separate botanical study that was undertaken for another project on Struisbult and the neighbouring Nelspoortjie Farm, five distinct vegetation communities were recognized (McDonald, 2011). Distinction was made between two communities within the Bushmanland Basin Shrubland type and two within the Bushmanland Arid Grassland type. The communities of Bushmanland Basin Shrubland and Bushmanland Arid Grassland are mixed in a fine-scale mosaic that is determined by soil type and depth. Shallow

soils over calcrete support Asteraceous Shrubland or "bossieveld" whereas somewhat deeper sandy-loams support *Rhigozum trichotomum* (granaatbos) Shrublands with patches of *Stipagrostis* Grassland interspersed. The *R. trichotomum* is a tough woody shrub and is scattered throughout the study area (see **Figure 4.1**). The Asteraceous Shrubland on the other hand is the most extensive vegetation type in the study area with the greatest diversity of species. This vegetation occurs on shallow sandy-loam soils often with bedrock, mostly as hardpan calcrete.

Figure 4.1 Photograph of *Rhigozum trichotomum* Shrubland (coarse mid-high shrubland on sandy-loam soils) with Copperton in the background (McDonald, 2012)

The asteraceous bossieveld is dominated by *Pentzia incana* (ankerkaroo) and *Pteronia* spp. Other species recorded include *Berkheya* cf. *annectens* (disseldoring), *Enneapogon desvauxii* (eight day grass), *Eriocephalus microphyllus* var. *pubescens* (wild rosemary)*, Lycium* sp. (a low, almost prostrate, spiny shrublet), *Monechma* sp. (Boesmanlandse bloubos), *Plinthus karooicus* (silwerkaroo)*, Ruschia* cf. *intricata, Salsola tuberculata* (blomkoolganna) *Sarcocaulon* sp. (bushman's candle), *Stipagrostis* sp. (boesmansgras) and *Zygophyllum microphyllum* (muishondbos).

Furthermore *Prosopis glandulosa* (mesquite) is present as large trees on Farm Struisbult. 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. Other alien invasive species noted are the herbaceous *Atriplex lindleyi* subsp. *inflata* (blasiebrak) and *Salsola kali* (rolbos).

b) Impact assessment

The potential impacts of the proposed project on the vegetation on Farm Struisbult 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 according to the preferred alternative 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. The potential impact for the preferred alternative is considered to be of high magnitude, local extent and long term and therefore of **high (-)** significance, without mitigation for the preferred layout. However, by

implementing mitigation measures the potential impact would be of low magnitude, local extent and long term and therefore of **low (-)** significance. No difference in significance would result from the proposed technology alternatives.

In contrast, the alternative site would impact on an area three times the size of the preferred site. The vegetation type that would be lost is very similar as in the case of the preferred layout, except that the northern part of the alternative site's footprint includes calcrete ridges. This raises the possibility of affecting the protected species *Avonia albissima*, *Lithops hallii* and *Ruschia spinosa* that was identified during the botanical study undertaken for another project (Anderson, 2010). The potential impact would be of high magnitude, local extent and long term and therefore of **high (-)** significance, without mitigation for the alternative layout. With mitigation measures implemented, the significance rating is reduced to **moderate (-).** No difference in significance would result from the proposed technology 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;
- Shallow depressions, well defined pans, seasonal watercourses and calcrete and other rocky ridges should be avoided;
- Mesquite trees and / or shrubs within 250 m of the boundary of the PV plant footprint and the power-line route should be eradicated by cutting and treating with herbicide to prevent coppicing; and
- Should the alternative site be approved, the upland areas of calcrete and calcrete ridges should be avoided and considered to be no-go areas.

d) Cumulative impacts

The vegetation types in the Copperton area of the Northern Cape are widespread and not under threat. The cumulative impact of loss of these vegetation types as a result of the proposed solar energy facility and other proposed developments such as PV and wind energy facilities on nearby farms is considered to be low (-).

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 are 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 birds 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 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 Bushmanland Karoo, 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 in terms of the possible impacts of the PV facility 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
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

Furthermore, 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 showed regularly active Martial Eagle nests within about 3-4 km east of the proposed development area and within about 18 km to the west

During the site investigation, 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 or in 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 as well. Densities of regional endemics such as the 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. Furthermore, at least one Ludwig's Bustard (*Neotis ludwigii)* collision victim has been found under a 132 kV power line in the vicinity.

On the basis of these observations, in combination with existing documented information on the avifauna of the general area, ten priority species are recognized as key in the assessment of avian impacts of the proposed project (see **Table 4.1**). These are mostly nationally and/or globally threatened species which are known to occur, or could occur, in relatively high numbers in the development area and which are likely to be, or could be, negatively affected by the proposed project. Eight of these species were included despite the fact that they were not recorded in either SABAP 1 or SABAP 2 data for the area, either because (a) they were seen on site, (b) the site is located within their respective distributions and the available habitat is possibly suitable, or (c) they may occasionally fly over the site *en route* between distant resource areas, and in so doing be exposed possible impacts.

Overall, the avifauna of the development site itself is almost entirely replaceable and can be considered to be a replication of the avifaunal community occurring across huge areas of 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.

a) Impact Assessment

The potential impacts of the proposed projects 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 and substation infrastructure.

Habitat loss – destruction, disturbance and displacement

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, power line 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.

Exposure is greatest in very aerial species, species inclined to make regular and/or long distance movements (migrants, any species with widely separated resource areas - food, water, roost and nest sites) and species that regularly fly in flocks (increasing the chances of incurring multiple fatalities in a single collision incident).

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 paneling. 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 could 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, 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.

[28] Perching birds and songbirds.

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; and
- 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.

Based on the above the potential impact on birds is considered to be of low to medium magnitude, local extent and long term and therefore of **medium to high (-)** significance without mitigation for all alternatives. With the implementation of mitigation measures this is anticipated to reduce to **low (-)** significance for all alternatives. Although there would be a slightly greater impact due to the new preferred CPV technology alternative (as opposed to conventional PV technology), the significance of the potential impact would not be significantly different.

b) Mitigation measures

The following mitigation measures are recommended.

- Minimize the footprint of the development to the actual area required for 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) for above-ground power lines that exclude birds physically from high risk areas of live infrastructure and comprehensively insulate such areas to avoid bird electrocution;
- Power lines and cables should be below ground. Where this is not possible, all new aboveground lines should be fitted 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.

c) 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 include small antelope, mongoose, Black-backed Jackals, Caracal, snakes, etc. The following 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. Local farmers have also indicated that the 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).

As the vegetation type is considered to be Least Threatened it is unlikely that the animals occurring within this vegetation type would be rare or endangered, as large areas of habitat remain (see **Section 4.2.1**).

a) Impact assessment

The density of the proposed project would also be very high, with project components located close together. The entire footprint would be cleared which would result in disturbance of animals or habitat. 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 or habitat 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.

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, which can continue to forage in the large areas between projects.

4.2.4 Impact on aquatic ecology

The study area is within the D54D quaternary catchment and the Lower Orange water management area. The Struisbult site has a number of drainage areas and a few endorheic pans (inward flowing). These pans and systems are an important wildlife habitat, particularly for birds (especially migratory birds), mammal species and invertebrates.

The proposed project could disturb these pans and systems and / or cause erosion to occur in sensitive areas such as these pans or drainage lines. This in turn could have an impact on the distribution of fauna and flora, as well as agricultural use. As such SiVEST SA (Pty) Ltd was appointed to carry out a desktop study of the surface hydrology of 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.

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 desktop study of the surface hydrology and the Aquatic Ecology Impact Assessment, as well as comment on the revised layout and technology alternatives, are included in **Annexure C.** The summaries below includes findings and recommendations of the specialists.

a) Description of the environment

The area covered by farm Struisbult is generally flat, with drainage areas and pans being ephemeral (seasonal) to various degrees. Some pans are not well defined although typical endorheic (inward flowing) (see **Figure 4.2**). *Prosopis glandulosa* (mesquite), an invasive alien plant, already exists on the farm and is associated with areas of elevated wetness and inundation i.e. it is preferentially associated with wetland and riparian areas. *P. glandulosa* is a deep-rooted tree that utilises groundwater and alters the species composition in its vicinity (by excluding indigenous flora). Furthermore, this specie promotes open more erodible sub-canopy areas. Due to its provision of shade, these areas also tend to get highly trampled which exacerbates potential erosion.

Climate

The study area occurs has an arid continental climate with a summer rainfall regime. Mean annual precipitation (MAP) is approximately 197 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 33ºC and the average winter night time temperatures of approximately 1ºC. Most of the rainfall is confined to summer and early autumn.

Geology

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

Drainage

A valley line bisects the site into two catchments, a northern and southern catchment, both draining into the same drainage valley line. The northern catchment naturally drains in a southern direction, whilst the southern catchment drains in a northern direction. Both site alternatives fall within the northern catchment. Furthermore, 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.

Slope

The site falls naturally in a south westerly direction towards the drainage line bisecting the farm. The average, natural slope for this site is approximately 0.84 % or a gradient of approximately 1:118.4.

Figure 4.2 An endorheic pan that is covered by shrub and grass species. At the boundary, *Lycium cinereum* and *Rhigozum trichotomum* species occur (MacKenzie Ecological and Development Services, 2012).

b) Impact assessment

The footprint of the proposed solar facility would result in the loss of 300 ha (preferred alternative) or 900 ha (alternative) on the Farm Struisbult. The proposed facility has the potential to change the water balance in the vicinity of its construction 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 and could also result in a change in the vegetation cover and composition, including the establishment of aliens, due to elevated and regular soil moisture availability. Furthermore, since the medium for washing would be water mixed with a mild

detergent, the potential exists for the water quality of nearby resources to be influenced, 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 (-)** significance 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, the three potential 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 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. Gravel access roads may also be vulnerable to erosion by stormwater run-off.

The volume of stormwater runoff from the site would be increased 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).

Considering the above, the potential impact of stormwater is considered to be of medium magnitude, 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. The alteration to soil chemistry would depend on the dilution and chemical nature of the washing medium.

The following mitigation measure is recommended:

- Monitor both soil chemistry and erosion and mitigate if required;
- 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;
- Install composting toilets that does not require water, septic tanks or soak-aways;
- Channel runoff should be diverted in such a way as to minimise erosion and if necessary, soil stabilising techniques should be implemented in vulnerable areas;
- Removal of perennial alien species such as *Prosopis glandulosa* at sites disturbed or cleared, or where panel washing occurs;

- Monitoring, together with the development of an operational environmental management plan should be implemented;
- No septic tanks / soak-aways should be allowed in drainage areas;
- Stormwater channels and "mitre" chutes should be constructed to direct the stormwater flows and minimize and control erosion;
- 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 31 mm/hour; and
- The major storm occurrence (i.e. 1:25 year, 1:50 year and 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 – 47 mm/hour, 1:50 year – 56 mm/hour and 1:100 year – 64 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, with the implementation of mitigation measures it is considered unlikely that stormwater would significantly impact on these drainage systems. In addition, monitoring, together with the development of an environmental management plan as operation proceeds, would be the most effective strategy to limit any cumulative impacts on the surrounding environment. As such the cumulative impact is considered to be of very low magnitude, site specific 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, gently undulating to flat, with a very gradual slope east to west. The landscape is covered in shrubs with a few sparse trees. Tall structures, such as existing powerlines, are visible for many kilometres and the potential therefore exists that the proposed PV plant and its 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, as well as the general area of the locality from where the site would most likely be visible, was assessed. The VIA 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. A summary of the findings and recommendations of the project is provided below.

a) Description of the environment

The overall landscape is defined as wide open, flat, remote, sparsely populated land that is typical of the rural open plains of the Karoo. The landscape is covered in grasslands and scrub with few shrubs on site. Trees are few, 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 abandoned copper mine and within 1 km of the proposed development site. The disused copper mine is situated approximately 4 km to the north of the proposed site and occupies an area of approximately 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.

Alkantpan is situated 9 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 regularly inhabited.

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 an industrial character into the rural landscape.

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, even though it would be valued to a degree for scenic remoteness. The 5 km viewshed considered for the proposed development includes the site and peripheral areas, the town of Copperton, road R357 to Copperton, the road to Marydale and the mine.

b) Impact assessment

The proposed development would consist of an extensive installation of PV panels situated 0.5 km – 1 km away from the Copperton settlement. The 100 MW preferred layout would occupy a 300 ha site and would be situated approximately 1 km from the Copperton settlement. The 300 MW alternative would occupy a 900 ha site located approximately 0.5 km from Copperton. Furthermore, the development would include security fencing, internal roads, single storey buildings, a transmission line and a sub-station. Both layout alternatives would be visible from Copperton. A smaller, 20 MW PV installation located south of the proposed site has been approved but not constructed. In terms of technology, the alternative consists of approximately 4 m high PV panels, whereas the preferred technology alternative would have CPV panels of 15.4 m in height and 22 m in width. The preferred technology alternative would however require fewer panels than the alternative.

The proposed development is a semi-industrial land use and would be located in an agricultural area, although there are industrial uses in the vicinity. 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 sites 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 will influence the view and act as a visual focus. These zones or viewsheds are recorded in **Figures 4.3** and **Figure 4.4**.

There are no receptors on the site itself and surrounding landscape, apart from people working on the farm and Eskom maintenance operatives.

In the town of Copperton (approximately 1 km from the preferred site and 0.5 km from the alternative site), most gardens in the town itself and on the perimeter of the town have large trees and shrubs that would provide screening from the development. In the case of the alternative technology option, residents would not be visually aware of the development when they are at home. However when they travel beyond the edge of town the site would definitely have a visual impact. In the case of the preferred technology option residents would be visually aware of the development and the top parts of the infrastructure likely to be visible during certain times of the day.

Traffic on the R357 would not be aware of the proposed development, travelling in either direction. Traffic on the road between R357 and Copperton would have a clear view of both the preferred and the alternate layouts for a distance of approximately 6.5 km. At the junction, a right turn takes the driver into the built up Copperton area. For the length of this road and travelling in either direction the view of both layouts would be clear and unimpeded. For over 12 km and travelling at 80 km/h, the view would last between 8 and 9 minutes.

The road to Marydale is accessed off the Copperton road and south bound traffic approaching the junction would be aware of the preferred site for just over 1 km, and of the alternative site for about 3.5 km. The junction is less than 2 km from the alternative site and over 2 km from the preferred site.

The Copperton turn off from the R357 connects with the mine, after the road to Copperton is passed; this east-west road eventually turns north-south and re-joins the R357. Most of the connecting roads off this road that took traffic into the mine are now blocked off. This means that the roads are very little used, and, while within the cone of visibility, there would be little impact.

The mine is closed and not visited by people except the few who still live there, and work locally. The view from the mine would be intermittent as it would be broken up by buildings, spoil and planting. People leaving Alkantpan would have a view of the preferred site over a distance of approximately 3 km.

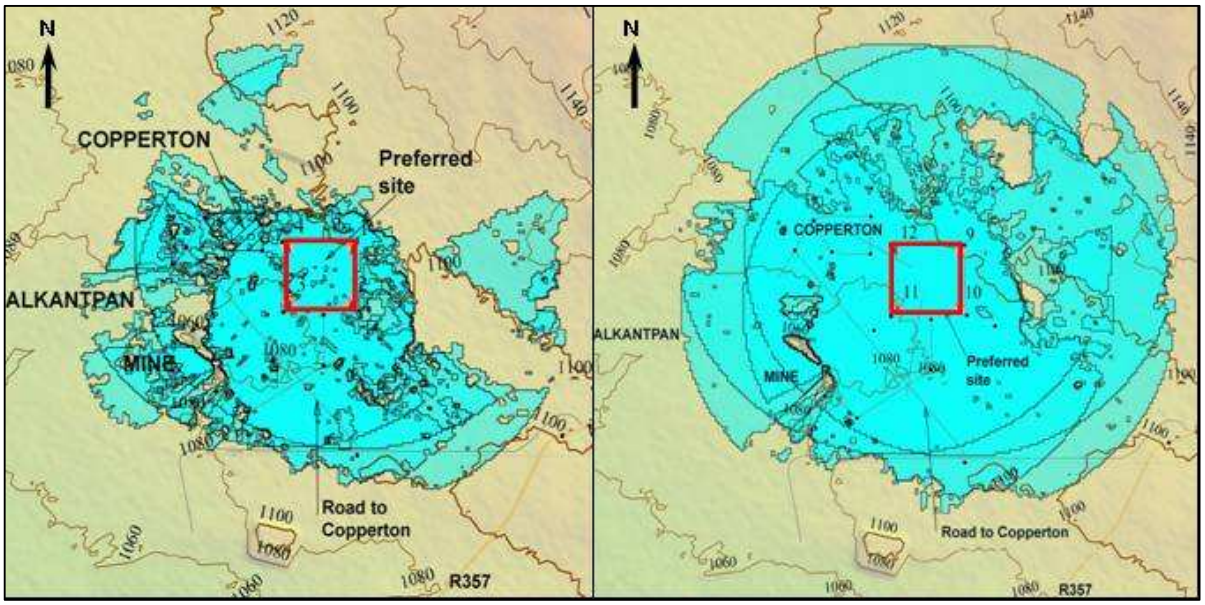

Figure 4.3 Maps showing the visual envelope calculated at a radius of 5 km with 4 m (left) and 15.4 m (right) high panels for the preferred site (K. Hansen, 2012)

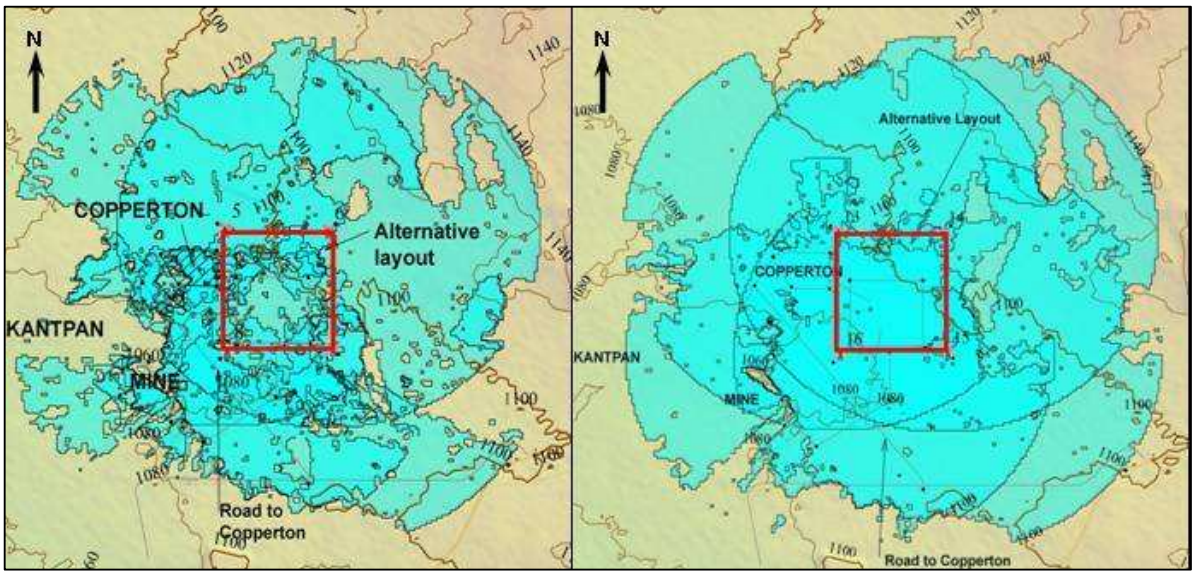

Figure 4.4 Maps showing the visual envelope calculated at a radius of 5 km with 4 m (left) and 15.4 m (right) high panels for the alternative site (K. Hansen, 2012)

Figure 4.5 shows a photomontage of the preferred site with 15.4 m high panels and the approved 20 MW PV project (approved PV1) site. The proposed Plan 8 wind energy facility is shown in the background.

Figure 4.5 View of the proposed preferred and alternative layouts for Struisbult, from the road to the copper mine. The proposed Mainstream wind energy facility can be seen beyond (K. Hansen, 2012)[29]

The preferred layout is less extensive than the alternative and slightly further from the settlement of Copperton. The preferred site with 4 m high panels would have a lesser zone of visual influence than the preferred 15.4 m high panels. If either of the mounting technology alternatives (tracking) were specified, the visual influence rating would not vary from the foregoing, as the affected road would be at a lower elevation than the site. Residents of Copperton would be screened from any such impact by intervening trees and shrubs.

Due to the scale of the development, the numbers and types of receptors directly affected and the semi-industrial nature of the proposed project, which is compatible with the local industrial uses, the potential visual impact is considered to be of medium magnitude, local extent and long term and therefore of **medium (-)** significance, without mitigation for all alternatives. With the implementation of mitigation measures the significance would remain **medium (-)** for all alternatives.

c) Mitigation measures

The following mitigation measures are recommended:

- Roads and hard-standings would be constructed as part of the works;
- The first 150 mm of naturally occurring substrate should be retained and then spread over finished areas;
- All excess material shall be removed off-site, and the ground shall be returned to original levels/gradients as far as possible;
- New structures should be placed where they are least visible to the greatest numbers of people, in places where the topography can offer shielding, where possible;
- Visibility of buildings and the local sub-station should be reduced by cladding the buildings in non-reflective colours and materials that will blend in with natural environment. E.g. cladding with local stone or plaster and paint with earthy tones for paint colours, roofs should be grey and non-reflective and doors and window frames should reference either the roof or wall colours;
- Finishing materials of the infrastructure (including support structures) should be of colours that are non-reflective and in dark matte colours such as dark grey or charcoal; and
- Information on the project should be provided to local people, such as through a poster at the entrance to the site.

[29] Note that no suitable image could be found for PV panels, hence text has been used to illustrate the scale of the proposed project.

d) Cumulative impacts

The visual impact of this proposed development was assessed in the context of the other renewable energy projects within the Copperton area that are in various stages of approval.

The local landscape may change in character from one which is agricultural and remote to one where there are isolated hi-tech developments, i.e. wind turbines and solar installations. The most visually significant developments, the wind energy facilities, are far apart from each other but the one proposed by Mainstream Renewable Energy is close to this site. The solar installations would also be extensive but the scale of the landscape is sufficient to provide a setting for these developments as they are widely spaced and the area already has an industrial component. Furthermore, the local landscape character has been changed and made more industrial. The cumulative impact is assessed as medium (-) for both magnitude and significance.

4.3.2 Impact on energy production

South Africa has experienced a shortfall in electricity supply in the past few years and continues to experience constrained electricity supply. The proposed project could impact on the ability of Eskom to provide electricity.

a) Description of the environment

Historical trends in electricity demand in South Africa have shown a consistent increase in demand. There are some years where the demand levels off or decreases but over the long term there is still an increase. Such a decrease in demand was seen in 2009 in line with the global recession, demand growth has since resumed. As a result, the reserve margin still remains low and Eskom is still short of capacity, a situation that is expected to continue until new base load capacity can be brought online from 2012 onwards. The reserve margin will again be constrained after 2018 should no new base load power stations be constructed. The proposed wind energy facility would be able to provide power to assist in meeting the energy demand within South Africa.

In Eskom's Medium Term Adequacy Report (Week 44 of 2011) it is anticipated that the reserve margin would vary between 6.8 % (2013) and 12.7 % (2011) of Eskom's capacity and it would be necessary to import 1 500 MW of electricity annually up until 2014[30].

As noted in Section 1.2.6.d of this report, South Africa aims to procure 3 725 MW capacity of renewable energy by 2016 (the first round of procurement). The proposed project could provide 100 MW, or 2.7 %, of this figure.

b) Impact assessment

Given the need for increased production capacity in South Africa, as well as the targeted renewable energy figure, the potential impact of the proposed project on energy production is considered to be of low magnitude, regional and long term and therefore of **low (+)** significance, without or with mitigation measures. No difference in significance would result from the proposed alternatives.

[30] http://www.eskom.co.za/c/article/803/adequacy-report-week-44/ (accessed 15/11/11)

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

As shown in **Figure 4.7** below five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. The potential cumulative impact of this proposed project on South Africa's energy production would remain of **low (+)** significance.

4.3.3 Impact on climate change

The establishment of a PV plant 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.

a) Description of the environment

Gases which contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH_4), water vapour, nitrous oxide, chloroflurocarbons (CFCs), halons and peroxyacylnitrate (PAN). All of these gases are transparent to shortwave radiation reaching the earth's surface, but trap long-wave radiation leaving the earth's surface, acting like a greenhouse. This action leads to a warming of the earth's lower atmosphere, with changes in the global and regional climates, rising sea levels and extended desertification. This is turn is expected to have severe ecological consequences and a suite of implications for humans. Total greenhouse gas emissions reported to be emitted within South Africa for the 2008 year was approximately 435 million metric tons of CO_2 equivalent (UN Statistical division, 2011).

b) Impact assessment

Greenhouse gases released from a new coal-fired power station are primarily CO_2 with minor amounts of nitrous oxide (N_2O). The Medupi Power Station (4 788 MW), currently under construction near Lephalale in Limpopo, is expected to produce 29.9 million metric tons of CO_2 per annum. The emissions from Medupi Power Station would increase South Africa's CO_2 equivalent emissions (2008) by some 7 %. This is a significant increase in greenhouse gas emissions, given the aims of the Kyoto Protocol, which are to reduce overall emission levels of the six major greenhouse gases to 5 % below the 1990 levels, between 2008 and 2012 in developed countries. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly.

No greenhouse gases are produced by PV plants during operation, as PV plants use solar energy that generate the electricity. Although PV plants would not completely replace coal-fired power stations within South Africa, since these would still be required to provide base-load, they would reduce South Africa's reliance on them. This would assist in reducing future volumes of greenhouse gas emissions.

A life-cycle analysis looks at the entire chain of activities needed for electricity production and distribution, such as fuel extraction and transport, processing and transformation, construction

and installation of the plant and equipment, waste disposal, as well as the eventual decommissioning. Every energy technology (solar, wind, hydro, coal, gas, etc.) has its own very distinct fuel cycle. A comparative life-cycle analysis for the current energy technologies used in Europe was conducted by AUMA (2000). The study focused mainly on emissions from the various energy technologies. Although the results of the analysis are not necessarily entirely accurate in the South African context, they offer a good proxy for a comparative assessment of coal-fired and wind energy facilities in South Africa. The results of the analysis are illustrated graphically in **Figure 4.6** below.

Figure 4.6 Matrix of environmental impacts by categories (AUMA, 2000)

It is evident from **Figure 4.6** above that environmental impacts associated with renewables, as opposed to fossil fuels such as coal, are significantly less over the entire life-cycle.

While the proposed PV plant would not provide an equivalent amount of energy to a typical new coal-fired power station (100 – 300 MW compared to 4 788 MW), when considered with regards to climate change and given the spirit of the Kyoto Protocol, the impact is deemed to be of

regional extent, very low magnitude and long term and therefore of **low (+)** significance, without mitigation.

a) Mitigation measures

No mitigation measures are recommended.

b) Cumulative impacts

As shown in **Figure 2.6**, five other renewable energy projects are proposed for the area, with a combined capacity of 900 - 950 MW. Furthermore, many more PV plants are proposed throughout South Africa. Given the number of PV plants 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.

4.3.4 Impact on local economy (employment) and social conditions

The establishment of the proposed PV energy facility would provide a number of direct, indirect and induced jobs. Direct jobs are created during manufacturing, construction and installation, operation and maintenance. The proposed project would also result in a large amount of expenditure in South Africa, both to procure services (e.g. transportation services) and materials (e.g. road building materials).

a) Description of the environment

Copperton falls within the Siyathemba Local Municipality (LM). The population of Siyathemba LM is 19 360 and this is split into 74 % Coloured, 14 % African, 11 % White and 1 % Other. The total number of households is 4 542. The main employment industry is farming, followed by mining. Agricultural activities extend to sheep, wheat, maize, lucerne, cotton, beans, vineyards and peanuts. There are 12 schools in the LM and, four clinics (one of which is in Prieska) and one hospital[31].

The site is located in a rural area and as such the population density is very low, with neighbours located kilometres away. Whilst Copperton itself was once a populated town, providing accommodation for the mine workers, this is no longer the case and the majority of houses have been demolished. A few houses are however still rented to retired farmers. According to the Pixley ka Seme DM SDF (2007) the 2001 population of Copperton (which fell under the DM's management, prior to being assimilated into the Siyathemba LM) was 37, with nine households. Employment opportunities in the immediate area stem from farming, the local accommodation lodge, Ietznietz, and Alkantpan weapons testing facility.

b) Impact assessment

Up to 100 operation and maintenance jobs would be created during the operational phase for the preferred site and 150 job opportunities for the alternative site. Indirect and induced jobs would also result from the proposed project. It is important to note that the number of jobs does not equate to the number of people employed.

[31] Taken from http://www.siyathemba.co.za/demographics.htm (accessed 02/01/11)

The operating expenditure of the proposed project would be roughly R 30 million (preferred alternative) or R90 million (alternative per year, of which up to R 15 million (preferred alternative) or R45 million (alternative) per year would be spent in South Africa. Increased spending (procurement of goods and services) in South Africa would indirectly result in more employment opportunities. Increased employment opportunities (direct and indirect) would allow for an improvement in social conditions for those who obtain employment. The project would also result in an increase in the revenue of the LM through increased rates and taxes. This in turn could result in an increase in municipal spending on social programmes.

Based on the number of employment opportunities during the operational phase the potential impact on the local economy (employment) and social conditions is considered to be medium magnitude, regional and long term and therefore of **medium (+)** significance, with or without mitigation for the preferred alternative. The alternative layout would have a **medium – high (+)** impact on the local economy.

c) Mitigation measures

The following mitigation measures are recommended:

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

d) Cumulative impacts

As noted previously, five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. The potential cumulative impact of these proposed projects on employment and socio-economic conditions in the local area would remain of **medium (+)** significance.

4.3.5 Impact on agricultural land

The Struisbult Farm covers an area of approximately 6 194 ha. For both alternative sites the footprint of the proposed facility would reduce the area available for agriculture. As such Mr Kurt Barichievy of SiVEST (Pty) Ltd was appointed to undertake a desktop Agricultural Impact Assessment. A brief site visit was conducted on 5 and 6 December 2011. The study considered climate, geology, soils, terrain, land capability, current agricultural practices and agricultural potential. The desktop Agricultural Assessment and comment on the revised layout and technology alternatives for Struisbult Farm is included in **Annexure C.** The findings and recommendations of the study are summarised below.

a) Description of the environment

For the purpose of this assessment, agricultural potential is described as an area's suitability and capacity to sustainably accommodate agricultural land use. In most cases the agricultural potential is benchmarked against crop production.

Climate

Copperton area has an arid continental climate with a summer rainfall regime. The region typically experiences hot days and cold nights with the average summer temperature of approximately 33ºC and the average winter night time temperatures of approximately 1ºC. Most

of the rainfall is confined to summer and early autumn. According to the Daily Rainfall Extraction Utility (Lynch, 2003) the MAP for the Copperton area is approximately 176 mm per year with 62 % of rainfall occurring between January and April. Considering that 500 mm is the minimum amount of rain required for sustainable dry land farming, the MAP of 176 mm is extremely low. Therefore without some form of supplementary irrigation, natural rainfall for the Copperton area is insufficient to produce sustainable harvests. This is reflected in the lack of dry land crop production within the area.

Geology

Struisbult Farm is underlain by two primary parent materials namely tillite and sedimentary material. Tillite consists of consolidated masses of unweathered blocks and unsorted glacial till and underlies the north-eastern and southern tip of Struisbult Farm. Non-descript sedimentary geologic materials dominate the remainder of the Struisbult site. The proposed solar energy facility would be underlain by both sedimentary and tillite parent materials.

Slope

The topography for the proposed site is characterised by a flat and gently sloping landscape and not a limiting factor for agriculture.

Land use

The proposed site identified for the proposed solar plant consists of a mix of natural veld and vacant land, which is used as general grazing land for livestock. Vast un-improved grazing land is interspersed by non-perennial stream beds. Stocking rates for the region are estimated at 1 small animal unit per 6 ha and 1 large animal unit per 35 ha. According to the land use data there are no signs of formal agricultural fields or cultivation on Struisbult Farm.

Soils

The Environmental Potential Atlas for South Africa (ENPAT) for the Northern Cape Province indicates that Sruisbult Farm is dominated by apedal soil types. The northern and northeastern portions of the site are dominated by red apedal soils while the southern and southwestern portions contain a mix of both red and yellow apedal soils. Apedal soils are weakly structured and tend to be freely drained. Due to the overriding climate conditions these soils tend to be Eutropohic (high base status). The study area is classified as having an effective soil depth[32] of less than 0.45 m deep and therefore is a limiting factor in terms of sustainable crop production. According to the Agricultural Geo-Referenced Information System (AGIS, 2012) the soils on Struisbult Farm are associated with saline soils with a low water holding capacity, high pH and low cation exchange capacity[33].

Agricultural potential

Restrictive climate characteristics (due to the strong summer rainfall regime), moisture stress and low winter temperatures reduce the agricultural potential of Struisbult Farm. The ENPAT Database provides an overview of the study area's agricultural potential based on its soil characteristics although it does not take prevailing climate into account. The database indicated

[32] Depth to which roots can penetrate the soil (SiVEST, 2012)

[33] The cation exchange capacity of a soil is defined as the sum total of exchangeable cations that a soil can absorb, and influences the amount of nutrients available to plants.

that the study area is dominated by soils which are not suited for arable agriculture, but which can still be used as grazing land.

Figure 4.7 An example of rocky and shallow soils found within the study area (taken on 29/09/2011)

By taking all the site characteristics (climate, geology, land use, slope and soils) into account, the agricultural potential for the majority of the study area is classified as being extremely low for crop production while moderate to moderately low for grazing. This poor agricultural potential rating is primarily due to restrictive climatic characteristics and soil depth limitations. The site is not classified as high potential nor is it a unique dry land agricultural resource.

b) Impact assessment

The footprint of the proposed project would result in the loss of 300 ha (preferred alternative) or 900 ha (proposed alternative) on the Struisbult. There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development. The farm can be classified as having extremely low agricultural potential for crop production, while moderate to moderately low potential for grazing . The proposed project would only influence a portion of Farm Struisbult and the remaining land would continue to function as it did prior to the proposed solar energy facility.

Consequently, the overall impact on agricultural potential and production is considered to be of very low intensity, local extent and long term and therefore of **very low (-)** significance with and without mitigation for both alternative layouts[34].

c) Mitigation measures

No specific mitigation measures are recommended.

[34] Note that a full agricultural assessment was not considered to be necessary by Mr Barichievy.

d) Cumulative impacts

The reduction in usable grazing owing to various solar projects (one approved and three, including this proposal, proposed) planned in and around Copperton could place increased pressure on adjacent land. However, due to the limited agricultural potential described above and on the other sites, the potential impact of this increased pressure is considered to be of very low (-) significance.

4.3.6 Impact on surrounding land uses

The predominant surrounding landuse is agriculture. However, a few other land uses occurs in the area and could be impacted on by the proposed project.

a) Description of the environment

At the abandoned Copperton mine a PV power generation facility is proposed by Mulilo that recently received an Environmental Authorisation (DEA Ref. No. 12/12/20/1722). Further west of the site is Alkantpan, a weapons testing range, used by many countries for weapons testing. Other proposed activities in the area include a wind energy facility to the east proposed by Plan 8 (Pty) Ltd (DEA Ref. No. 12/12/20/2099), two PV plants to the west and north of the site on farms Hoekplaas (DEA Ref. No. 12/12/20/2503) and Klipgatspan (DEA Ref. No.12/12/20/2501) and wind and solar energy facilities proposed by Mainstream Renewable Energy (Pty) Ltd (DEA Ref. No. 12/12/20/2320/1 and 12/12/20/2320/2) of which the one site (Farm 118/1) borders directly to Hoekplaas and Klipgats Pan. A prospecting right has also been granted for the Remainder of Portions 25 and 26 (portion of Portion 25) of Struisbult Farm, as well as Slimes Dam No. 154[35].

Furthermore, a 1.7 km airstrip, is located to the west of the site and is used by a number of aeroclubs (e.g. Aeroclub SA). The airstrip would however need to be relocated to Alkantpan should the wind energy facility (by Plan 8 (Pty) Ltd (DEA Ref. No. 12/12/20/2099)) receive approval. The current world record for paragliding (502 km) was set from Copperton. Copperton produces good thermal activity with minimal low level obstructions to facilitate safe launching and departures for paragliders and light aircraft.

Copperton town, consisting of a few dwellings and a small shop is located immediately west of the site.

As noted in **Section 1.2.3** the proposed PV plant site falls within the general astronomy advantage area and is located approximately 22 km north of a SKA station (see **Figure 4.8** below). The Karoo Core Astronomy Advantage Area will contain the MeerKAT radio telescope and the proposed core planned SKA radio telescope that will be used for the purposes of radio astronomy and related scientific endeavours. South Africa, along with Australia, has been shortlisted to host the world's largest telescope, the SKA. South Africa's bid proposes that the core of the telescope be located in an arid area of the Northern Cape, with approximately four antenna stations in Namibia, three in Botswana, two in each of Mozambique and Madagascar,

[35] Email from B. van Deventer on 11 January 2012.

and one each in Mauritius, Kenya, Ghana and Zambia[36]. A final decision on the location is expected to be made in early 2012 by the SKA Board of Directors.

b) Impact assessment

The proposed development could potentially impact on the SKA project. There are two major mechanisms that would result in detrimental effects on radio astronomy observations by PV facilities. The first effect is as a result of the electromagnetic interference generated from the power generation equipment. This is broadband interference, and would result in a complete shutdown of radio astronomy observations. Mulilo has however investigated radio frequency interference (RFI) shielding of the primary switchgear and insulated gate bipolar transistor (IGBT) components. Based on Mulilo's previous experience with RFI shielding, it is believed that a suitable system can be incorporated into the design and the South African SKA Project Office (SASPO) is invited to assist with this design at the appropriate time.

Without an accurate electromagnetic characterisation of the equipment being used, it would be difficult to determine a separation distance that would be required to ensure radio astronomy receivers are protected. Electromagnetic characterisation of the components can be accessed once detailed design is complete. However, SASPO has indicated that experience from other equipment that meets the various SANS standards in South Africa indicates that at least a 10 km separation distance would be required for equipment at ground level. Based on this fact, Mulilo has selected the current locations of the sites and performed a view shed analysis (refer to **Figure 4.8**) on them to ensure no line of site impacts were evident. Furthermore, the SKA station is located approximately 22 km away from the proposed PV plant.
At heights greater than 50 m above ground, this separation distance would increase significantly due to the lack of potential topographical shielding. The second, and probably more significant mechanism, is that of the PV facility acting as secondary transmitters. That is, the solar panels would reflect distant radio signals from other transmitters onto the radio telescopes. This would result in detrimental effects to the radio astronomy facility. International practice suggests that energy facilities should not be in line-of site of any radio telescope receiver.

Based on the information available, it is unlikely that the proposed PV plant would impact on the SKA satellite station. However, should the PV plant do interfere, the potential impact is considered to be of low magnitude, regional extent and long term and therefore of **low (-)** significance, without mitigation. Note that the confidence in this impact is considered to be Unsure[37]. 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.

[36] http://www.ska.ac.za/bid/index.php (accessed 19/10/11)
[37] Limited useful information on and understanding of the environmental factors potentially influencing this impact is available.

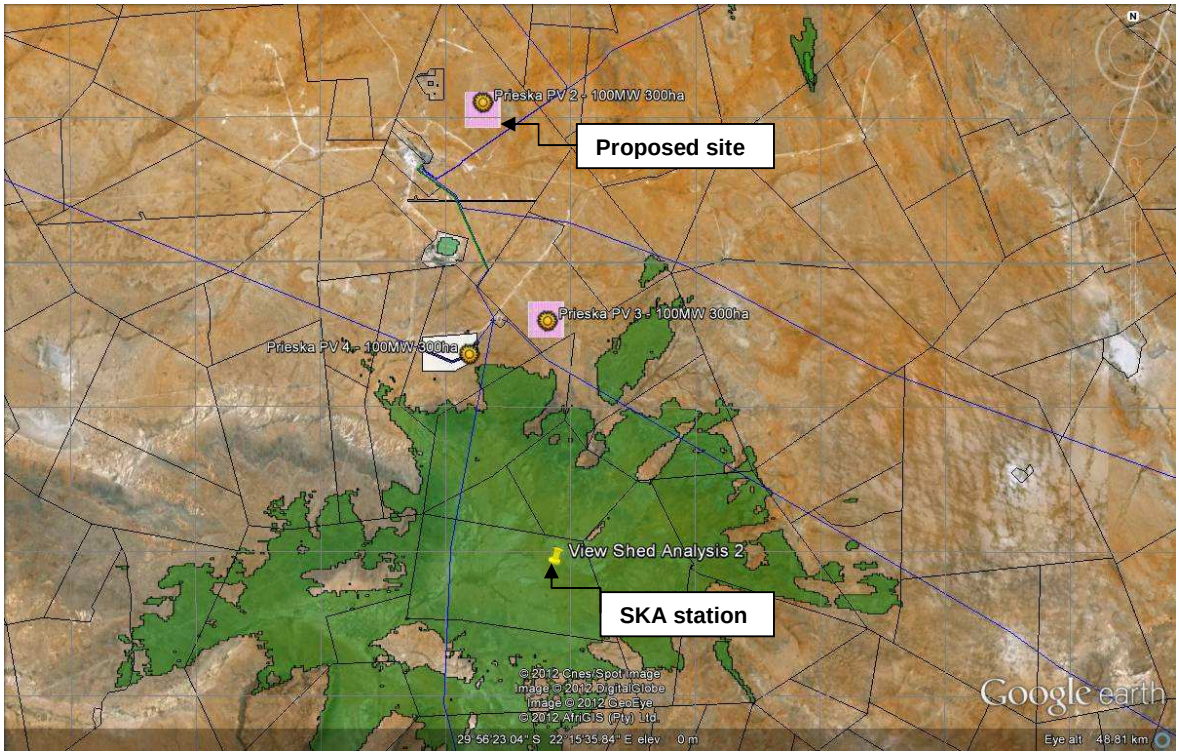

Figure 4.8 Results from a view shed analysis (areas indicated in green) undertaken by Mulilo to identify potential impacts on the nearest SKA station (courtesy Mulilo)

As mitigation measures have not yet been determined it is not possible to ascertain the significance of the potential impact after mitigation at this point. However, it is anticipated that mitigation measures would be sufficient to reduce the significance of the potential impact to a level acceptable to SASPO, failing which the proposed project would not be allowed to proceed. The significance of the potential impact would only be determined after the detailed impact analysis is complete.

It should be noted that should the SKA project be awarded to Australia no impact would result from the proposed wind energy facility. This decision is due to be taken early in 2012 by the SKA Board of Directors.

c) Mitigation measures

It is anticipated that mitigation measures would be identified after the detailed impact analysis has taken place.

d) Cumulative impacts

It is anticipated that the potential impact on SKA would be reduced to a level acceptable to SASPO. Furthermore, it is expected that any other PV energy facilities would need to reduce their potential impact (including cumulative impact) to a level acceptable to SASPO.

4.4 CONSTRUCTION PHASE IMPACTS ON THE BIOPHYSICAL AND SOCIAL ENVIRONMENTS

The construction phase is likely to result in a number of negative impacts on the biophysical and the social environment. These could potentially include:

- Disturbance of flora, avifauna and fauna;
- Sedimentation, erosion and aquatic ecology;
- Impact on traffic;
- Impact on local economy (employment) and social conditions;
- Visual impact;
- Storage of hazardous substances on site;
- Noise pollution; and
- Dust impact.

The significance of construction phase impacts is likely to be limited by their relatively short duration, since the construction phase should last approximately 18 to 30 months. Many of the construction phase impacts could be mitigated through the implementation of an appropriate EMP. A life-cycle EMP is contained in **Annexure D** of this report, which specifies the mitigation measures that could be implemented to mitigate construction phase impacts, amongst others.

4.4.1 Disturbance of flora, avifauna, and fauna

Flora

It is anticipated that there would be loss of vegetation and ecological processes during the construction phase of the facility for both the preferred alternative and the alternative.

Avifauna

Given the considerable space requirements of commercially viable PV facilities (300 or 900 ha for this proposed project) the construction phase would result in temporary damage or permanent destruction of habitat larger than this area. This could have a lasting impact in cases where the site coincides with critical areas for restricted range, endemic and/or threatened species. The effect could be significant in some instances, allowing for the possible cumulative effects of multiple facilities in one area. Furthermore, construction activities could disturb breeding, foraging or migrating birds. Bird species of particular concern, which may be affected, include Red Lark and Sclater's Lark, Martial Eagle, Lanner Falcon, Ludwig's Bustard and possibly flamingo.

Fauna

Any affected fauna would generally be largely mobile and would relocate during the construction phase and are likely to recolonise the area, once the construction phase has been completed and the disturbed areas rehabilitated.

Based on the above the potential impact on flora, birds and fauna during construction due to disturbance, habit loss and displacement is considered to be of low to medium magnitude, local extent and short term and therefore **low (-)** significance without mitigation. With the

implementation of mitigation measures this is anticipated to reduce to **very low (-)** significance. There would be no difference in significance as a result of the proposed alternatives.
The following mitigation measures are recommended:

- In all cases construction of access roads should be designed for minimal impact. All construction should take place within the footprint of the proposed PV plant;
- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to;
- 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;
- The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require 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 should be avoided wherever possible;
- Shallow depressions and well defined pans should be avoided and buffered by at least 50 m; and
- The site should be cleared in sections as required for construction and not all at once.

4.4.2 Sedimentation, erosion and aquatic ecology

The sediment loads of any drainage depressions or pans may increase due to the excavations on the site, the laying of linear infrastructure such as roads across drainage lines and other construction related activities. This would be exacerbated during the wet season and during any intense rainfall events. Other potential impacts include the formation of barriers to drainage areas, increased invasion by alien plant species, especially perennial aggressive species such as *P. glandulosa* and the production and handling of wastewater. This impact is considered to be of low magnitude, local extent and medium term and therefore of **low (-)** significance without mitigation and **very low (-)** with mitigation for all alternatives.

The following mitigation measures are recommended:

- The proposed project should be located away from the no-go areas, as well as a 50 m buffer area around these no-go areas;
- Access roads should be positioned in such a way that no clearing within no-go areas is required and definite drainage areas should be avoided. Should additional access roads be required, these should be built with culverts to prevent the impediment of water movement;
- The use of erosion control measures to minimise erosion at excavation / clearing sites or aggregate storage sites is necessary and earth moving construction activities should take place in the dry season as far as possible; and
- Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared by construction activities.

4.4.3 Impact on heritage (including palaeontology) resources

As a result of the relatively undisturbed nature of the site, and the findings of the archaeology study on Struisbult for the approved 20 MW project (see **Section 4.3.5a**) and on an adjacent property, it is highly likely that archaeological or cultural material would be found on site. Furthermore, the site is located in an area of the Main Karoo Basin of South Africa that is underlain by potentially fossiliferous sedimentary rocks of the Karoo Supergroup known for its value as potential source of palaeontology heritage.

A Palaeontology Impact Assessment (PIA) was therefore undertaken by Dr John Almond and included a desktop review and previous field assessments of the paleontological aspects in the project area.

In addition, a Heritage Impact Assessment (HIA) was conducted by Jayson Orton of the Archaeology Contracts Office (ACO) to assess the impacts of the proposed PV project on the heritage resources in the project area. Information for the study was sourced from published and unpublished archaeological reports, as well as a physical survey by the specialists of the project area on 11 December 2011.

The PIA and HIA, as well as comments on the revised layout and technology alternatives, are included in **Annexure C**. The findings and recommendations of these studies are summarised below.

a) Description of the environment

The site is situated just southeast of the town of Copperton and northeast of the Prieska Copper Mine. It occupies a flat area but slopes gently uphill towards the northeast and is predominantly covered in gravel and low density, knee-high vegetation. The landscape includes two pans although numerous areas were found to hold ephemeral water after the rain.

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) are also present. These artefacts are generally very well weathered in the form of background scatter. Excavations at Bundu Pan 25 - 30 km northwest of Copperton uncovered archaeological material regarded to be generally rare in South Africa and included findings of preserved Pleistocene faunal material, bones of wildebeest, warthog, extinct giant hartebeest, species of equid (horse/zebra), baboon, springbok and blesbok. Rock art in the form of engravings dating back to the period when indigenous people or Bushman lived in the area are widely known in the area. More recent heritage includes typical flat-roofed Karoo-style houses commonly found in the small towns and war graves and a British fort at Prieska dating from the Anglo-Boer War.

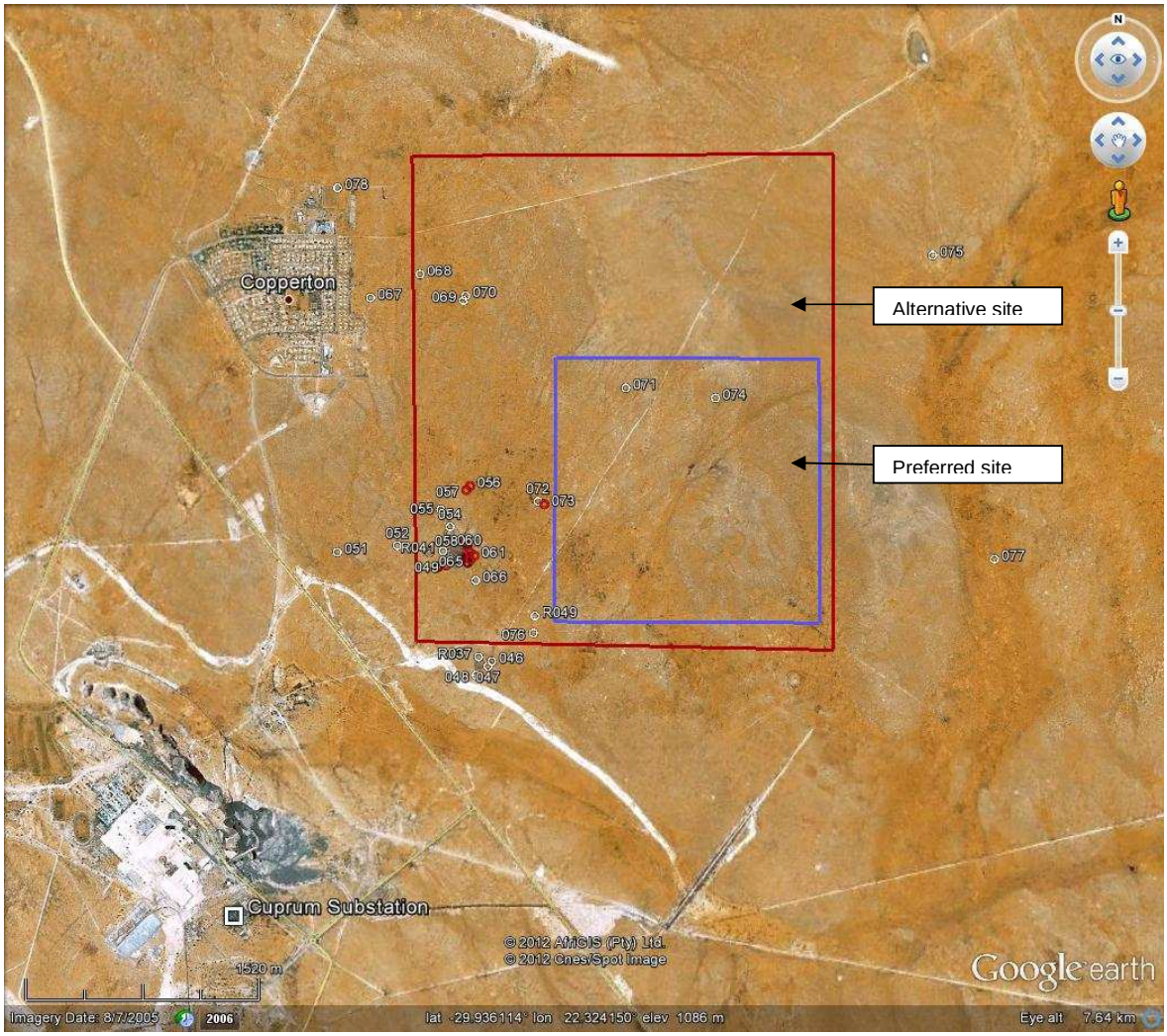

Figure 4.9 Aerial view of the study area taken from Google Earth and showing the distribution of recorded archaeological occurrences by their field numbers. Red points require mitigation, white points do not (ACO, 2012)

Figure 4.9 shows the distribution of archaeological resources recorded during the survey. The majority of recorded occurrences are situated in two clusters that relates to the larger pans on the site and mainly contain LSA occupation material. Most examples of MSA and ESA material were in low densities in the form of background scatter and included heavily weathered stone material such as hand-axes. LSA material includes stone implements of quartzite, ostrich eggshell and bone fragments and these sites were focussed on the margins of the pans, particularly Perdepan.

Figure 4.10 Selection of isolated artefacts from the background scatter found at Struisbult Farm showing the variability in materials and weathering states (ACO, 2012)

Three "piles" of stones (see **Figure 4.11**) were located in sandy areas and are potentially of very high significance as they are anthropogenic. These may possibly be graves but this can only be verified with excavation.

Figure 4.11 View of one of the stone mounds (ACO, 2012)

No buildings, structures or cultural landscape features were identified on site as the site is on open, undeveloped land.

The R357 connecting Prieska and Vanwyksvlei via Copperton, is a generally scenic route and contributes to the sense of place created by typical undeveloped Karoo open space.

In terms of palaeontology, the general region forms part of the low-relief Kaiingveld of the eastern Bushmanland and the terrain is fairly flat-lying, arid, sandy to gravely. Drainage is limited to small, intermittently active streams and pans (Perdepan and Saaipan) which flow towards the west into old Tertiary drainage systems.

The geology of the study area consists of Permo-Carboniferous glacial sediments of the Dwyka Group (Karoo Supergroup) that overlie granitoid Precambrian basement rocks of the Namaqua-Natal Metamorphic Province and are locally intruded by Karoo dolerites and narrow kimberlite dykes of Cretaceous age. These older bedrocks are widely covered by a range of superficial deposits of Pleistocene to Recent age, including alluvium, down wasted coarse gravels, calcrete hardpans, and sandy to silty soils and pan sediments. The main geological units mapped within the study region are indicated in **Figure 4.12** below.

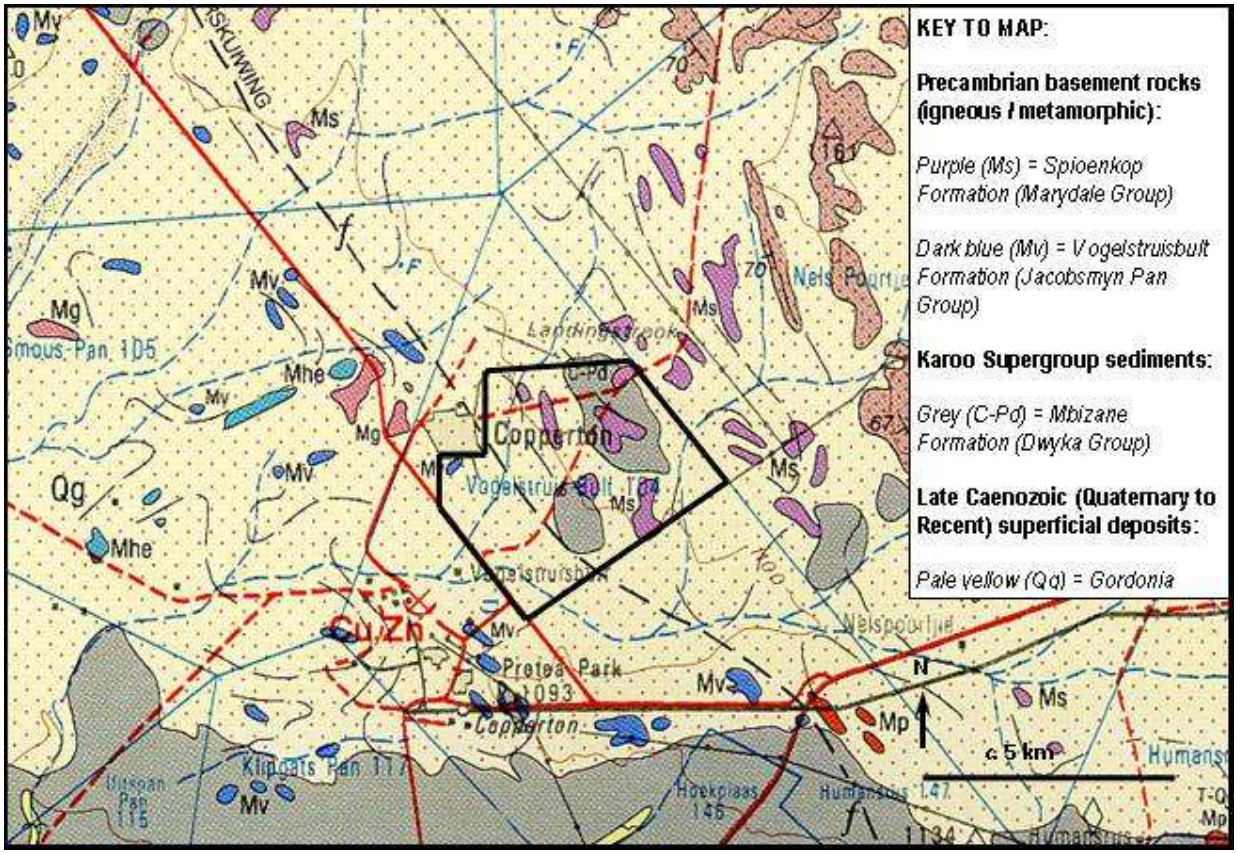

Figure 4.12 Extract from the 1:250 000 geology map 2922 Prieska (Council for Geoscience, Pretoria) showing approximate outline of the proposed solar energy facility near Copperton (black polygon) (Natura Viva, 2012)

Previous field visits suggest that the poorly-exposed upper Dwyka Group bedrocks in the study area do not contain rich trace fossil assemblages, petrified wood or other fossil material. 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 study area is largely mantled by Pleistocene to Recent superficial sediments (soils, alluvium, calcretes and gravels) generally of low paleontological sensitivity.

Fossil bones and teeth of mammals preserved within buried Pleistocene fluvial and pan sediments were recorded at Bundu Pan and younger fossil teeth have been reported from subsurface gravels on Hoekplaas in the same region. Similar fossils may also be preserved on buried palaeosurfces and within gravels or pan sediments on the Farm Struisbult, but these occurrences are likely to be sparse with unpredictable distribution.

Karoo bedrocks onsite are deeply weathered and at most sparsely fossiliferous and significant fossil material (e.g. mammal remains) at or near surface is probably very sparsely distributed in the study area.

b) Impact assessment

The construction and operation of solar energy facilities could potentially result in a wide range of impacts that would affect the heritage qualities of an area. During the construction phase of the project, activities such as bulldozing of access roads to PVs and excavation of cable trenches may result in the following impacts on the landscape and heritage environment:

- Displacement of pre-colonial and colonial archaeology material;
- Accidental damage and / or vandalism to the build environment, such as historical structures and ruins; and
- Negative visual impact of solar energy generation facilities on the cultural landscape, scenic quality and sense of place of the Karoo and Bushmanland.

Most of the archaeology present on the site is of low significance, but important LSA archaeological sites do occur and is focussed around the pans. Given the smaller size of the preferred alternative site, cumulative impacts would be of a smaller magnitude in terms of the loss of less archaeology. The R357, although scenic, is little used aside from a few local farmers and is not considered an important scenic route which makes the visual impacts very low.

Based on the above considerations the potential impact on the archaeological resources is considered to be of medium magnitude, site specific and long term duration and therefore of **medium (-)** significance, without mitigation. With the implementation of mitigation measures the potential impact is likely to be local and of **low (-)** significance.

With regards to palaeontology, the construction of the proposed PV plant would involve excavations into the superficial sediment cover (soils, alluvial gravels etc.) and potentially also into the underlying potentially fossiliferous bedrock. Potential fossil heritage within the study area may be destroyed, disturbed or permanently sealed in and would no longer be available for scientific research or other public good.

The footprints for both the preferred and alternative sites are relatively small and largely underlain by superficial deposits of low paleontological sensitivity. Extensive, deep bedrock excavations are not envisaged during the construction phase. As such, the impact significance on fossil heritage is considered to be of low magnitude, local extent and long term and therefore of **low (-)** significance, without or with mitigation, for all alternatives.

c) Mitigation measures

The following mitigation measures are recommended:

- From a heritage and visual perspective, a smaller footprint is preferable;
- Archaeological sites should be mitigated by excavation and sampling of sites before the start of construction (red dots in **Figure 4.9**);
- Test excavations should be carried out around the pans to check for subsurface archaeology which may require sampling;
- A buffer zone of 100 m from the edge of the pans should be employed; and

- In the event of accidental uncovering of graves or substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood), work must stop immediately and SAHRA should be notified. An archaeologist / palaeontologist should be involved to assist with the investigation and procedures to address the situation.

d) Cumulative impacts

Considering the scale of archaeological research in other parts of South Africa, relatively little is known of Bushmanland and the loss of any significant LSA sites would impact on knowledge of the wider region. With many energy generation facilities planned in the region, the potential to lose many sites exists.

Given the low overall paleontological sensitivity of the Karoo bedrocks and Pleistocene to Recent superficial sediments of the region as a whole, the cumulative impact of this development is not considered to be of a significance higher than the individual impact (i.e. low (-)).

4.4.4 Visual impact

Construction activities would include the upgrade of site access roads, construction of new site roads, excavation for foundations and installations of above ground infrastructure. These are expected to be most visible within 2 km, especially as the construction plant will be fitted with warning lights and sounds.

The potential construction phase visual impact is considered to be of medium magnitude, local and site specific in extent with the duration of the impact limited to the construction period and therefore of **medium (-)** significance, without mitigation. With the implementation of mitigation measures this would reduce to **low (-)** significance. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Minimise the construction period, where possible;
- Access road to be kept clean, and measures taken to minimise dust from construction traffic on gravel roads;
- Surface material should be conserved and used for rehabilitation;
- Careful consideration should be given to the visual implications of the siting of the construction camp and should be screened off;
- Site offices, if required, should be limited to single storey and should be sited carefully using temporary screen fencing to screen from the wider landscape; and
- All site operatives should receive training in awareness of issues such as the use of fires and contaminants and litter on site.

4.4.5 Impact on local economy (employment) and social conditions

The proposed PV plant would employ a medium local content i.e. up to 45% of the expenditure would be within South Africa. The local financial value of the project equates to roughly R 900 million (or R 9 million per MW).

Local labour would be employed during construction. ~~Up to 900 construction jobs could be created for the preferred 100 MW alternative and 2700 jobs for the 300 MW alternative. The construction period would last for some three years.~~ The proposed PV facility would employ a maximum of 200 jobs onsite (amounting to a total of 900 person months (preferred 100 MW alternative) and 2700 (300 MW alternative) employment crated over the construction period) depending on the procurement method used. Local labour (between 65 and 75%) would be employed during construction which could last for two years.

Increased employment opportunities would allow for an improvement in social conditions for those who obtain employment. As the majority of labour would be accommodated within Prieska, an increase in spending would result in Prieska thereby stimulating the local economy. The project would also result in an increase in the revenue of the LM through increased rates and taxes. This in turn could result in an increase in municipal spending on social programmes.

Based on the number of employment opportunities, as well as the local expenditure, during the construction phase the potential impact on the local economy (employment) and social conditions is considered to be medium magnitude, regional and short term (for the construction period) and therefore of ***medium (+)*** significance for the preferred 100 MW alternative and **high (+)** for the 300 MW alternative, with or without mitigation.

The following mitigation measures are recommended:

- Obtain a list of locally available labour and skills. Give preference to local communities for employment opportunities;
- Base recruitment on sound labour practices and with gender equality in mind; and
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.

4.4.6 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 40-foot containers;
- Two to five digger loaders for land clearing; and
- Five to ten trucks with cranes to assemble the plant.

Transporting components to site is likely to necessitate the upgrading of sections of road to ensure clearances and bends are negotiable by trucks.

The potential impact of the project on transport is considered to be of low magnitude, regional extent and short term and therefore of **very low (-)** significance, with or without mitigation. The cumulative potential impact of energy projects on transport is considered to be of high magnitude, regional extent and short term and therefore of high (-) significance, with or without mitigation due to the significance of transporting wind turbine components. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

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

4.4.7 Storage of hazardous substances on site

As at any construction site, various hazardous substances (less than 5 m^3) are likely to be used and stored on site. These substances may include amongst other things, diesel, curing compounds, shutter oil and cement. Utilisation of such substances in close proximity to aquatic environments such as pans is of greater concern than when used in a terrestrial environment.

Use of hazardous substances at a construction site is controlled by various pieces of legislation. The management and protection of the environment would however be achieved through the implementation of an EMP, which would *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage.

The potential impact of spillages is considered to be of low intensity, site specific in extent and long term and therefore of **low (-)** significance, without mitigation. With the implementation of mitigation measures this would reduce to **very low (-)** significance. No difference in impact significance would result from the proposed alternatives.

4.4.8 Noise pollution

An increase in noise pollution would be expected from the operation of heavy machinery during the construction period, as well as due to the increased traffic. The severity of this impact is likely to be reduced due to the low numbers of people in close proximity to the site.

The potential impact of noise is considered to be of very low intensity, site specific in extent and short term and therefore of **very low (-)** significance, without or with mitigation. No difference in impact significance would result from the proposed alternatives.

4.4.9 Dust impacts

Construction vehicles are likely to make use of the existing farm roads to transport equipment and material to the construction site. Earthworks would also be undertaken. These activities would exacerbate dust especially in the dry winter months. The dust impact would be managed through the EMP, which would include procedures for dealing with dust pollution events including watering of roads, etc.

The potential impact of dust is considered to be of low intensity, site specific in extent and short term and therefore of **very low (-)** significance, without and with mitigation. No difference in impact significance would result from the proposed alternatives.

4.5 SUMMARY OF POTENTIAL IMPACTS

A summary of all the potential impacts from the proposed project assessed above is included in **Table 4.2**. While some difference in magnitude of the potential impacts would result from the proposed alternatives this difference was not considered to be significant for any of the potential impacts. As such, the table below applies to all proposed alternatives.

Table 4.2 Summary of potential impacts of the proposed project[38]

Potential impact	No mit/Mit[39]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[40]	Reversibility
OPERATIONAL PHASE								
Impact on botany:	No mit	Local	High	Long term	**High (-)**	Definite	Sure	Irreversible
Preferred layout	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Alternative layout	No mit	Local	High	Long term	**High (-)**	Definite	Sure	Irreversible
	Mit	Local	Medium	Long term	**Medium (-)**	Probable	Sure	Irreversible
Impact on birds	No mit	Local	Medium - High	Long term	**Medium - High(-)**	Probable	Sure	Irreversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Impact on fauna	No mit	Local	Low	Short term	**Low (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short term	**Low (-)**	Probable	Low	Reversible
Impact on aquatic ecology: Aquatic	No mit	Local	Medium	Short term	**Medium (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short term	**Low (-)**	Probable	Low	Reversible
Stormwater	No mit	Local	Medium	Short term	**Medium (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Low	Reversible
Visual aesthetics	No mit	Regional	Medium	Long term	**Medium (-)**	Definite	Sure	Reversible
	Mit	Regional	Medium	Long term	**Medium (-)**	Definite	Sure	Reversible
Impact on energy production	No mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
Impact on climate change	No mit	Regional	Very Low	Long Term	**Low (+)**	Probable	Sure	Reversible
	Mit	Regional	Very Low	Long Term	**Low (+)**	Probable	Sure	Reversible
Impact on local economy	No mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
(employment) and social conditions	Mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on agricultural land	No mit	Local	Very low	Long term	**Very low (-)**	Probable	Sure	Reversible
	Mit	Local	Very low	Long term	**Very low (-)**	Probable	Sure	Reversible
Impact on surrounding land uses	No mit	Regional	Low	Long term	**Low(-)**	Probable	Unsure	Reversible
	Mit				Undetermined			
CONSTRUCTION PHASE								
Impacts on flora, avifauna and	No mit	Local	Low	Medium term	**Low (-)**	Probable	Sure	Reversible
fauna	Mit	Local	Very Low	Medium term	**Very Low (-)**	Probable	Sure	Reversible

[38] Note that there was found to be no difference in significance for the potential impacts from the proposed alternatives.
[39] Note that this refers to No mitigation and Mitigation.
[40] Conf.=Confidence in the assessment of the potential impact.

Potential impact	No mit/Mit[39]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[40]	Reversibility
Sedimentation, erosion and aquatic ecology	No mit	Local	Low	Medium term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Medium term	**Very Low (-)**	Probable	Sure	Reversible
Impact on traffic	No mit	Regional	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Regional	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Impact on heritage resources:	No mit	Local	Medium	Long term	**Medium (-)**	Definite	Low	Irreversible
Archaeology: Preferred layout	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Palaeontology	No mit	Local	Low	Long term	**Low (-)**	Unlikely	Low	Reversible
	Mit	Local	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on visual	No mit	Local	Medium	Short term	**Medium (-)**	Definite	Sure	Reversible
	Mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversile
Noise pollution	No mit	Local	Very Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Very Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Storage of hazardous substances on site	No mit	Local	Low	Short term	**Low (-)**	Probable	Sure	Irreversible
	Mit	Local	Low	Short term	**Very Low (-)**	Unlikely	Sure	Irreversible
Impact of dust	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

5 CONCLUSIONS AND WAY FORWARD

The purpose of this Chapter is to briefly summarise and conclude the EIAR and describe the way forward.

5.1 CONCLUSIONS

The proposed project comprises:

- Construction of a 100 MW (preferred) or 300 MW (alternative) PV plant;
- Associated infrastructure including:
    - Upgrade of existing internal farm roads to accommodate the construction vehicles.
    - Construction of a 132 kV transmission line to connect the proposed PV plant with Eskom's grid via the Cuprum substation.

The following feasible alternatives have been identified for further consideration in the EIAR:

- Location alternatives:
    - One location for the proposed Struisbult PV plant; and
    - Electricity distribution via a 4.2 km 132 kV connection to Cuprum substation.
- Activity alternatives:
    - Solar energy generation via a PV plant; and
    - "No-go" alternative to solar energy production.
- Site layout alternatives:
    - Two layout alternatives (100 MW with 300 ha footprint and 300 MW with 900 ha footprint).
- Technology alternatives:
    - Two technology alternatives in terms of the solar panel type (PV and CPV); and
    - Four foundation options.

Aurecon submits that this Draft EIAR provides a comprehensive assessment of the environmental issues associated with each of the feasible alternatives of the proposed project outlined in the FSR and the associated Plan of Study for EIA. These impacts and alternatives were derived in response to inputs from consultation with I&APs, provincial and local authorities, and the EIA project team.

Table 5.1 provides a summary of the significance of the environmental impacts associated with this proposed project.

Table 5.1 Summary of significance of the potential impacts associated with the proposed development[41]

OPERATIONAL PHASE IMPACTS			No Mit	With Mit
1.1	Impact on botany	Preferred layout	H	L
1.2		Alternative layout	H	M
2	Impact on birds		M-H	L
3	Impact on fauna		L	L
4.1	Impact on aquatic ecology	Aquatic	M	L
4.2		Stormwater	M	VL
5	Visual aesthetics		M	M
6	Impact on energy production		L+	L+
7	Impact on climate change		L+	L+
8	Impact on local economy (employment) and social conditions		M+	M+
9	Impact on agricultural land		VL	VL
10	Impact on surrounding land uses		L	Undetermined
CONSTRUCTION PHASE IMPACTS				
11	Impacts on flora, avifauna and fauna		L	VL
12	Sedimentation, erosion and aquatic ecology		L	VL
13	Impact on traffic		VL	VL
14.1	Impact on heritage resources	Archaeology	M	L
14.3		Palaeontology	L	L
15	Impact on local economy (employment) and social conditions		M+	M+
16	Impact on visual		M	L
17	Noise pollution		VL	VL
18	Storage of hazardous substances on site		L	VL
19	Impact of dust		VL	VL

KEY

H	High Significance	VL	Very Low Significance
M-H	Medium to High Significance	N	Neutral Significance
M	Medium Significance	H+	High positive significance
L-M	Low to Medium Significance	M+	Medium positive significance
L	Low Significance	L+	Low positive significance
VL-L	Very Low to Low Significance		

[41] Note that there was found to be no difference in significance for the potential impacts from the proposed alternatives.

5.2 LEVEL OF CONFIDENCE IN ASSESSMENT

With reference to the information available at the feasibility stage of the project planning cycle, the confidence in the environmental assessment undertaken is regarded as being acceptable for decision-making, specifically in terms of the environmental impacts and risks. The EAP believes that the information contained within the FSR and this EIAR is adequate to inform Mulilo's decision making regarding which alternatives to pursue and will allow DEA to be able to determine the environmental acceptability of the proposed alternatives.

It is acknowledged that the project details will evolve during the detailed design and construction phases to a limited extent. However, these are unlikely to change the overall environmental acceptability of the proposed project and any significant deviation from what was assessed in this EIAR should be subject to further assessment. If this was to occur, an amendment to the Environmental Authorisation may be required in which case the prescribed process would be followed.

5.3 OPERATIONAL PHASE IMPACTS

With reference to **Table 5.1**, the most significant (**medium to high (-)**) operational phase impacts on the biophysical and social environment, without mitigation was for the potential impacts of the proposed solar energy plant on botany, avifauna, aquatic ecology and visual aesthetics. With the implementation of mitigation measures the impact on botany, avifauna and aquatic ecology would decrease to **low (-)**. The impact on visual aesthetics would however remain **medium (-)** with the implementation of mitigation measures. It is not currently known what the significance of the impact on surrounding land uses would decrease to, however it is anticipated that, if required, mitigation measures agreed to in consultation with SKA would decrease to a level acceptable to SKA. It should be noted that three potential positive impacts on energy production, climate change and local economy (employment) and social conditions would result and these would be of **medium (+), low (+)** and **low (+)** significance (respectively), with and without mitigation measures.

The potential cumulative impacts were also considered, including other proposed renewable energy facilities in the area. The significance of these were considered to be of **low-high (-)** significance and **low-medium (+)**, without mitigation. These potential cumulative impacts would decrease, with implementation of mitigation measures for the proposed project as well as other proposed projects in the area, and are considered to be acceptable. However, it should be noted that it is not possible to assess these cumulative impacts in a project specific EIA, not least because not all the proposed projects in the area may be approved or constructed. As such it would be necessary for DEA, or a similar body, to undertake a strategic assessment in this regard.

In terms of differences in the significance of potential impacts of the feasible alternatives, there are none and as such Mulilo should choose their preferred alternative based on technical, financial and/or other considerations.

5.4 CONSTRUCTION PHASE IMPACTS

The most significant construction phase impact was that on heritage and archaeology which was considered to be of **high (-)** and **low (-)** significance with and without mitigation respectively, for all alternative. The remaining negative construction phase impacts were deemed to have a significant impact on the environment, given their duration (approximately 18-30 months) and localised extent. The construction impacts were assessed to be of **very low-medium (-)** significance, without mitigation measures. With the implementation of the proposed mitigation measures and recommended EMP the significance of the remaining construction phase impacts is likely to reduce to **very low-low (-)**. It should be noted that a potential positive impact on local economy (employment) and social conditions would result and would be of **medium (+)** significance, with and without mitigation measures. The impact of the 300 MW alternative on the local economy would however have a **high (+)** significance due it its size.

5.5 RECOMMENDATIONS

Chapter 4 has outlined mitigation measures which, if implemented, could significantly reduce the negative impacts associated with the project. Where appropriate, these and any others identified by DEA could be enforced as Conditions of Approval in the Environmental Authorisation, should DEA issue a positive Environmental Authorisation. The mitigation measures are outlined below:

Operation phase impacts:

Botanical impacts

- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to;
- Shallow depressions, well defined pans, seasonal watercourses and calcrete and other rocky ridges should be avoided;
- Mesquite trees and / or shrubs within 250 m of the boundary of the PV plant footprint and the power-line route should be eradicated by cutting and treating with herbicide to prevent coppicing; and
- Should the alternative site be approved, the upland areas of calcrete and calcrete ridges should be avoided and considered to be no-go areas.

Avifaunal (bird) impacts

- Minimize the footprint of the development to the actual area required for 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) for above-ground power lines that exclude birds physically from high risk areas of live infrastructure and comprehensively insulate such areas to avoid bird electrocution;
- Power lines and cables should be below ground. Where this is not possible, all new aboveground lines should be fitted 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.

Faunal impacts

- 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.

Aquatic ecology

- Monitor both soil chemistry and erosion and mitigate if required;
- 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;
- Install composting toilets that does not require water, septic tanks or soak-aways;
- Channel runoff should be diverted in such a way as to minimise erosion and if necessary, soil stabilising techniques should be implemented in vulnerable areas;
- Removal of perennial alien species such as *Prosopis glandulosa* at sites disturbed or cleared, or where panel washing occurs;
- Monitoring, together with the development of an operational environmental management plan should be implemented;
- No septic tanks / soak-aways should be allowed in drainage areas;
- Stormwater channels and “mitre” chutes should be constructed to direct the stormwater flows and minimize and control erosion;
- 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 31 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 – 47 mm/hour, 1:50 year – 56 mm/hour and 1:100 year – 64 mm/hour respectively.

Visual impacts

- Roads and hard-standings would be constructed as part of the works;
- The first 150 mm of naturally occurring substrate should be retained and then spread over finished areas;

- All excess material shall be removed off-site, and the ground shall be returned to original levels/gradients as far as possible;
- New structures should be placed where they are least visible to the greatest numbers of people, in places where the topography can offer shielding, where possible;
- Visibility of buildings and the local sub-station should be reduced by cladding the buildings in non-reflective colours and materials that will blend in with natural environment. E.g. cladding with local stone or plaster and paint with earthy tones for paint colours, roofs should be grey and non-reflective and doors and window frames should reference either the roof or wall colours;
- Finishing materials of the infrastructure (including support structures) should be of colours that are non-reflective and in dark matte colours such as dark grey or charcoal; and
- Information on the project should be provided to local people, such as through a poster at the entrance to the site.

Impacts on local economy (employment) and social conditions

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

Surrounding land uses impacts

- Implement measures recommended in the modelling study, as agreed to with SKA.

Construction phase impacts:

Flora, avifauna and fauna impacts

- In all cases construction of access roads should be designed for minimal impact. All construction should take place within the footprint of the proposed PV plant;
- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to;
- 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;
- The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require 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 should be avoided wherever possible;
- Shallow depressions and well defined pans should be avoided and buffered by at least 50 m; and
- The site should be cleared in sections as required for construction and not all at once.

Sedimentation and erosion impacts

- The proposed project should be located away from the no-go areas, as well as a 50 m buffer area around these no-go areas;

- Access roads should be positioned in such a way that no clearing within no-go areas is required and definite drainage areas should be avoided. Should additional access roads be required, these should be built with culverts to prevent the impediment of water movement;
- The use of erosion control measures to minimise erosion at excavation / clearing sites or aggregate storage sites is necessary and earth moving construction activities should take place in the dry season as far as possible; and
- Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared by construction activities.

Heritage resources (including palaeontology) impacts

- From a heritage and visual perspective, a smaller footprint is preferable;
- Archaeological sites should be mitigated by excavation and sampling of sites before the start of construction (red dots in **Figure 4.9**);
- Test excavations should be carried out around the pans to check for subsurface archaeology which may require sampling;
- A buffer zone of 100 m from the edge of the pans should be employed; and
- In the event of accidental uncovering of graves or substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood), work must stop immediately and SAHRA should be notified. An archaeologist / palaeontologist should be involved to assist with the investigation and procedures to address the situation.

Visual impacts

- Minimise the construction period, where possible;
- Access road to be kept clean, and measures taken to minimise dust from construction traffic on gravel roads;
- Surface material should be conserved and used for rehabilitation;
- Careful consideration should be given to the visual implications of the siting of the construction camp and should be screened off;
- Site offices, if required, should be limited to single storey and should be sited carefully using temporary screen fencing to screen from the wider landscape; and
- All site operatives should receive training in awareness of issues such as the use of fires and contaminants and litter on site.

Impacts on local economy (employment) and social conditions

- Obtain a list of locally available labour and skills. Give preference to local communities for employment opportunities;
- Base recruitment on sound labour practices and with gender equality in mind; and
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.

Transportation impacts

- Ensure that road junctions have good sightlines;
- Implement traffic control measures where necessary;
- Transport components overnight as far as possible; and

- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc. are scheduled.

Noise impacts

- Implement measures as provided in the EMP, which includes procedures for dealing with noise.

Storage of hazardous substances on site

- Implement measures as provided in the EMP, which *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage; and
- Comply with the various pieces of legislation controlling the use of hazardous substances at a construction site.

Dust impacts

- Implement measures as provided in the EMP, which includes procedures for dealing with dust pollution events including watering of roads, etc.

5.5.1 Considerations in identification of preferred alternative

Following the finalisation in the EIAR, the next step in the EIA process is for Mulilo to identify their preferred option, utilising this EIAR together with technical, financial and other considerations to inform their decision.

The proposed project results in **low to medium (+)** significance impacts and **medium to high (-)** significance impacts, without mitigation, on the environment. The negative impacts, of the proposed project are considered to be environmentally acceptable, considering the positive impacts and considering that the significance of impacts would reduce to **medium to very low (-)** with the implementation of mitigation measures.

The potential cumulative impacts were also considered, including other proposed renewable energy facilities in the area. The significance of these were considered to be of **low to high (-)** significance and **low to medium (+)**, without mitigation. These potential cumulative impacts would decrease, with implementation of mitigation measures for the proposed project as well as other proposed projects in the area, and are considered to be acceptable. However, it should be noted that it is not possible to assess these cumulative impacts in a project specific EIA, not least because not all the proposed projects in the area may be approved or constructed. As such it would be necessary for DEA, or a similar body, to undertake a strategic assessment in this regard.

In terms of differences in the significance of potential impacts of the feasible alternatives, there are none and as such Mulilo should choose their preferred alternative based on technical, financial and/or other considerations.

5.5.2 Opinion with respect to environmental authorisation

Regulation 32(2)(m) of the EIA Regulations requires that the EAP include an opinion as to whether the activity should be authorised or not.

The impacts associated with the proposed project would result in regional impacts (both biophysical and socio-economic) that would negatively affect the area. The significance of these impacts **without mitigation** are deemed to be of **high or lower** significance. However, with the implementation of the recommended mitigation measures the significance of the negative impacts would be minimized and would be **low or very low**, for all but one impact.

Associated with the proposed project are positive impacts on energy production, climate change and local economy (employment) and social conditions of **low to medium (+)** significance.

Based on the above, the EAP is of the opinion that the proposed solar energy facility and associated infrastructure, including alternatives, being applied for be authorised as the benefits outweigh the negative environmental impacts. The significance of negative impacts can be reduced with effective and appropriate mitigation through a Life-Cycle EMP, as described in this report. If authorised, the implementation of an EMP should be included as a condition of approval.

5.6 WAY FORWARD

The Draft EIAR has been lodged at the Prieska (Elizabeth Vermeulen) Public Library, Ietznietz in Copperton and on the Aurecon website (www.aurecongroup.com/)(change "Current Location" to South Africa and follow the public participation links). All registered I&APs have been notified of the availability of the Draft EIAR by means of a letter which includes a copy of the Draft EIAR Executive Summary. The public will have until 16 April 2012 to submit written comment on the Draft EIAR to Aurecon.

The Final EIAR has been completed via the addition of ~~any~~ I&AP comments and the addition of a letter from Mulilo indicating which mitigation measures will be implemented (see **Annexure H**). The Final EIAR will ~~then~~ be submitted to the Northern Cape DEANC and DEA for their review and decision-making, respectively.

The Final EIAR has been made available for review at the same locations as the Draft EIAR. Any comments received on the Final EIAR will not be included in a Comments and Response Report but will instead be collated and forwarded directly to DEA.

Once DEA has reviewed the Final EIAR, they will need to ascertain whether the EIA process undertaken met the legal requirements and whether there is adequate information to make an informed decision. Should the above requirements be met, they will then need to decide on the environmental acceptability of the proposed project. Their decision will be documented in an Environmental Authorisation, which will detail the decision, the reasons therefore, and any

related conditions. Following the issuing of the Environmental Authorisation, DEA's decision will be communicated by means of a letter to all registered I&APs and the appeal process will commence, during which any party concerned will have the opportunity to appeal the decision to the Minister of Environmental Affairs in terms of NEMA.

6 REFERENCES

6.1 REPORTS

African EPA. 2007.PixleykaSeme IEMP (2007)

African EPA. 2007.PixleykaSeme District Municipality SDF (2007)

Aurecon. 2011. Proposed Wind Energy Facility near Copperton, Northern Cape: Final Scoping Report. *Report No. 5357A/ 106563*

Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 053 F. Republic of South Africa, Provincial Government of the Western Cape, DEA&DP.

DEA. 2010. Integrated Environmental Information Management (IEIM), Information Series 5: Companion to the NEMA EIA Regulations of 2010

DEA. 2010. Implementation Guidelines: Sector Guidelines for the EIA Regulations (draft)

DEAT. 2002. Integrated Environmental Information Management, Information Series 2: Scoping. DEAT, Pretoria.

DEAT. 2002. Integrated Environmental Information Management, Information Series 3: Stakeholder Engagement. DEAT, Pretoria.

DEAT. 2002. Integrated Environmental Information Management, Information Series 4: Specialist Studies. DEAT, Pretoria.

DEAT. 2004. Integrated Environmental Management, Information Series 11: Criteria for determining Alternatives in EIA. DEAT, Pretoria.

DEAT. 2004. Integrated Environmental Information Management, Information Series 12: Environmental Management Plans. DEAT, Pretoria.

DEAT. 2005. Integrated Environmental Management Guideline Series, Guideline 4: Public Participation, in support of the EIA Regulations. Unpublished.

DEAT. 2007. Integrated Environmental Management Guideline Series, Guideline 7: Detailed Guide to Implementation of the Environmental Impact Assessment Regulations. Unpublished.

DJ Environmental Consultants. 2010. Final Environmental Impact Report for a proposed solar farm in Prieska (2010)

Government Gazette No. 34809. 2011. Threatened Terrestrial Ecosystems in South Africa.

Gestamp Solar. 2012. Plan for the Dismanteling of the Plant and restoring the Area to its Original Condition.

Ibrahim, A. 2010. Effect of Shadow and Dust on the Performance of Silicon Solar Cell. *Journal of Basic and Applied Scientific Research*, 1(3)222-230.

Lynch, S.D. 2003. The development of a raster database of annual, monthly and daily rainfall for southern Africa. *Water Research Commission*, Pretoria, South Africa, *WRC Report* 1156/0/1. Pp 78 plus Appendices.

Mucina, L. and Rutherford, M.C.(eds). 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 053 F. Republic of South Africa, Provincial Government of the Western Cape, DEA&DP.

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.

Siyathemba Municipality. 2007. IEMP (2007)

Winter, S. & Baumann, N. 2005. Guideline for involving heritage specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 053 E. Republic of South Africa, Provincial Government of the Western Cape, DEA&DP.

6.2 ELECTRONIC RESOURCES

South African National Botanical Institute BGIS: http://bgis.sanbi.org/index.asp?screenwidth=1280 (Accessed on: October 2011)

Rossouw, D 2003, *A technical risk evaluation of the Kantienpan volcanic hosted massive sulphide (VHMS) deposit and its financial viability* , MSc dissertation, University of Pretoria, Pretoria. Available on: http://upetd.up.ac.za/thesis/available/etd- 08132008-094204/ (Accessed on: 12/11/10)

http://www.orangesenqurak.org/river/subbasins/lowerorange.aspx (Accessed on: 02/01/11)

http://196.33.85.14/cgs_inter/content/GSSA/GSSASpecialPubsA.htm (Accessed on: 12/11/10)

http://www.siyathemba.co.za/demographics.htm (Accessed on: 02/01/11)

http://www.ska.ac.za/bid/index.php (Accessed on: 19/10/11)

http://www.eskom.co.za/c/73/ipp-processes/ (Accessed on: 29/10/11)

http://www.ipp-renewables.co.za/wp-content/uploads/2011/08/Tender_Notice.png (Accessed on: 30/10/11)

http://www.ipp-renewables.co.za/ (Accessed on: 30/10/11)

http://www.nortonrose.com/knowledge/publications/54959/south-africa-renewable-energy-ipp-request-for-proposals (Accessed on: 30/10/11)

http://www.ipp-renewables.co.za/wp-content/uploads/2011/08/Tender_Notice.png (Accessed on: 30/10/11)

http://www.ipp-renewables.co.za/?page_id=524 (Accessed on: 30/10/11)

http://www.eskom.co.za/c/article/150/independent-power-prodicers-ipp/ (Accessed on: 30/10/11)

Republic of South Africa (2008) People – Planet – Prosperity: A National Framework for Sustainable Development in South Africa**.** Pretoria: Department of Environmental Affairs (DEA), Republic of South Africa [Internet]. Available on: http://www.environment.gov.za (Accessed on: 29/03/2011).

http://www.solaria.com/products/docs/US_Whitepaper_Water.pdf (Accessed on: 2/11/2011)

http://en.wikipedia.org/wiki/Solar_tracker#Tracker_type_selection (Accessed on: 24 October 2011)

www.solar-tracking.com/ (Accessed on: 24/10/2011)

http://www.iucnredlist.org/apps/redlist/details/8542/0 (Accessed on: 31/10/2011)

http://www.iucnredlist.org/apps/redlist/details/10276/0 (Accessed on: 31/10/2011)

http://www.orangesengurak.org/river/subbasins/lowerorange.aspx (Accessed on: 02/01/11)