



Appendix A

LEGISLATIVE PRINCIPLES

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the new legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess material are required to register it. The management of heritage resources are integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have interest in the graves: they may be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle will be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the developer's cost. Thus, developers will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection, to all historic and pre-historic cultural remains, including graves and human remains.

3.2 Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administered by a local authority. Graves in the category located inside a formal cemetery administered by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.



Appendix C

Heritage Assessment Methodology

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report compiled by PGS Heritage (PGS) for the proposed Helena 3 Solar projects will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consists of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site.
- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by qualified archaeologists, aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.
- Step III – The final step involved the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites was based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
 - Density of scatter (dispersed scatter)
 - Low - <10/50m²
 - Medium - 10-50/50m²
 - High - >50/50m²
- **uniqueness** and
- **potential** to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

- A - No further action necessary;
- B - Mapping of the site and controlled sampling required;
- C - No-go or relocate pylon position
- D - Preserve site, or extensive data collection and mapping of the site; and
- E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 13: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	Grade 4C	Low Significance	Destruction



Appendix C

**Impact Assessment Methodology to be utilised
during EIA phase**

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

10.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 3.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

10.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

10.2.1 Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.

4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.

2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive

		effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report.

IMPACT TABLE FORMAT		
Environmental Parameter	<i>A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water</i>	
Issue/Impact/Environmental Effect/Nature	<i>A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water</i>	
<i>Extent</i>	<i>A brief description of the area over which the impact will be expressed</i>	
<i>Probability</i>	<i>A brief description indicating the chances of the impact occurring</i>	
<i>Reversibility</i>	<i>A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity</i>	
<i>Irreplaceable loss of resources</i>	<i>A brief description of the degree in which irreplaceable resources are likely to be lost</i>	
<i>Duration</i>	<i>A brief description of the amount of time the proposed activity is likely to take to its completion</i>	
<i>Cumulative effect</i>	<i>A brief description of whether the impact will be exacerbated as a result of the proposed activity</i>	
<i>Intensity/magnitude</i>	<i>A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily</i>	
<i>Significance Rating</i>	<i>A brief description of the importance of an impact which in turn dictates the level of mitigation required</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	<i>Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures</i>	

	<i>have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMP.</i>
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Table 14: Rating of impacts

10.3 Impact Summary

The impacts will then be summarized and a comparison made between pre and post mitigation phases as shown in Table 4 below. The rating of environmental issues associated with different parameters prior to and post mitigation of a proposed activity will be averaged. A comparison will then be made to determine the effectiveness of the proposed mitigation measures. The comparison will identify critical issues related to the environmental parameters.

The table below is to be represented in the Executive Summary of the report.

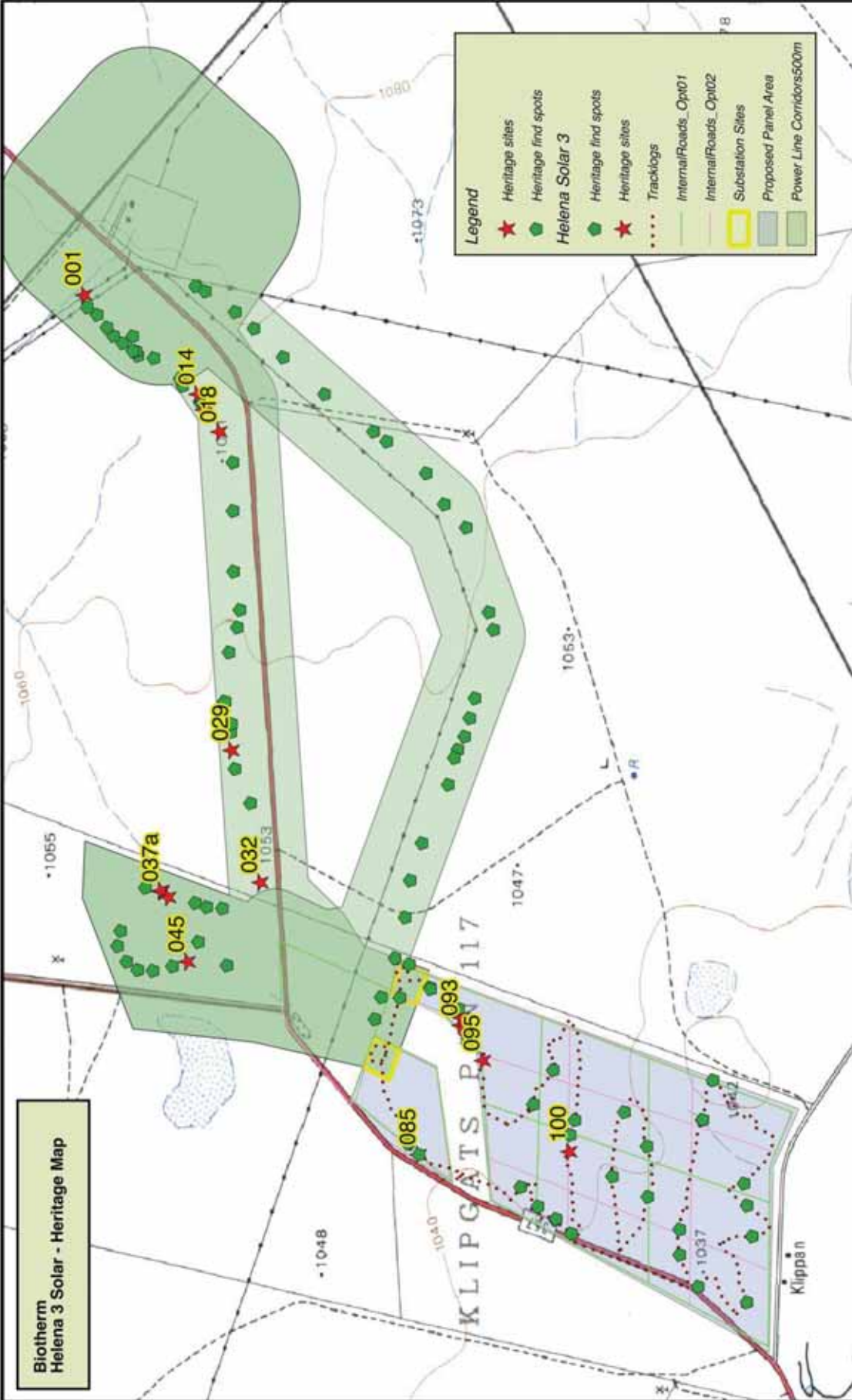
Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Surface water	Erosion	43		16	
	Oil spills	22		22	
	Alteration of aquatic biota	16		3	
			- 0,0		-0,0
			Low Negative Impact		Low Negative Impact

Table 15: Comparison of summarised impacts on environmental parameters

Finally, the 2010 regulations also specify that alternatives must be compared in terms of impact assessment. Hence all alternatives will need to be comparatively assessed.



Appendix D
Heritage Maps



**Biotherm
Helena 3 Solar - Heritage Map**

Legend

- ★ Heritage sites
- Heritage find spots
- Helena Solar 3
- Heritage find spots
- ★ Heritage sites
- ⋯ Tracklogs
- InternalRoads_Opt01
- InternalRoads_Opt02
- Substation Sites
- Proposed Panel Area
- Power Line Corridors500m



WG84





Appendix 6G: Socio-economic Assessment

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED HELENA 3 SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY, NEAR COPPERTON, NORTHERN CAPE

July
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Socio-Economic Impact Assessment Study
Final Report

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EXECUTIVE SUMMARY

Urban-Econ Development Economists (Urban-Econ) was appointed by SiVest Environmental Division (SiVest) to undertake a Socio-Economic Impact Assessment (SEIA) Study for the proposed Helena 3 Solar Photovoltaic (PV) Energy Facility near Copperton, Northern Cape Province. The SEIA forms part of the Environmental Impact Assessment process managed by SiVest. The SEIA provides an assessment of the economic impacts associated with the development of the solar PV facility and associated infrastructure.

This report details the results of the Socio-Economic Impact Assessment (EIA) specialist study undertaken by Urban-Econ Development Economists as part of the overall Environmental Impact Assessment (EIA) process undertaken by SiVest. The SEIA documented in this report builds on the Socio-Economic Impact Assessment: Scoping Phase Inputs Report compiled as part of the Scoping Phase of the EIA process.

Economic impact refers to the effect on the level of economic activity and the welfare of households in a given area because of some form of external intervention in the economy. The intervention can be in the form of new investment in infrastructure (as in the case of the current assessment), new development, adoption of a new policy or service, expansion of the current operations, etc. The types of economic impact stimulated by the intervention are generally positive and include creation of additional jobs, generation of business sales and value-added, improved quality of life, increase in disposable income, and growth of government revenue.

Any type of intervention does not only create direct benefits experienced by the investor, but has spill over effects on the other economic agents through a multiplier effect. Two types of multiplier effects can be distinguished, i.e. production induced effects or indirect effects and consumption induced effects or induced impacts.

Economic impacts can also be viewed in terms of their duration, or the stage of the project's lifecycle that is being analysed. Generally two phases are subjected to the economic impact assessment namely the construction phase and the operational phase. The construction phase economic impacts are of a temporary nature, they have; therefore, a temporary effect. On the other hand, the operational phase of the project usually takes place over a long-term; hence, the impacts during this stage are generally of a sustainable nature.

After collecting the relevant data for the project and delineating the study area, potential socio-economic impacts of the construction and the operational phases on the local and regional economies were identified and analysed. The results of the impact assessment found that the construction and operation activities will result in various positive economic impacts which are summarised in the table below.

Impact	Nature	Pre-mitigation significance	Post-mitigation significance
Construction phase			
Temporary increase in production	Positive	High	High
Temporary increase in GDP	Positive	Medium	Medium
Temporary increase in employment	Positive	Medium	Medium
Impact on skills development	Positive	Medium	Medium

Temporary increase in household income	Positive	Medium	Medium
Increase in government revenue	Positive	Low	Low
Impact on balance of payment	Negative	Low	Low
Sterilisation of agricultural land	Negative	Low	Low
Increased pressure on basic services	Negative	Low	Low
Increase in social pathologies	Negative	Low	Low
Operational phase			
Sustainable increase in production	Positive	Medium	Medium
Sustainable increase in GDP	Positive	Medium	Medium
Impact on employment	Positive	Medium	Medium
Impact on skills development	Positive	Medium	Medium
Increase in household income	Positive	Low	Low
Increase in government revenue	Positive	Low	Low
Investment in local communities	Positive	Low	Low
Impact on sense of place	Negative	Low	Low

Aside from the improvement of energy security which is key to sustaining and growing the economy, the solar PV facility has the potential to improve the standard of living of households. The project will also assist with the reduction of greenhouse gas emissions that indirectly affect the livelihoods of the global population. Amongst the most prominent socio-economic benefits of solar PV technology, is the project's potential to stimulate local industries and generate new and sustainable employment opportunities. Therefore, from an economic perspective, the project should be approved for development, under the condition that the proposed mitigations are implemented.

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ACRONYMS

CSP	Concentrated Solar Power
DM	District Municipality
DoE	Department of Energy
EA	Environmental Authorisation
ED	Enterprise Development
EIA	Environmental Impact Assessment
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
GDP-R	Gross Domestic Product per Region
GWh	Gigawatt hour
IPAP	Industrial Policy Action Plan
IRP	Integrated Resource Plan
kV	Kilovolts
LM	Local Municipality
MW	Megawatt
NDP	National Development Plan
NGP	National Growth Plan
NGPF	New Growth Path Framework
PV	Photovoltaic
REIPPP	Renewable Energy Independent Power Procurement Producer
SED	Socio-Economic Development
SEIA	Socio-Economic Impact Assessment

1. INTRODUCTION

This document was prepared by **Urban-Econ Development Economists** in response to a request by **SiVest Environmental Division (SiVest)** on behalf of **BioTherm Energy (Pty) Ltd** to undertake a Socio-Economic Impact Assessment (SEIA) Study for the **proposed Helena 3 Solar Photovoltaic (PV) Energy Facility** near Copperton. The SEIA is conducted as part of the Environmental Impact Assessment (EIA) process managed by SiVest. This document provides an assessment of the socio-economic impacts associated with the development of the Helena 3 Solar plant which is one of the three plants proposed for development.

1.1 Project background and description

The Integrated Resource Plan for Electricity 2010-2030 (IRP 2010-2030) promulgated on 6 May 2011 projected that an additional uncommitted capacity of 42 539 megawatts (MW) will be required to support the development in the country over the next twenty years and ensure adequate reserves. About 75% of the required capacity will be generated through the use of renewable energy sources to reduce carbon emissions involved in generating electricity. Specifically, 19.7% or 8 400 MW of the new uncommitted capacity is allocated towards solar Photovoltaic (PV) projects.

In the wake of the IRP targets, government set in motion the Renewable Energy Independent Power Procurement Producer (REIPPP) Programme with the publication of the South African Renewable Energy (RE) IPP Request for Proposals in August 2011. The South African RE IPPP Programme follows a competitive bid process and aims to procure 3 725 MW of renewable energy projects and to contribute towards socio-economic and environmentally sustainable growth, job creation and to stimulate the renewable energy industry in South Africa. In order to submit a bid, the proponent is required to have obtained an Environmental Authorisation (EA) in terms of the Environmental Impact Assessment (EIA) Regulations as well as several additional authorisations or consents. Compliant bids are evaluated on the basis of price and economic development, with allocations of 70 and 30 points out of 100 respectively.

The REIPPP programme was to be broken down into five bidding windows and the progress thus far is shown below:

- ❑ The first bid window closed on 4 November 2011 with a total of 53 applications for all renewable energy projects. On 7 December of the same year, Round 1 preferred bidders were announced with 18 PV projects being chosen with a total of 631.5MW of installed capacity.
- ❑ The second bid window closed on 5 March 2012 with the submission of 79 renewable energy project bids. On 21 May 2012, government announced the preferred bidders for round two including nine PV projects equating to 417.1MW of installed capacity.
- ❑ The third bid window closed on 19 August 2013 with the submission of 93 renewable energy project bids. On 4 November 2013, government announced the preferred bidders for round three which include six PV projects equating to 431MW of installed capacity.
- ❑ The fourth bid window closed on 18 August 2014 with the submission of 77 renewable energy project bids. The preferred bidders for round four were announced on 16 April 2015 and include six PV projects equating to 415MW of installed capacity.
- ❑ The fifth bid window RFP is planned to be released in the second quarter of 2016.

The Minister of Energy, Ms Tina Joemat-Pettersson, also announced that bidding window 4 of the REIPPP will be extended by a further 1 800 MW to reconsider unsuccessful project bids from windows 1 to 4 (Forder, 2015).

In line with the IRP 2010-2030, BioTherm are proposing the construction of a photovoltaic (PV) power generating facility that will have an installed capacity of 75 MW. The facility is planned to be located on Portion 3 of the farm Klipgats Pan No 117 in the Northern Cape Province.

1.2 Terms of reference and project scope

The terms of reference for the Socio-Economic Impact Assessment require:

- ❑ A description of the environment that may be affected by the activity and the manner in which the environment may be affected by.
- ❑ A description and assessment of the potential social-economic issues associated with the proposed facility.
- ❑ Identification of enhancement and mitigation aimed at maximising opportunities and avoiding and or reducing negative impacts.

The purpose of the socio-economic impact assessment is to determine the potential socio-economic implications of the project activities and associated infrastructure and to compare its effects with the “no-go” alternative. The “no-go” alternative assumes that the proposed 75 MW solar PV plant is not established, which means that it represents the current status of the environment, including the socio-economic situation.

The scope of the socio-economic impact study is thus understood as follows:

- ❑ Delineate of the primary, secondary, and tertiary study areas.
- ❑ Undertake a policy review and assess the alignment of the proposed project with the national, provincial, and local socio-economic policies.
- ❑ Create a socio-economic profile for the study area using primary and secondary data.
- ❑ Identify, analyse and interpret potential negative and positive socio-economic impacts that could be created by the proposed project during its life cycle.
- ❑ Provide recommendations with respect to possible mitigation measures that could be implemented to reduce potential negative impacts and capitalise on the possible positive economic effects of the project.
- ❑ Evaluate potential impacts following a selected methodology for the cases before and after mitigations.

1.3 Project Content, Location and Study Area Delineation

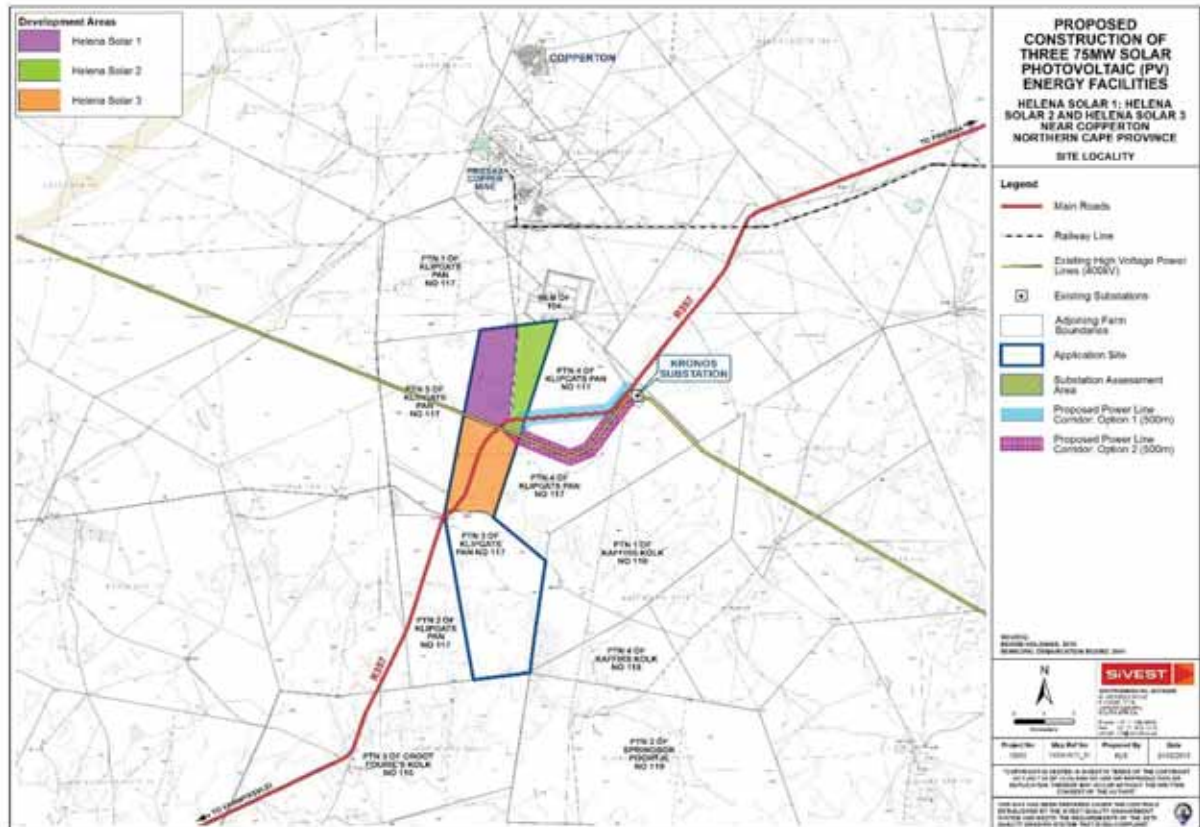
The proposed solar photovoltaic facility will accommodate an array of approximately 300 000 solar PV panels with a generating capacity of 75MW. The total area earmarked for the development of the facility is approximately 430 ha, however, it is envisaged that the 75MW energy facility layout will only require approximately 250 ha. The facility will be linked to the grid via a 132kV power line.

The basic infrastructure associated with the establishment of the Helena 3 Solar PV facility will include:

- ❑ Solar PV panels with a generating capacity of 75 MW;
- ❑ Onsite substation and transformer to step up power from medium voltage to high voltage;
- ❑ 22-33 kV underground cabling in order to feed power to the on-site substation;
- ❑ A 132 kV power line linking the on-site substation to the Kronos substation;
- ❑ Inverter stations;
- ❑ Laydown area for temporary storage of materials;
- ❑ Internal access roads;
- ❑ Car park and fencing around the project; and
- ❑ Administration, control and warehouse buildings.

It should be noted that the possibility to allow shared associated infrastructure will be considered should the other two PV projects that are being proposed by BioTherm on the same farm also be granted EAs and be awarded preferred bidder status (SiVest, 2015).

The proposed project is to be located near Copperton in the Siyathemba Local Municipality (LM), which is part of the Pixley ka Seme District Municipality (DM) situated in the Northern Cape Province. It is envisaged that the solar panels will be set up on Portion 3 of Klipgats Pan No 117 while the power line will run on Portion 4 of Klipgats Pan No 117 as illustrated in Map 1-1.



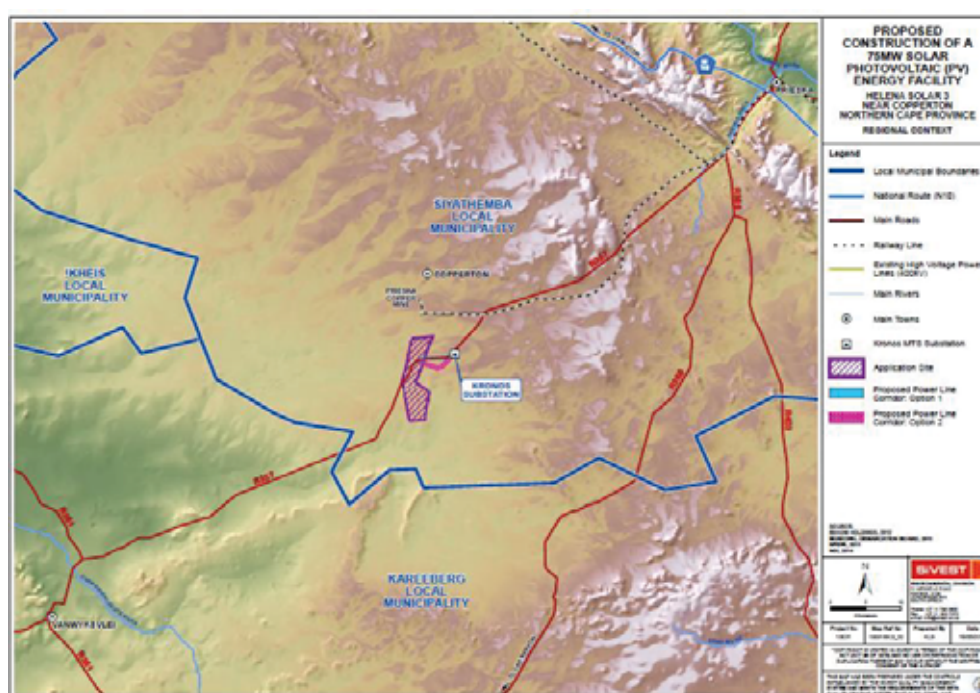
Map 1-1: Project location (SiVest, 2015)

In order to delineate the study area, it is important to understand the concept of socio-economic impacts. The socio-economic impacts on the project area and surrounds are dependent on the activity and the structure and composition of the locality. The more diversified the immediate locality of the project is in terms of its socio-economic variables, the more concentrated the impact will be in that area. Understanding the potential distribution and concentration of impacts is important to determine the magnitude and significance of these impacts in the context of spatial units.

The project area is characterised by a largely dispersed settlement pattern. The closest major town to Copperton is Prieska, which is situated in the Siyathemba LM about 60 km north-east from the project site by road. According to Census 2011 data, the Siyathemba LM population is 21 593. However, only a small percentage of the people in this municipality have some form of higher education, which means that many skilled and high-skilled workers will most likely be sourced from other parts of the country and possibly even from other countries; while those positions requiring little or no skill would be available for the locals. Aside from the above, the proposed project could be associated with a number of social, economic and environmental impacts. These might impact people and economic activities situated in close proximity to the site.

Given the above, the study areas for the analysis have been defined as follows:

- Primary study area refers to the locality where direct economic impacts of the proposed activity are to be concentrated. The primary study area was chosen to be the site as well as adjacent farms which form the immediate zone of influence, Prieska and the Siyathemba LM.
- Secondary study area includes the Northern Cape Province. The proposed project is to be located about 60km away from Prieska and about 280km away from Kimberley; which is a major urban centre of the Northern Cape Province. Thus it is safe to assume that some of the inputs required for the establishment and operations would be sourced from the Northern Cape, i.e. the same province where the project is located.
- Tertiary study area is South Africa. The indirect effects of the construction and operation of the facility will be distributed throughout the country and will not be concentrated in a particular municipality. At the same time certain inputs will be sourced from outside South Africa and would have a macro-level negative effect, again highlighting the need to look at the country's profile.



Map 1-2: Regional context of project site (SiVest, 2015)

1.4 Methodology

The methodology employed in conducting the study comprised of three main steps as described below:

Step 1: Study area profiling

Profiling involved the description of the study area in terms of selected economic variables. It included the analysis of parameters such as population size and household numbers, structure and growth of the economy, labour force, and employment situation. Profiling for the study was done making use of the Quantec Research database and selected Stats SA statistics, such as Census 2011.

Step 2: Impact identification

This step included the identification of the potential sensitive receptors and beneficiaries of the project and description of socio-economic impacts that could be expected during various phases of the project's life cycle. The identification of potential socio-economic issues associated with proposed facility is based on interviews with directly affected and adjacent land owners, review of relevant documentation, and experience with similar projects.

Step 3: Impact evaluation and recommendations

The purpose of this step was to interpret the identified socio-economic impacts in the context of their effects on the local communities and economies. Where applicable, measures to reduce or eliminate negative impacts and enhance positive impacts were proposed.

All impacts identified were rated according to the evaluation methodology prescribed by the environmental consultant. The following table outlines various ratings used to determine different levels of severity, spatial scale, duration, and probability during evaluation.

Table 1-1: Criteria options and associated rating

NATURE		
This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the duration of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects

3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Table 1-2: Impact significance thresholds

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.

29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

2. POLICY REVIEW

A policy review plays an integral role in the early stages of a project. The review provides a high level indication of whether a project is aligned with the goals and aspirations of the developmental policy within a country and at a local level. Furthermore, the analysis signposts any red-flags or developmental concerns that could jeopardise the development of the project; thus, assisting in making an informed decision with respect to the proposed project's location.

The following government strategic documents applicable to the delineated study areas were examined:

- National (South Africa):
 - New Growth Path Framework (NGPF) (2011)
 - White Paper on Renewable Energy (2003)
 - Integrated Resource Plan (IRP) 2010-2030 promulgated in 2011
 - Integrated Resource Plan (IRP) 2010-2030: Update Report 2013
 - National Development Plan (NDP) 2030 (2011 – 2030)
 - Industrial Policy Action Plan (IPAP) (2014/2015 – 2016/2017)
- Regional (Limpopo Province and Mpumalanga Province):
 - Northern Cape Provincial Spatial Development Framework (2012)
 - Northern Cape Provincial Growth and Development Strategy
- Local (Pixley ka Seme district Municipality and Siyathemba LM):
 - Pixley Ka Seme District Municipality Integrated Development Plan (2011-2016)
 - Siyathemba Local Municipality Integrated Development Plan
 - Siyathemba Local Municipality Local Economic Development Strategy

The **New Growth Path Framework** (Department of Economic Development, 2010) and the **National Development Plan 2030** (National Planning Commission, 2011) confer that all regions are to seize the advantages of the natural resources endowed to them towards achieving accelerated economic growth, poverty alleviation and job creation. This however, should be done in a sustainable and equitable manner. The NGP identifies the green economy as one of the key sectors for job creation which will be achieved through expansions in construction and the production of technologies for solar, wind and biofuels, clean

manufacturing and environmental services. The NDP 2030 sets a target of creating approximately 11 million new jobs and achieving an annual average economic growth rate of 5.4% by 2030. The National Development Plan 2030 seeks to ensure that half of all new electricity generating capacity is provided through renewable energy resources. Related to this objective, is the importance of transitioning towards a low carbon economy, which is in line with international protocols and ambitions.

In its **White Paper on Renewable Energy** (Department of Minerals and Energy, 2003) the South African government sets out its vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in the country. One of these is the “target of 10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro.” It also outlines the need for government to create an enabling environment; i.e. fiscal and financial mechanisms within an appropriate legal and regulatory framework, to allow renewable energy technologies to compete with fossil-based technologies. Furthermore, the **Integrated Resource Plan (IRP) 2010 – 2030** (Department of Energy, 2011) explicitly spells out the need to support the development of a local industry for renewable technologies, with a particular focus on wind and solar. The IRP provides for a diversified energy mix, in terms of new generation capacity, that will comprise inter alia, renewable energy carriers, which include hydro at 6,1%, wind at 19,7%, concentrated solar power at 2,4% and photovoltaic at 19,7%. To this end, the government has set up the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) which “provides an ideal vehicle to support the development of a competitive renewable energy manufacturing sector and related support industries” and announced in December 2012 an additional 3 200 MW available for procurement by 2020 (Department of Trade and Technology, 2013).

It was indicated at the time of promulgation that the IRP should be a “living plan”, which would be revised by the Department of Energy (DoE) every two years; to this end the update report was formulated in 2013. According to the **IRP 2010-2030 Update Report** the economic situation in South Africa has changed and the energy sector in the country has undergone some developments since the promulgation of the IRP in 2011. The electricity demand outlook has been downgraded, which reduced the targeted installed capacity by 2030 from 67 800 MW to 61 200 MW (Department of Energy, 2013). In addition, certain developments and uncertainties in the energy sector such as change in technology cost, potential for shell gas and future cost of fuel necessitated the revision of the future path taken to build up necessary electricity generating capacities in the country. As a result, the allocation of installed capacities among various technologies has changed and would depend on the scenario chosen. For the base case, the nuclear capacity is planned to be reduced, while the gas capacity increases and CSP increases substantially at the expense of wind capacity. However, PV capacity remains important and even increases slightly; from 8 400 MW in the original IRP 2010 policy adjusted plan to 9 770 MW in the IRP update report.

The **IPAP 2014/2015 – 2016/2017** represents the sixth annual iteration of the first IPAP launched in the 2007/8 financial year. It represents a significant step forward in scaling up the country's efforts to promote long term industrialisation and industrial diversification beyond the current reliance on traditional commodities and non-tradable services and also to promote sustainable development. The IPAP identifies green industries as one of the key sectors in which to strengthen industrial policy interventions. To further

the country's development of and transition to a green economy. The IPAP focuses on improving opportunities in the market and strengthening capacity in solar and wind power generation and therefore increasing the local content of renewable energy projects in South Africa.

The **Northern Cape Provincial Spatial Development Framework** makes reference to renewable energy sources, stating that, "there is considerable potential for wind energy ... along the Namaqualand area and in certain parts of the interior of the province". Feasibility and desirability of a large scale wind energy plant on the coastland therefore, needs to be assessed and, if desirable, promote the development thereof. It also makes reference to the energy targets as set out in the White Paper for Renewable Energy and the impacts associated with achieving the target, which include, among others, adding 1 667MW new renewable energy capacity, creation of additional government revenue, creation of jobs and a contribution towards water saving. To this end the document notes that energy supply schemes need to be developed and instituted so as to contribute to the targets as set out.

The importance of developing the renewable energy sector is further corroborated by the **Northern Cape Provincial Growth and Development Strategy (NCPGDS)**. The NCPGDS makes reference to the need to ensure availability of affordable energy. It notes, "in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured." At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes that, "development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc.; could be some of the means by which economic opportunity and activity is generated in the Northern Cape". The NCPGDS also notes that "sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation". In this regard, care needs to be taken to ensure that renewable energy facilities do not impact negatively on the region's natural environment. The document further indicates the planned solar corridor stretching from the Pixley ka Seme region to the //Khara Hais Municipality in ZF Mgcau (Siyanda) District Municipality

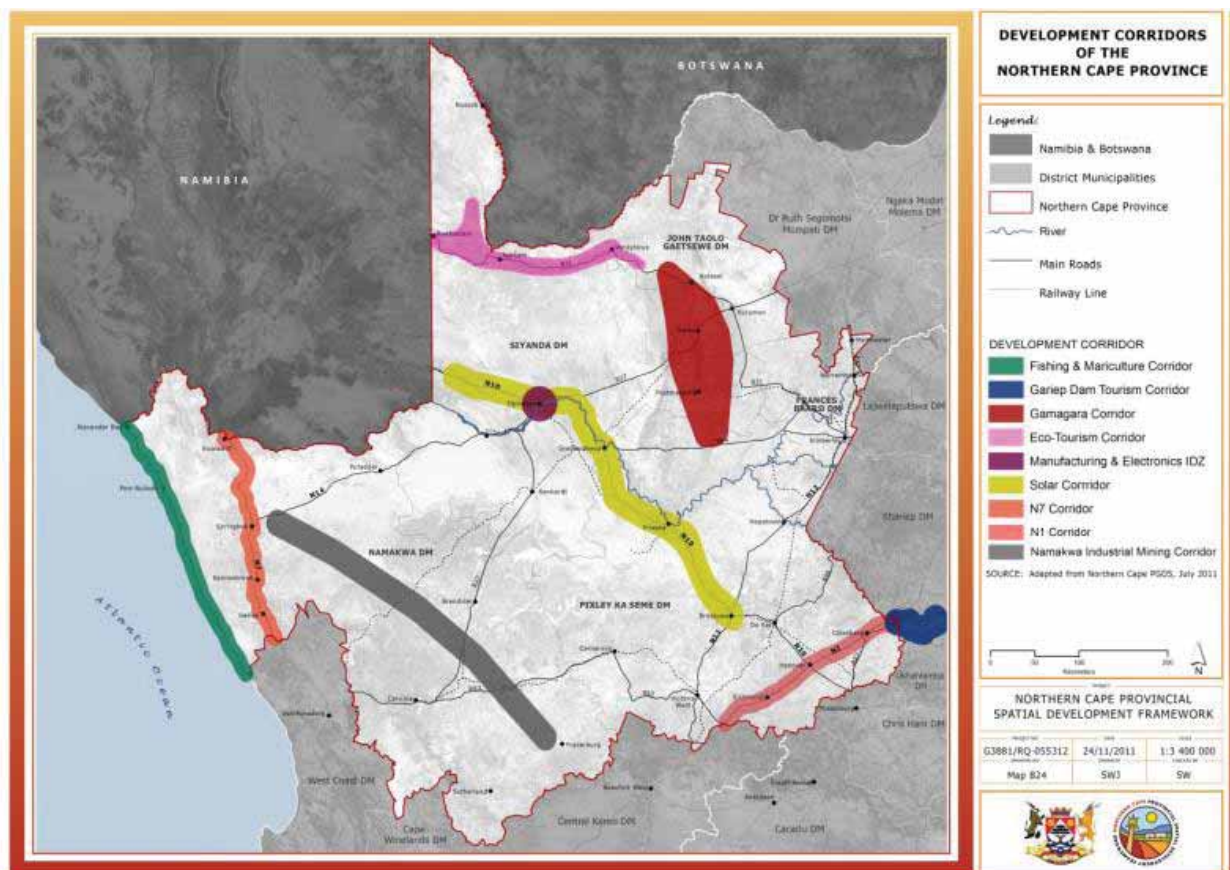


Figure 2-1: Development corridors of the Northern Cape (Dennis Moss Partnership, 2012)

With the recognition of the potential in the Northern Cape and the construction of large solar and wind power stations, it is no surprise that the province is fast becoming the country's renewable energy hub through the construction of large solar and wind power stations. The Renewable Energy Independent Producers Procurement Programme, directed by the Department of Energy, has so far approved 31 projects for the province. The fast growing renewable energy and green economy sector in the province concentrates mainly on solar energy and is expected to attract massive investments.

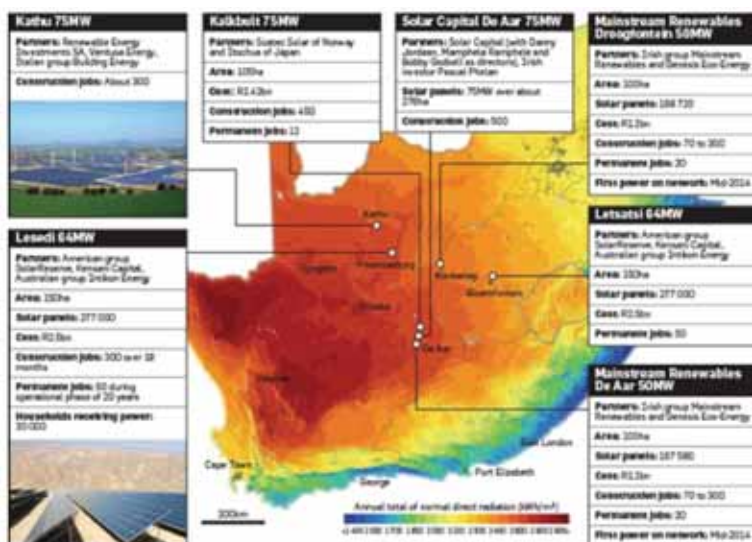


Figure 2-2: Large solar PV project in the Northern Cape

The **Pixley ka Seme DM IDP** has identified the need for attraction and retention of investors in the region. Renewable energy projects have the potential to attract a number of investors. With regard to energy/electricity, the district municipality is currently in the process of promoting the use of renewable energy (solar, wind, gas, biomass and bio-digestion) as an alternative source of energy for industrial, agricultural and domestic uses (Pixley ka Seme District Municipality, 2011). The IDP also recognises renewable energy projects as being in line with identified local economic development objectives and strategies, and notes that their promotion could reverse the current trends of decline and lack in diversity of the economy. The Siyathemba Local Municipality believes that renewable energy development is an opportunity for economic development in the municipality and further states in the **Siyathemba LM IDP** that “electricity shortages could be alleviated through local production, which could justify investment in a local solar power plant” (Siyathemba Local Municipality, 2014).

The **Siyathemba LM LED Strategy** is focused on developing the economic and natural resources of the area. Its goals are to promote agricultural and rural development, tourism, industrial development and creating a safe environment for business. One of the development opportunities identified in the agricultural sector is investment in a local solar power plant in order to alleviate electricity shortages. The local production of solar panels that could supply the utilities sector of the Northern Cape is also a development opportunity identified by the LED strategy for the manufacturing sector (Siyathemba Local Municipality, 2012).

To summarise, this project will assist in achieving some of the governmental objectives which include, increased energy security, transitioning to a low carbon economy, development of a competitive renewable energy manufacturing sector and job creation. The project will also aid the efforts to diversify and reverse the declining trend of the local municipality's economy. The policies also guard against unsustainable use of natural resources citing that care needs to be taken to ensure that renewable energy facilities do not impact negatively on the region's natural environment. However considering that the site is located in an abandoned town with low agricultural potential and a low population density, it can be argued that the project will not disturb the natural environment significantly. It therefore appears that the project is not in conflict with any of the key policies and strategies reviewed but it is rather aligned with key economic development priorities.

3. BASELINE INFORMATION

This chapter examines key socio-economic characteristics of the study area. This is essential as it provides both qualitative and quantitative data related to the communities and economies under observation, creating a baseline against, which the impacts can be assessed.

3.1 Study area's composition

Spatial context and regional linkages

The proposed Copperton Solar PV Plant is located in the Siyathemba Local Municipality, which is one of the eight local municipalities making up the Pixley ka Seme District Municipality. The other seven local municipalities are Thembelihle Local Municipality, Emthanjeni Local Municipality, Siyancuma Local Municipality, Umsobomvu Local Municipality, Ubuntu Local Municipality, Kareeberg Local Municipality and Renosterberg Local Municipality.

The **Northern Cape Province** is geographically the largest province in South Africa covering an area of 372 889 km², which constitutes approximately 30% of the country's total area. Despite having the largest surface area, the Northern Cape Province is the least populated of all nine provinces. According to Census 2011, the province's population was 1 145 859 or 2.2% of the national population. The province is bordered by Namibia and Botswana in the north, while domestically, the North West Province borders it in the north-east, the Free State Province in the east, the Eastern Cape Province in the south-east and the Western Cape Province to the south and south-west. The Northern Cape consists of five districts, namely Frances Baard, Pixley ka Seme, Namakwa, ZF Mgcawu (previously known as Siyanda) and John Taolo Gaetsewe.

Pixley ka Seme DM which lies in the south-east of the Northern Cape Province is geographically the second largest of the five district municipalities and covers a surface area of 103 410 km². It is bordered by the Free State in the east, ZF Mgcawu District in the north, the Eastern Cape Province to the south, and Namakwa District in the west. The total population of the district, according to the 2011 Census, was approximately 186 349; making it the municipality with the second lowest population in the Province.

The **Siyathemba LM** is located within the central eastern parts of the Northern Cape Province and is traversed from the east to west by the Orange River, the country's largest river. The municipality covers a geographic area of 14 725 km². Prieska functions as the administrative seat of the local municipality. Other settlements include Marydale, Nierkerkshoop and Copperton.

Spatially, Siyathemba is very distant from South Africa's largest consumer markets. The area is traversed by the R357 which links the site to Prieska. Prieska has easy access to the main railway line to Namibia, good tarred road connections to Upington, Kimberly and De Aar. It is located some 182 km from De Aar (administrative seat of the Pixley ka Seme DM) and 236 km from Kimberley.

Towns and Settlements

Copperton was once a populated town, providing accommodation for the mine workers and their families. It was then sold to a private owner after the closing of the Copperton Mine and is currently on a long-term lease by the Request Trust. Some of the houses were initially demolished but after the lease agreement was signed with the Request Trust, an agreement was reached that the rest of the houses could be retained (Siyathemba Local Municipality, 2014). According to the Census 2011 results, the population of Copperton was 55 with 33 households. A few of these houses are used by Denel SOC Ltd, which operates a missile testing centre in the area (Wikipedia, 2014).

The site is located in a rural area and as such, the population density is very low, with major towns located kilometres away. The closest major town to Copperton is Prieska, which is approximately 60 km away in the same local municipality. Prieska is home to 14 248 people LM (Stats SA, 2014). Marydale, situated 60km north-west of Copperton, is also a rural service centre near the site also located in the Siyathemba LM. Nierkerkshoop, another rural service centre, is approximately 80 km north-east.



Figure 3-1: Settlements and towns near the project site

Siyathemba LM has a population of 21 593 people, comprising of 5 830 households. The most dominant population group is coloured. This group represents 80% of the total population in the municipal area; other groups are black (12%) and white (8%). Education levels in the municipality are low, with approximately 1 500 people out of the adult population having no schooling all, while only 2 200 people have completed high school and 720 people have a higher education qualification.

In 2011, the unemployment rate in Siyathemba LM was 24.7%. The main employment industry is farming, followed by mining. The level of unemployment in the area is low with 7.5% having no income at all, and a further 58.6% earning less than R3 200 per month. The land uses in the area are mainly agriculture, consisting mostly of sheep farming and production of wheat, maize, lucerne, cotton, beans and peanuts.

Prieska is the administrative seat of the Siyathemba Local Municipality and is located on the Southern Bank of the Orange River, approximately 50km northeast of the proposed site. While relatively isolated, Prieska has good access to the main railway line to Namibia, good tarred road connections to Upington, Kimberley and De Aar, and two landing strips for light aircrafts. The Prieska area is also known for its high quality semi-precious stones, specifically tiger's eye.

Resources and land capability

Generally, the area does not have any significant mineral deposits. To the south of Prieska, on the farm Doornfontein, a medium-sized mineral deposit of Phosphate can be found. Various small mineral deposits can be found near Nierkerkshoop. These include Tiger's-eye and Crocidolite (Asbestos). Small deposits of

Alluvial Diamonds can be found in the Orange River. Other small mineral deposits within the Municipal boundary include Salt, Gypsum, Iron and Uranium (Siyathemba Local Municipality, 2012).

The Orange River runs through the Municipality and provides ideal conditions for irrigation farming in Siyathemba, especially the cultivation of grains and vegetables.

The town of Prieska is located on the south bank of the Orange River at the foot of the Doringberg. It was originally named Prieskap, a Khoisan word meaning, "lace of the lost she-goat". The following are the main Tourism attractions in the region (Siyathemba Local Municipality, 2014):

-  Die Bos Nature Reserve
-  British Fort
-  Green Valley Nuts
-  The Oranjezicht and Keikamspoort Hiking Trails
-  Khoisan Rock Art
-  Memorial Garden
-  Prieska Museum
-  Ria Huysamen Aloe Garden Schumann Rock Collection
-  Wonderdraai Island

Land-uses within the affected zone of influence

The surrounding land uses are mainly agriculture, consisting mostly of sheep grazing. The main livestock farming in the region include cattle, sheep and goat farming (Siyathemba Local Municipality, 2014).

The interviews with the farm owners within the affected zone of influence corroborates the fact that the area is mainly used for sheep farming. Land-use information for some the farms where various components of the project will be established is discussed in detail in section four.

3.2 Demographic Profile and Income Levels

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential in gaining an accurate perspective of those who are likely to be affected by any prospective development or project.

The Siyathemba LM is home to approximately 21 593 people, with a total of 5 830 households (Stats SA). The population has increased by 14.9% from 18 376 in 2001. A large portion (87.2%) of the population in the LM resides in urban areas, while the rest (12.8%) lives in on farms. Both urban to urban migration, and rural to urban migration are relevant in the Pixley ka Seme region, including the Siyathemba LM. Rural to urban migration is perceived as the dominant migration type at present (Pixley ka Seme District Municipality, 2011). The large proportion of people living in the urban area can be explained by the ease of access to opportunities and services within the larger urban centres, in this case Prieska. The majority (72.2%) of the people in the municipality are Coloured with 18.5% of the population being Black, followed by White 8.4%), and Indians/Asians (0.5%). Afrikaans is the language most spoken in the LM. The municipality's gender

ratios are not very skewed, the female population (50.1%) accounts for slightly more of the LM's population compared to the male population (49.9%).

The youth (age 15-34) make up the majority of the people living in the Siyathemba LM with 31.7%, followed by the group between the ages of 35 and 64 years with 31.4%. Considering the working age group that is between the ages of 15 and 64 years, the municipality has a slightly bigger percentage of working age males than females (refer to Figure 3-2). The population in the area is characterised by a high dependency ratio (58.5%) with a total of 36.8% of the population within the ages of 0 to 14 years (30.6%) and over 65 years old (6.2%). According to the district municipality's IDP, the implications of this population structure are a higher demand on the provision of social and physical facilities, like schools, primary health care centres, etc.

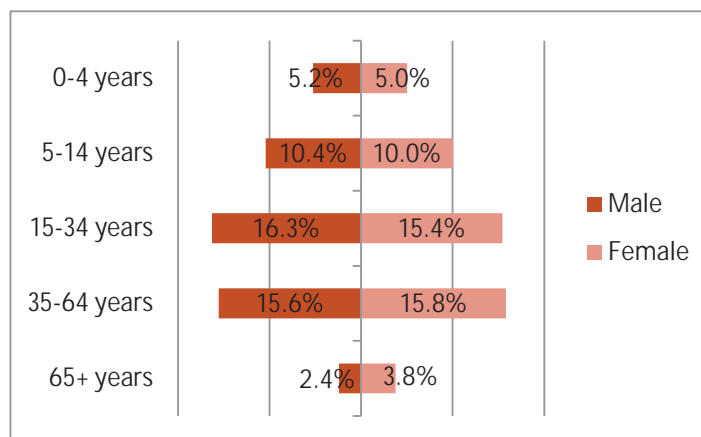


Figure 3-2: Age and gender profile (Quantec, 2015)

In terms of education levels in the LM, 11.5% of the adult population (over 20 years of age) had no education at all, while 64% have primary or secondary education (Stats SA, 2015). Those with higher educational qualifications accounted for 5.5% of the population. These figures indicate an increase in all categories since 2001, except for the no schooling, some primary, and some secondary categories. In general, there has been an improvement in the educational qualifications of the labour force in the local municipality. The no schooling category decreased by 10%, indicating a higher percentage of people attending school. While the share of people with no schooling at district level is 14.1%, the percentage of people with no schooling is notably lower at provincial (11.1%) and LM (11.5%) level. Additionally, the number of people who have completed matric in Siyathemba is 17.3%, which is lower than the 20% and 22.1% at district and provincial levels, respectively.

The average monthly household income in the Siyathemba LM was R6 858 in 2014 prices. This was less than the national, provincial and district levels which had average household incomes of R9 743, R8 116, and R7 030. Overall, approximately two thirds of the population in the Siyathemba LM earns up to R3 400 a month; this is larger than the same group at district and provincial level. According to the Pixley ka Seme IDP, the cut-off monthly household income for indigence in the Siyathemba LM is R1 500. This means those households who, due to a number of socio-economic factors are unable to afford basic services such as water, basic sanitation, basic energy, health care, housing, food and clothing. From income data obtained in the 2011 Census, approximately 39.4% of the households would qualify as indigent in the local municipality.

3.3 Structure of the Economy

The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors.

The Northern Cape Province contributes the least percentage (2.3%) to the country's Gross domestic Product (GDP). However, although the Northern Cape Province has the smallest economy of the nine provinces, Gross Domestic Product of the Region (GDPR) per capita is higher than national average which is R59 917 and R58 533, respectively. The Siyathemba LM economy was valued at R 796 million in current prices. The LM contributed 10.9% to the economy of the Pixley ka Seme District and made a contribution of 1.2% to the province's economy. Over a period of ten years (2003-2013), the municipality's economy grew at a Compounded Average Growth Rate (CAGR) of 2.4% per year. This was slightly higher than the district and provincial average growth rates of 1.8% and 2.3%, respectively.

In terms of economic activities, the economy of the Northern Cape Province depends heavily on the primary sectors of the economy (agriculture and mining) which made up 36.5% of GDP-R in 2013. The largest sector is mining, which has been fluctuating between periods of growth and decline in contribution to the GDP-R. Agriculture, on the other hand has declined in contribution from 8.7% in 2002 to 5.4% in 2013. A worrying characteristic of the Northern Cape Province is the limited amount of processing of the primary commodity output in agriculture and mining. This is evident in the fact that the manufacturing sector contributes only 2.4% towards GDP-R. All industries in the secondary sector have shown very little growth if any. The tertiary sector was the largest contributor to the economy of the Northern Cape Province, making up 56.8% of GDP-R. General government services (15.2%) were the second largest industry contributors after mining (31.2%).

Contrary to the province's economy, mining and quarrying continues to be a small contributor to the economy of the LM, making a meagre 3.1% contribution compared to the province's 31.2%. The mining sector historically played a major role in the local economy, with asbestos and copper mining the key activities. Currently, mining activities are mainly related to alluvial diamond mining activities along the Orange River. The closure of the asbestos mines as well as the Copperton mine, has had a major lasting negative impact on the Siyathemba LM economy. On the other hand, the agricultural sector makes a significant contribution of 16.7%, making it the second largest single contributor after finance and business services. The most extensively cultivated crops in the municipality are maize, wheat, peanuts, lucerne and table grapes. Stock farming activities are mainly based on sheep and goats. Overall, the economy of Siyathemba LM is a service economy with the tertiary sector contributing 70% to the municipality's GDP-R.

3.4 Labour Force and Employment Structure

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being.

The Census 2011 data indicates that the Siyathemba LM had about 13 656 people in the working-age population. This amounts to 63% of the total population. Of these, 7 113 people were economically active; while roughly 48% of the working age population were not economically active (NEA), that is, persons aged 15–64 years who are neither employed nor unemployed at the time of the survey, including discouraged job seekers. The employed labour in the LM was estimated at 5 356; while the unemployed population was estimated at 1 757, reflecting an unemployment rate of 24.7%. This was lower than the country's unemployment rate of 29.7% and lower than the provincial unemployment rate that was recorded at 27.4%.

In the town of Prieska, 3 094 of the working age population was employed, with 1 212 of them unemployed. This means that 28.1% of the labour force in Prieska was unemployed. On the other hand, 4 672 of the working age population was not economically active. In the smaller towns, the unemployment situation was worse, with unemployment rates 41% and 33.6% in Marydale and Nierkerkshoop, respectively (Stats SA, 2014). The Copperton community is very small and isolated from employment opportunities and amenities.

More than three quarters of the employed individuals in the Siyathemba LM were employed in the formal sector, and only 10.8% were employed in the informal sector. Private households provided for 11.8% of the employment opportunities in the municipality. In Prieska, 74.4% of the employment opportunities were provided by the formal sector and only 8.6% came from the informal sector. In Marydale, 86.5% of the population is employed in the formal sector while only 52.3% of the Nierkerkshoop employment opportunities come from the formal sector. A significant percentage (43.4%) of Nierkerkshoop's employment opportunities come from the informal sector, while the same sector contributes only 7.7% towards employment in Marydale (Stats SA, 2014).

In terms of the structure of employment, the agricultural sector was the most important economic sector not only in the LM but in the district as well. In the Siyathemba LM, this sector contributed 27.8% of the total employment opportunities, while creating 27.1% of employment opportunities in the Pixley ka Seme District. This was followed by personal services and general government. These figures are almost similar to those of the province, but general government is the largest contributor to employment in the Northern Cape Province. Table 3-1 below indicates the contribution of economic sectors to employment in the district and the LM.

Table 3-1: Employment by economic sectors in Ehlanzeni DM and Siyathemba LM

Economic Sector	Pixley ka Seme DM Employment		Siyathemba LM Employment	
	Employment	%	Employment	%
Agriculture	12 587	27.1%	1 637	27.8%
Mining and quarrying	342	0.7%	32	0.6%
Manufacturing	1 354	2.9%	219	3.7%
Electricity, gas and water	358	0.8%	24	0.4%
Construction	2 813	6.1%	596	10.1%
Trade	6 491	14.0%	774	13.1%
Transport and communication	839	1.8%	50	0.8%
Finance and business services	5 357	11.6%	751	12.8%
Personal services	8 489	18.3%	921	15.6%
General government	7 756	16.7%	888	15.1%
TOTAL	46 387	100%	22 3232	100%

Source: (Quantec, 2015)

3.5 Access to housing and basic services

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure are other indicators to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities, further indicates the nature of the study area that is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against which the potential impacts of the proposed project can be assessed.

- **Housing:** Approximately 85% of the households in the Siyathemba LM reside in formal housing in the form of a house or other brick structures on a separate stand or yard. 14.3% of the households live in informal dwellings. Furthermore, 0.7% of the municipality's households live in traditional dwellings. These numbers are similar to those of Prieska with about 85.3% households living in formal dwellings, while 14.5% live in informal structures.
- **Access to water:** In terms of access to piped water, 88.7% of the households in the municipality have access to piped water either inside the dwelling or in the yard. The picture improves in Prieska, where 94.9% of the households have access to piped water inside their dwellings or yard. Only 1.2% of the households in the town do not have access to piped water at all. In terms of the supply, the bulk of the water in the LM is supplied by the municipality or other service providers. In Prieska, close to 97% of the households' water is supplied by the municipality or other water service providers, while in the non-urban areas of the municipality only 1.1% of water is supplied by bulk water infrastructure connections. Two thirds of the households in non-urban areas used boreholes (Stats SA, 2014). The district's IDP note that water provision and availability is one of the issues that will have to be addressed in order to improve the economic activity in most towns situated within the Pixley ka Seme District Municipal area (Pixley ka Seme District Municipality, 2011).
- **Access to sanitation:** If not properly managed and monitored, sewerage and sanitation are basic needs of communities which can pose serious health and hygiene risks. 71.2% of the households in the Siyathemba LM had access to a flushing toilet while 16.8% of the households used pit latrines. 7.7% of families have no access to toilet facilities and 3.8% is still using the bucket system. According to the Siyathemba LM IDP the municipality has a sanitation backlog of 470 households.
- **Access to electricity:** The indicator "energy for lighting" was used as a proxy for measuring households' access to electricity. The majority of households (86.3%) in the municipality have access to electricity, while 13.7% use alternative forms of energy for lighting; mainly candles (11%).

3.6 Social and recreational infrastructure

The Siyathemba LM has the following social and recreational infrastructure available:

- Where education facilities are concerned, the municipality has one crèche, 6 primary schools and 3 combined schools, and one secondary school.
- The municipality has five community halls.

- There are four libraries in the municipality.
- Recreational facilities are available in each of the three towns.
- There is a police station in each of the three towns (Marydale, Prieska and Nierkerkshoop)
- There are five health facilities in the municipality; i.e. one hospital, three clinics and a mobile clinic in Prieska. It is indicated that the main challenge is the lack of ambulance services in Nierkerkshoop (Siyathemba Local Municipality, 2014)

3.7 Conclusion

The Siyathemba LM, where the proposed activity is to take place, comprises of 21 593 people and 5 830 households. Over the last decade, the size of the municipality from a population perspective has grown by 14.9%; with a large portion of the population in the municipality residing in urban areas.

Households residing in the local municipality have a relatively lower income as compared to the average household in the Northern Cape Province, but it is significantly lower than the average household income in South Africa. This means that the households in the LM do not have the same level of access to economic opportunities as the rest of South Africa.

The labour market in the primary study area comprises of 5 356 employed and 1 757 unemployed people. It has a smaller labour participation rate (52%) than in South Africa and the Northern Cape, which explains a lower average household income earned by Siyathemba LM households versus the rest of South African households. The unemployment rate in the local municipality is lower than in any of the analysed areas. Overall, the economy of the Siyathemba LM is a service economy. However, the agricultural sector also makes a significant contribution both in terms employment and GDP-R.

The situation with housing and service delivery is above average. About 85% of the households reside in formal dwellings. With respect to water and sanitation, a significant portion of households have access to water inside their dwellings and yards while 71% of the households have access to a flushing toilet.

Given all of the above, it can be concluded that the primary study area is in need of investment to stimulate its economy and create new jobs. Ideally, such investment should focus on diversification of local economic activities and create new value chains within the local economy. Any new developments in the municipality should also take into account the local housing and service delivery situation, and, if possible, put interventions in place that would assist in improving access to formal dwellings as well as access to basic services.

4. IMPACT ASSESSMENT ASSUMPTIONS

This chapter provides assumptions related to the proposed project and the activities in the zone of influence.

4.1 Proposed project related assumptions

Cost related and employment assumptions for the construction and operational phases are based on information provided by the client. Some assumptions are also based on information reported by the Department of Energy (DoE) for the approved Bid Window 4 projects.

Construction-phase assumptions

It is envisaged that the construction phase will last for a period of about 18 to 21 months. Based on the information provided, it is estimated that about R1 500 million will be spend during the construction period and 129 skilled and unskilled employment opportunities will be created

The majority of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. It is thus assumed, that 80% of the positions will be filled by local people.

Operational-phase assumptions

It is expected that the proposed Helena Solar 3 PV facility will be in operation for 20 years. The average annual electricity generated by the proposed 75 MW plant will amount to about 140 000 MWh per annum. The annual revenue generated by the plant could amount to up to R50 million. Furthermore, it is expected that 43 jobs per annum will be created at the plant.

4.2 Assumptions regarding affected land uses and economic activities

The proposed development area covers an area of 430 ha on Portion 3 of the farm Klipgats Pan No 117, however it is envisaged that the project footprint will only require an area of about 250 ha. The proposed power line corridor runs on Portion 4 of the farm Klipgats Pan No 117.

In order to obtain baseline information on the socio-economic conditions characterising the potentially affected land parcels in terms of current and predicted future changes with and without the project, telephonic interviews were conducted.

Out of the list of eleven farms that were included in the zone of influence, eight farmers were engaged with. No contact details were available for the owners of Portions 1, 2 and 5 of Klipgats Pan 117 and hence they could not be contacted for comment. Owners of the Remainder of Slimes Dam 154, Portion 2 of Springbok Poortje 119, Portion 2 of Kaffirs Kolk 118 and Portion 1 of Kaffirs Kolk 118 did not wish to be engaged with.

Table 4-1 summarises information that was obtained during the interviews. All respondents were of the view that the proposed development would bring about positive socio-economic benefits to the area and would not be a threat to existing activities.

Table 4-1: Land-uses – site and adjacent land

Farm	Land use	Demographics	Sensitivity
Portion 3 of Klipgats Pan 117	<ul style="list-style-type: none"> Small private sheep farm 	<ul style="list-style-type: none"> 4 people living on the farm 1 labourer 	Directly affected (PV site)
Portion 4 of Klipgats Pan 117	<ul style="list-style-type: none"> No activities currently taking place 	<ul style="list-style-type: none"> No one lives on the land 	Directly affected (power lines)
Portion 3 of Groot	<ul style="list-style-type: none"> Commercial sheep 	<ul style="list-style-type: none"> 4 people living on 	Adjacent

Fouries Kolk 116	farming	the farm • 4 labourers	
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Source: Telephonic interviews with landowners

5. Comparative assessment of alternatives

The study requires an assessment of the alternatives, however, from a socio-economic perspective no alternative takes preference over the other as the impacts remain the same for whichever alternative is chosen. Therefore, all impacts analysed in this chapter will be equally applicable to the three site alternatives.

Alternative	Preference	Reasons
SUBSTATION		
Substation Site Alternative 1	No preference	Impact is the same
Substation Site Alternative 2	No preference	Impact is the same
INTERNAL ROADS		
Internal Road Alternative 1	No preference	Impact is the same
Internal Road Alternative 2	No preference	Impact is the same
POWER LINES		
Power Line Corridor Alternative 1	No preference	Impact is the same
Power Line Corridor Alternative 2	No preference	Impact is the same

6. SOCIO-ECONOMIC IMPACT ASSESSMENT AND EVALUATION

6.1 Construction phase assessment results

The analysis of the expected impacts from the construction phase of the development of the proposed project is presented in the following paragraphs. The assessment covers a number of aspects including the impact on production, GDP, employment, household income, and government revenue of the local and regional economies. It includes the assessment of both positive and potential negative economic impacts.

Temporary increase in production

One of the most important objectives of the South African government is to enhance local manufacturing through the REIPP. The programme obliges bidders to meet varying minimum local content requirements depending on the technology with a threshold of 45% set for solar PV projects.

During the construction phase, the demand for necessary goods, services, and materials will induce production amongst the supporting industries and their supply value chains. Total local expenditure during the development phase is estimated to be about R675 million which represents the direct impact of the proposed project on the economy. Therefore, the development of the solar PV facility will have a positive impact on the regional, as well as the national economy. The direct impact will be wholly absorbed by the

construction sector through companies that will be directly involved in the construction activities, i.e. construction contractors and engineering firms.

Based on experience and knowledge of other solar PV studies undertaken by Urban-Econ, it is envisaged that a significant portion of new business sales in the economy during construction will be stimulated through indirect effects or production-induced effects, i.e. by companies that will be supplying inputs and services to the contractors and engineering firms operating on site. Aside from the building and construction sector that will benefit from sub-contracting activities, the manufacturing sector will also benefit from the development of the solar PV plant.

In addition to the direct and indirect impacts resulting from the initial capital investment, construction of the solar PV plant will result in significant consumption induced increases in new business sales. Construction activities will lead to the creation of new temporary employment opportunities through both direct and indirect effects which will in turn increase the household income and consequently stimulate sales in a variety of sectors through household consumption. Considering the distribution of consumption induced impacts, the manufacturing industry, real estate, trade, and transport will be the biggest beneficiaries from the temporary increase in household spending. Although the majority of new business sales stimulated through consumption induced effects will be distributed throughout the country, some of it will be captured in the local economy (within the Siyathemba LM) and will most likely benefit businesses within the tertiary sectors such as trade, transport, and personal services.

Environmental Parameter	<i>Economic production is defined as any activity that uses inputs such as labour and capital to produce outputs in the form of services or goods.</i>
Issue/Impact/Environmental Effect/Nature	<i>The impact takes place due to the investment on the project that will be spent in the country. Besides the direct impact, it involves the indirect and induced effects that are created when either suppliers of goods and services to the project experience an increase in demand or when businesses servicing households experience an increase in demand for their products.</i>
Extent	<i>The national economy will experience an increase in production.</i>
Probability	<i>It is most likely that there will be a temporary increase in production during construction.</i>
Reversibility	<i>The impact is irreversible, as the capital spent on the project cannot be paid back.</i>
Irreplaceable loss of resources	<i>No loss of resource.</i>
Duration	<i>Short term</i>
Cumulative effect	<i>High, as there are a number of planned renewable energy developments in the area.</i>
Intensity/magnitude	<i>Considering multiplier effects, the total impact on the national economy's output could be more than three times more than the expenditure of R0.7 billion.</i>

Significance Rating	<i>This is a positive high impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	4	4
Significance rating	+64(high positive)	+64 (high positive)
Mitigation measures	<p><i>In order to optimise the stimulation of the local economy through direct, indirect, and induced effects, the following should be applied where possible:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Procure construction materials, goods, and products from local suppliers if feasible.</i> <input type="checkbox"/> <i>Employ local contractors where possible.</i> <p><i>The proposed mitigation measures will possibly increase the positive impact in the local economy; however, this will not affect the rating.</i></p>	

Temporary increase in GDP-R

A country's gross domestic product (GDP) is the total value of all "final" goods and services, which were produced within the borders of the country, during a year. Most of the investment activities in the country are associated with a value-adding activity, which has a positive impact on the Gross Domestic Product per Region (GDP-R). The capital investment into the establishment of the proposed solar PV facility will generate some value added. Again, increase in employment will lead to increase in household income and consequently result in an increase of household consumption and expenditure on goods and services. This will result in an increase in GDP-R in the country due to consumption induced effects in addition to the direct and indirect impacts. Sectors that will experience the largest temporary growth in value added as a result of this investment will include the manufacturing industry, as well as the trade, transport, finance, and business services sectors.

Environmental Parameter	<i>Gross domestic product (GDP) is the total value of all "final" goods and services, which were produced within the borders of the country during a year.</i>
Issue/Impact/Environmental Effect/Nature	<i>The impact is generated through capital expenditure that shocks the economy. It results in growth of sectors that include businesses supplying goods and services required for the establishment of the</i>

	<i>facility and businesses that benefit from the increased consumer expenditure.</i>	
<i>Extent</i>	<i>The national economy will experience an increase in GDP-R.</i>	
<i>Probability</i>	<i>It is most likely that there will be a temporary increase in GDP-R during construction.</i>	
<i>Reversibility</i>	<i>The impact is irreversible, as the capital spent on the project cannot be paid back.</i>	
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>	
<i>Duration</i>	<i>Short term</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>There will be a significant increase in the country's GDP.</i>	
<i>Significance Rating</i>	<i>This is a positive medium impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	4
Intensity/magnitude	3	3
Significance rating	+48 (medium positive)	+48 (medium positive)
Mitigation measures	<ul style="list-style-type: none"> <input type="checkbox"/> <i>Recruit local labour.</i> <input type="checkbox"/> <i>Sub-contract to local construction companies.</i> <input type="checkbox"/> <i>Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.</i> <p><i>The proposed mitigation measures will possibly increase the positive impact in the local economy; however, this will not affect the rating.</i></p>	

Temporary increase in employment

The establishment of the solar PV plant is expected to create 129 skilled and unskilled jobs over the construction period. It is not possible to state at this stage of the development where the workers will come from; however, it can be expected that a relatively notable share will come from the immediate and surrounding areas, i.e. from within the Northern Cape Province. Besides the employment that will be temporarily created by the construction of the facility directly, an increase in labour demand as a result of production and consumption induced effects is also expected.

According to Census 2011 data, the Siyathemba LM had 1 757 unemployed individuals in 2011. It is envisaged that about 80%, or 103 job opportunities will be made available to individuals from within the municipality. This means that the project will have the potential to reduce unemployment in the municipality by about 6% for a temporary period provided that the local unemployed individuals will be suitable and willing to work on site.

It is expected that the sectors with the largest expected growth in temporary employment during the construction period will be the construction and manufacturing industries.

Environmental Parameter	<i>Employment impacts are calculated in terms of the Full-Time Equivalent (FTE) employment positions, which is the same as a FTE job or one man-year of work.</i>	
Issue/Impact/Environmental Effect/Nature	<i>The impact is generated through capital expenditure that shocks the economy. It involves the creation of direct new job opportunities related to the construction of the proposed development and employment opportunities that will be indirectly created through the increased expenditure in sectors supplying goods and services to the construction activity and in sectors benefiting from the increase of consumer expenditure.</i>	
Extent	<i>Increase in employment will affect the entire country depending on the areas where inputs required are sourced.</i>	
Probability	<i>It is most likely that there will be a temporary increase in employment during construction.</i>	
Reversibility	<i>Irreversible as employment created, albeit for a temporary period, cannot be undone.</i>	
Irreplaceable loss of resources	<i>No loss of resource.</i>	
Duration	<i>Short term.</i>	
Cumulative effect	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
Intensity/magnitude	<i>There will be a notable reduction in unemployment within the Siyathemba LM.</i>	
Significance Rating	<i>This is a positive high impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	+48 (medium positive)	+48 (medium positive)

Mitigation measures	<ul style="list-style-type: none"> ❑ <i>Employ labour-intensive measures in construction.</i> ❑ <i>Employ local residents.</i> ❑ <i>Sub-contract to local construction companies.</i> ❑ <i>Utilise local suppliers.</i> ❑ <i>Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation.</i>
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Impact on skills development

The construction of the proposed solar PV facility will require general construction experience as well as expert knowledge. It is expected that where specialist training can be provided, candidates from local communities will be trained. People involved in the project will have opportunities to further perfect and develop the skills within their own fields of expertise or acquire new skills. This could particularly be relevant to the unskilled and semi-skilled people engaged in the construction.

The creation of jobs through indirect and induced effects, although for a short-term, will create another opportunity for people to develop and acquire new skills. Given that the impact during construction will affect almost all sectors, although at different levels, it could be argued that the project will stimulate the creation of a comprehensive set of new skills in the country. Most importantly, unlike employment opportunities during construction, skills developed during that period will not expire once the phase is complete. Thus, the impact on skills development is much more sustainable and has a positive impact on the employability of the affected people. This means that although employment will be temporary, people benefiting from skills developed during that employment will have a far greater chance of finding permanent jobs than they had before the project.

Environmental Parameter	<i>Skills development: employment creation gives way to a host of skills transfer and development opportunities in terms of honing an existing skill or acquiring a new skill.</i>
Issue/Impact/Environmental Effect/Nature	<i>The impact takes place during the creation of new employment opportunities, and unlike the actual employment created is sustainable.</i>
<i>Extent</i>	<i>People across the country will have the opportunity to develop their skills.</i>
<i>Probability</i>	<i>Possible – one cannot be certain that people gaining employment during the construction phase will be able to develop or acquire new skills.</i>
<i>Reversibility</i>	<i>Barely reversible - skills obtained cannot be lost unless they are not being used and/or become outdated</i>
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>
<i>Duration</i>	<i>Short term.</i>

<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>High impact on local employees' skills - 11.5% of the adult population in the Siyathemba LM had no education at all, while 64% have primary or secondary education and only 5.5% have higher educational qualifications. In the context of the national economy, though this impact will be of a lower magnitude.</i>	
<i>Significance Rating</i>	<i>This is a medium positive impact.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	3
Reversibility	3	3
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	+42 (medium positive)	+45 (medium positive)
Mitigation measures	<ul style="list-style-type: none"> ❑ <i>Contractors should provide learnerships and on-job training;</i> ❑ <i>Where specialist training can be provided, candidates from local communities should be prioritised for training; and</i> ❑ <i>Share knowledge with the sub-contracting companies during the construction period.</i> <p><i>These mitigation measures could potentially improve the weighting of the impact in terms of its probability.</i></p>	

Temporary increase in household income

Given the temporary increase in production levels across the country as well as the increase in temporary employment, a temporary growth in household income is expected. This increase in household income, although temporarily, will result in an increase in the standard of living of the benefitting households. It is essential to keep in mind that this impact is of a temporary nature and it will not be sustained once the facility has been established. Since some of these construction workers will be recruited from outside the area, not all of that spending will be realised in the local community and nearby towns

In addition to the direct impact on household income, individuals who obtain jobs through indirect and induced effects of the construction activities will also experience growth in their income levels and consequently, more households in the province and other parts of the country will also benefit.

Environmental Parameter	<i>Household income: the result of a household's member engaging in economic activity; has a direct link to the standard of living of these households.</i>
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Issue/Impact/Environmental Effect/Nature	<i>The impact takes place during construction as a result of jobs created through direct, indirect and induced impacts.</i>	
Extent	<i>Increase in household income will be nationwide since the temporary increase in employment will affect the entire country.</i>	
Probability	<i>Probable - the impact will most likely take place.</i>	
Reversibility	<i>Irreversible.</i>	
Irreplaceable loss of resources	<i>No loss of resource.</i>	
Duration	<i>Short term.</i>	
Cumulative effect	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
Intensity/magnitude	<i>High – The income earned by households located in the LM as a result of the project will be on average higher than the average income of these households. The impact within the national economy, though will be less significant.</i>	
Significance Rating	<i>This is a medium positive impact. Mitigation measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before mitigations will not be affected.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	+48 (medium positive)	+48 (medium positive)
Mitigation measures	<ul style="list-style-type: none"> <input type="checkbox"/> <i>Recruit local labour as far as feasible to increase the benefits to the local households.</i> <input type="checkbox"/> <i>Employ labour-intensive methods in construction.</i> <input type="checkbox"/> <i>Sub-contract to local construction companies.</i> <input type="checkbox"/> <i>Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.</i> 	

Increase in government revenue

The construction phase of the proposed project will last for about 18 to 21 months. During this period, the construction company and the workers will earn income and pay government taxes including income taxes and payroll taxes. Although the spending of this money by government is difficult to associate with a specific budget item, any revenue received by government is allocated towards certain budget items, provinces, or

local municipalities to support and assist with improvement of their service delivery. Thus, without doubt this revenue would be spent on improving socio-economic conditions of the population in some way.

Environmental Parameter	<i>Government revenue: government obtains its revenue by collecting taxes and rates from the country's residents and business.</i>	
Issue/Impact/Environmental Effect/Nature	<i>The impact will take place as a result of local expenditure on construction and will be acquired by government through indirect and direct taxes on the project's activity.</i>	
<i>Extent</i>	<i>The fiscal gain will be collected by the national government and used in the national budget; it is not possible to pinpoint exact regions benefitting from this increase.</i>	
<i>Probability</i>	<i>Definite - the impact will definitely take place, although one cannot be certain of the exact amount that government will be collecting as a result of this phase of the proposed project.</i>	
<i>Reversibility</i>	<i>Irreversible.</i>	
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>	
<i>Duration</i>	<i>Short term.</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>Low – the project will make a small contribution to the national revenue.</i>	
<i>Significance Rating</i>	<i>This is a low positive impact.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+17 (low positive)	+17 (low positive)
Mitigation measures	<i>No mitigations.</i>	

Impact on balance of payment

The balance of payments can be described as a summary of all economic transactions between South Africa and all other countries in the world. Two sections make up the balance of payments, namely the current account and the capital account whereby the former refers to trade in the form of export and imports whereas the latter refers to Foreign Direct Investment (FDI), Investment Portfolio, and other investments which reflect on national accounts.

The establishment of the Helena 3 Solar PV facility will require an investment of approximately R1 500 million, of which about 55% or R825 million will be spent on imported goods and services. Expenditure on imported goods can be regarded as a leakage of money from the national economy, which has a negative impact on the trade balance. Any purchase of imported goods and services in South Africa is accounted for in the Current Account as either 'merchandise imports' or 'payments for services'. Thus, the R825 million that is expected to be spent on imported goods will be accounted under 'merchandise imports'.

Over the last decade, South Africa's trade balance has been at a deficit. Between 2007 and 2014, the deficit fluctuated between 1.5% and 5.8% of the GDP (SARB, 2015). It reached the lowest level in 2010 (1.5% of GDP), which could be associated with the increase in demand for South Africa's goods and services due to the shift in global trade patterns following the global financial crisis in 2009, and increase in travel receipts from South Africa hosting 2010 FIFA World Cup™. Thus the need to import materials, equipment, and services required for the construction of the PV plant would most likely increase the trade deficit in the country. However, the effect will be temporary since the construction period is only about two years. Importantly, though, is that the amount is not significant to have any notable negative effect on macro-economic indicators and government policy.

The negative effect of the balance of payment during the construction period will be negligible. Moreover, a negative balance of payments in a developing economy such as South Africa is generally acceptable as the economy needs to borrow money to allow it to invest in infrastructure, people, and businesses that which will further stimulate economic growth. Care, though, should be taken to ensure that the current account deficit does not grow beyond the means of the country to service its debt.

Mitigations thereof are possible, but only if goods and services required for the establishment of the project can be procured locally at a competitive price.

Environmental Parameter	<i>Balance of payments: a summary of all economic transactions between South Africa and all other countries in the world.</i>
Issue/Impact/Environmental Effect/Nature	<i>The impact takes place during construction as a result of importing goods and services.</i>
<i>Extent</i>	<i>Importing will affect the balance of the national and international accounts.</i>
<i>Probability</i>	<i>Probable - It is likely that machinery and equipment required for the construction of the plant will be imported.</i>
<i>Reversibility</i>	<i>Completely reversible.</i>
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>
<i>Duration</i>	<i>Short-term.</i>
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>
<i>Intensity/magnitude</i>	<i>Low – the project will make a small contribution to the national revenue.</i>
<i>Significance Rating</i>	<i>The impact is low negative - requires development of the local manufacturing capabilities.</i>

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-12 (low negative)
Mitigation measures	<ul style="list-style-type: none"> <input type="checkbox"/> <i>Local goods and services are procured domestically instead of imported.</i> <input type="checkbox"/> <i>Recruit local labour as far as feasible to increase the benefits to the local households.</i> 	

Potential loss of agricultural land

Activities such as the establishment of access roads, the movement of heavy vehicles, the establishment of lay-down areas and foundations, as well as the establishment of the substation and permanent administration building would potentially damage topsoil and vegetation. The footprint of the project considering the proposed layout will directly affect two farms. One farm is currently being used for private sheep farming, while there are no agricultural activities currently taking place on the other farm. It is assumed that all agricultural activities currently underway at the proposed site will be halted once construction begins.

Since the farms are not being used for commercial agricultural purposes, there will be no significant or meaningful income and employment losses incurred as a result of the construction of the proposed facility.

Environmental Parameter	<i>Land sterilisation: loss of land to new development.</i>
Issue/Impact/Environmental Effect/Nature	<i>The impact will take place as a result of replacement of the low intensity farming activities.</i>
<i>Extent</i>	<i>Will affect farms on which project will be developed.</i>
<i>Probability</i>	<i>Definite - without the sale/lease of land the project will not go ahead</i>
<i>Reversibility</i>	<i>Barely reversible.</i>
<i>Irreplaceable loss of resources</i>	<i>Marginal loss of resources.</i>
<i>Duration</i>	<i>Long-term.</i>
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>
<i>Intensity/magnitude</i>	<i>Low – the intensity of agricultural activities is low.</i>

<i>Significance Rating</i>	<i>The impact is low negative. Mitigation may reduce intensity of impact</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	3	3
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-15 (low negative)	-15 (low negative)
Mitigation measures	<ul style="list-style-type: none"> <input type="checkbox"/> <i>Reasonable compensation must be negotiated with the affected farmers.</i> <input type="checkbox"/> <i>Should resettlement of farm workers be required, a Resettlement Action Plan must be developed and implemented.</i> <input type="checkbox"/> <i>Implementation of rehabilitation measures.</i> 	

Increased pressure on basic services and social and economic infrastructure

The construction of the solar PV plant will put some pressure on both economic and social infrastructure in the local economy, particularly given the fact that many of the workforce involved in the development would be coming from outside Copperton.

The construction activities will increase the traffic along the R357 road, which could lead to the deterioration of the road infrastructure and require greater expenditure on road maintenance by the municipality. Although the situation regarding access to services in the area appears to be well managed, influx of people to the area and employment of construction workers from outside the local communities will put a strain on the housing and accommodation situation, basic service provision and health facilities during the construction period. Proper mitigation measures need to be put in place to minimise the impact on infrastructure and to ensure that increased pressure does not lead to the deterioration of infrastructure which could reduce the standard of living of the entire community.

<i>Environmental Parameter</i>	<i>Basic services and social and economic infrastructure: this includes housing, water and sanitation, electricity, roads, clinics, recreational facilities</i>
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>The influx of jobseekers to the area and migration of workers will increase the demand for basic services, as well as social and economic infrastructure in the area.</i>
<i>Extent</i>	<i>The added pressure on infrastructure will be felt by the local municipality.</i>
<i>Probability</i>	<i>Possible.</i>

<i>Reversibility</i>	<i>This impact is partly reversible but will require significant investment to provide adequately for the area with a temporary increase in population and straining infrastructure.</i>	
<i>Irreplaceable loss of resources</i>	<i>This impact is not associated with any losses of resources; however, deterioration of man-made infrastructure is probable.</i>	
<i>Duration</i>	<i>Medium-term - impacts may last post the construction phase until mitigated.</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>Low - considering that there are no existing challenges with regards to basic service delivery.</i>	
<i>Significance Rating</i>	<i>The impact is low negative.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	<ul style="list-style-type: none"> ❑ <i>Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers.</i> ❑ <i>Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads).</i> 	

Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.)

The local area is not sufficiently diversified to provide all skills and workers necessary during construction. The area may thus experience an influx of migrant labourers who may move to the area looking for employment opportunities. The influx of job seekers and migrant construction workers is expected to create social disturbances and conflicts in the local economy, amongst which include crime (stock theft, burglaries, assaults, etc.), and adverse health impacts around the site and elsewhere in the community. The significance of such impacts depends to some extent on the proportion of workers that are recruited from outside the local community.

The findings of this study indicate that the proposed site is located in a sparsely populated rural area with major towns located many kilometres away. There overall numbers of labourers on adjacent farms is small. Given the site lay-out, it appears that no construction camp will be established on the site. The potential for adverse impacts on the relevant rural community is therefore, not rated as significant.

Provided that the stated 80% local recruitment target is met or closely approached, the bulk of construction workers would be from within the Siyathemba LM, particularly Prieska. Given existing skills levels, the majority of the employment opportunities are likely to be filled by semi- and low-skilled workers. Potential social impacts associated with construction workers are usually associated with low-skilled workers, and not the more skilled workers. The fact that the bulk of low skilled workers would potentially be from the local community itself would therefore, serve to neutralise potential impacts as these workers form part of the local social network. It is therefore, unlikely that the remaining fraction of workers recruited from outside the local community will pose a significant risk to the local community.

Environmental Parameter	<i>Social pathologies - social factors such as deterioration of health; increase in crime; prostitution; and drugs among others.</i>	
Issue/Impact/Environmental Effect/Nature	<i>Potential impacts on social factors associated with the presence of construction workers and job seekers.</i>	
<i>Extent</i>	<i>The local community.</i>	
<i>Probability</i>	<i>Probable.</i>	
<i>Reversibility</i>	<i>Partly reversible. However, in the case of HIV and AIDS, the impact is irreversible.</i>	
<i>Irreplaceable loss of resources</i>	<i>This impact could be associated with some losses of personal goods and livestock.</i>	
<i>Duration</i>	<i>Short-term.</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>Low.</i>	
<i>Significance Rating</i>	<i>The impact is low negative - requires development of the local manufacturing capabilities.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-12 (low negative)
Mitigation measures	<i>The developers could implement the following measures to limit the occurrence of an increase in social pathologies:</i>	

	<ul style="list-style-type: none"> ❑ <i>Employ locals as far as feasible through the creation of the local skills database and recruitment of suitable candidates.</i> ❑ <i>Set up a gate or access control to site to limit or completely eliminate the possibility of livestock theft and burglaries at the residential properties.</i> ❑ <i>Control the movement of workers between the site and areas of residence to minimise loitering.</i> ❑ <i>The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks.</i> ❑ <i>Implementing health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.</i>
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6.2 Operational phase assessment results

The following sections describe the impact of the proposed solar PV plant during the operational phase. The facility is envisaged to have a lifespan of about 20 years. Impacts observed during this phase regardless of whether they are positive or negative will therefore, be long lasting.

Sustainable increase in production

Based on production assumptions made, once operational the proposed facility is expected to generate an annual turnover of R50 million. In addition to the new business sales created each year directly attributable to the proposed project, new business sales will also be generated as a result of indirect and induced effects. However, due to the fact that operational expenditure for the facility is generally small, multiplier effects are expected to be limited and thus the indirect and induced effects stimulated by spending on operations are not expected to be of a significant amount

Given that the Siyathemba LM's economy is quite small (R796 million in current prices) and relatively undiversified it is reasonable to assume that a significant portion of the inputs required will be procured from outside, which means that other local economies in the country will benefit from these expenses. With regard to sectoral benefits, it can be expected that the utilities sector will be the biggest beneficiary. It is also envisaged that local businesses involved in sectors such as manufacturing and financial and business services will experience some increase in annual turnover. Nationwide, industries expected to benefit the most from production induced or indirect impacts include the insurance, business activity, and transport industries; while increased consumer spending as a result of increased household income will benefit agriculture, trade, real estate, and health and social services.

Environmental Parameter	<i>Economic production is defined as any activity that uses inputs such as labour and capital to produce outputs in the form of services or goods.</i>	
Issue/Impact/Environmental Effect/Nature	<i>The impact results from sustainable production of the solar PV facility, as well as procurement of goods and services required for its sustainable operations and creation of sustainable employment opportunities through direct and indirect effects.</i>	
<i>Extent</i>	<i>The national economy will experience an increase in production</i>	
<i>Probability</i>	<i>It is most likely that there will be an increase in production.</i>	
<i>Reversibility</i>	<i>The impact is irreversible.</i>	
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>	
<i>Duration</i>	<i>This impact is rated as long-term since it will be experienced over the entire operational life of the project.</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>Medium.</i>	
<i>Significance Rating</i>	<i>This is a positive medium impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	+36 (medium positive)	+36 (medium positive)
Mitigation measures	<i>The project should aim to benefit the local economy as far as possible and feasible by opting for procurement of local goods and services. However, this will not affect the rating.</i>	

Sustainable increase in GDP-R

New business sales generated through direct and spin-off effects of operations at the facility will generate value added for the national economy. A significant portion of value added will be created directly by the PV facility operations. The rest will be created through production and consumption induced impacts. Similar to the impact on production, the utilities sector will be the sole beneficiary of the direct value added. In addition, it is expected that the biggest overall stimulus will be experienced by the community and government service, business services, transport, and trade and accommodation sectors.

In 2013, the Siyathemba LM's economy was valued at R796 million. Considering the expected revenue, the project's value added would most likely range between R30 million and R40 million per annum. Assuming that the facility's GDP will be accounted in the local municipality, it will increase the local economy by about 5%. Based on the baseline analysis, the Siyathemba LM's economy is dominated by the tertiary sector with the agricultural sector also playing an important role. It can therefore, be argued that the proposed project will assist in diversifying the local municipality's economy.

Some of the production and consumption induced impacts may also be retained in the Siyathemba LM, suggesting that the facility will benefit the local economy not only through direct impact, but also through the multiplier effect. Importantly, the greater the value of goods and services procured by the mine during its operations from the local economy, the greater the overall economic benefit for the local municipality.

Environmental Parameter	<i>Gross domestic product (GDP) is the total value of all "final" goods and services, which were produced within the borders of the country during a year.</i>	
Issue/Impact/Environmental Effect/Nature	<i>The impact is generated through continuous operation of the solar facility. It stimulates economic activities of directly and indirectly affected businesses, which subsequently leads to the creation of new business sales and generation of value added. Through increased household expenditure, an additional round of value adding is created.</i>	
Extent	<i>The national economy will experience an increase in GDP-R.</i>	
Probability	<i>It is most likely that there will be an increase in GDP-R during operations.</i>	
Reversibility	<i>The impact is irreversible.</i>	
Irreplaceable loss of resources	<i>No loss of resource.</i>	
Duration	<i>This impact is rated as long-term since it will be experienced over the entire operational life of the project.</i>	
Cumulative effect	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
Intensity/magnitude	<i>Medium - The direct impact associated with the project will lead to the change in the local economy's structure but will have a diluted effect on the national economy.</i>	
Significance Rating	<i>This is a positive medium impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2

Significance rating	+36 (medium positive)	+36 (medium positive)
Mitigation measures	<input type="checkbox"/> Investigate local procurement opportunities. <input type="checkbox"/> Procurement from local suppliers should be encouraged if feasible to the viability of the facility.	

Impact on employment

The facility will create about 43 skilled and unskilled sustainable employment opportunities per annum. The creation of the unskilled and semi-skilled jobs will provide opportunities for the unemployed people in the local communities to acquire a sustainable source of income and potentially develop skills. This means that the proposed facility will be able to reduce the current unemployment level in the Siyathemba LM, albeit by a small percentage. This positive impact though, will be retained for the entire duration of operational activities at the mine.

Besides the employment opportunities created at the facility itself, the project will stimulate the creation of additional jobs throughout the economy through production and consumption induced impacts. The jobs supported by the solar PV plant operation through the multiplier impact will be distributed among various economic sectors particularly agriculture, utilities, financial and business services, manufacturing and community services sectors.

Environmental Parameter	<i>Employment impacts are calculated in terms of the Full-Time Equivalent (FTE) employment positions, which is the same as a FTE job or one man-year of work.</i>
Issue/Impact/Environmental Effect/Nature	<i>The project is expected to create over 800 person-years throughout its operational lifespan, including 80% from the local communities, and will also create and support additional employment opportunities through multiplier effects.</i>
<i>Extent</i>	<i>Increase in employment will affect the entire country depending on the areas where inputs required are sourced.</i>
<i>Probability</i>	<i>It is most likely that there will be an increase in employment during operations.</i>
<i>Reversibility</i>	<i>The impact is irreversible.</i>
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>
<i>Duration</i>	<i>Long-term – the created employment opportunities are expected to last for the duration of the project.</i>
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>
<i>Intensity/magnitude</i>	<i>Low – there will be some reduction in unemployment within the Siyathemba LM</i>
<i>Significance Rating</i>	<i>This is a positive low impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.</i>

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+16 (low positive)	+16 (low positive)
Mitigation measures	<ul style="list-style-type: none"> ❑ <i>Where possible, the employment of local labour should be practiced to increase the benefit to the local community through prevention of leakage of buying power.</i> ❑ <i>Local small businesses should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation.</i> 	

Impact on skills development

Establishing and operating the plant will result in improved skills amongst the staff if the facility includes a skills development component. On-the-job training is also a key element of the staff development; many of the required skills during the operational phase will be taught to staff through day-to-day operations. It should, however, be noted that most of the jobs required to support operations of the plant are unskilled and semi-skilled jobs that do not present significant opportunities for skills transfer (i.e. panel cleaners and security personnel).

Environmental Parameter	<i>Skills development: employment creation gives way to a host of skills transfer and development opportunities in terms of honing an existing skill or acquiring a new skill.</i>
Issue/Impact/Environmental Effect/Nature	<i>The impact takes place through the creation of employment opportunities during operations, and unlike the actual employment created is sustainable.</i>
<i>Extent</i>	<i>People across the country will have the opportunity to develop their skills.</i>
<i>Probability</i>	<i>Possible – one cannot be certain that people gaining employment during the operational phase will be able to develop or acquire new skills.</i>
<i>Reversibility</i>	<i>Irreversible; skills once gained cannot be lost.</i>
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>
<i>Duration</i>	<i>Permanent – the skills transferred will remain after the life of the project</i>
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>

<i>Intensity/magnitude</i>	<i>Impact is rated as being of low intensity due to the nature of skills required for the operations.</i>	
<i>Significance Rating</i>	<i>This impact is given a significance rating of low positive. Enhancement measures exist that can be implemented to ensure that skills development does take place which would improve the probability rating of this impact.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+18 (low positive)	+19 (low positive)
Mitigation measures	<i>In order to improve the chances of skills being developed during the operational period it is recommended that vocational skills transfer/training programmes be developed and knowledge sharing among employees encouraged. This mitigation measure could potentially improve the weighting of the impact in terms of its probability and increase its significance slightly.</i>	

Increase in household income

The creation of employment opportunities in each year of operation of the Helena 3 facility will positively impact on household income levels and allow these households to improve their standard of living. Furthermore, persons who obtain jobs as an indirect result of the facility's operations will experience growth in their income levels and consequently, more households in the province and other parts of the country will also benefit.

A household in the Siyathemba LM earns on average R6 858 per month with 15% of the households having no income at all. From income data obtained in the 2011 Census approximately 39.4% of the households would qualify as indigent in the local municipality. This means that about four in every ten households are unable to afford basic services such as water, basic sanitation, basic energy, health care, housing, food and clothing. The increase in the local tax base will improve this scenario, leading to the positive effect of the increased employment on living standards of community members being enjoyed by more than just those able to obtain employment at the facility.

Environmental Parameter	<i>Household income: the result of a household's member engaging in economic activity; has a direct link to the standard of living of these households.</i>
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Issue/Impact/Environmental Effect/Nature	<i>The impact takes place during operations as a result of jobs created through direct, indirect and induced impacts</i>	
Extent	<i>Increase in household income will be nationwide since the sustainable increase in employment will affect the entire country</i>	
Probability	<i>Probable - the impact will most likely take place</i>	
Reversibility	<i>Irreversible.</i>	
Irreplaceable loss of resources	<i>No loss of resource.</i>	
Duration	<i>Long-term – the created employment opportunities are expected to last for the duration of the project.</i>	
Cumulative effect	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
Intensity/magnitude	<i>Medium intensity</i>	
Significance Rating	<i>This is a medium positive impact. Mitigation measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before mitigations will not be affected.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	+36 (medium positive)	+36 (medium positive)
Mitigation measures	<i>Local procurement of labour and required goods and services should be encouraged as far as feasible to increase the benefit to the local households. This, though, will not affect the overall rating.</i>	

Increase in government revenue

Operations at the facility will contribute to government revenue collection through direct, indirect and payroll taxes during the operational phase. Although the spending of this money by government is difficult to associate with a specific budget item, any revenue received by government is allocated towards certain budget items, provinces or local municipalities to support and assist with improvement of their service delivery. Thus, without doubt, this revenue would be spent on improving socio-economic conditions of the population in some way.

Environmental Parameter	<i>Government revenue: government obtains its revenue by collecting taxes and rates from the country's residents and business.</i>
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Issue/Impact/Environmental Effect/Nature	<i>The impact takes place mostly with payment of royalties and corporates taxes, as well as a result of payment of salaries and wages and declaration of dividends.</i>	
Extent	<i>The fiscal gain will be collected by the national government and used in the national budget; it is not possible to pinpoint exact regions benefitting from this increase.</i>	
Probability	<i>Definite - the impact will definitely take place, although one cannot be certain of the exact amount that government will be collecting as a result of this phase of the proposed project.</i>	
Reversibility	<i>Irreversible.</i>	
Irreplaceable loss of resources	<i>No loss of resource.</i>	
Duration	<i>Long-term</i>	
Cumulative effect	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
Intensity/magnitude	<i>Low – the project will make a small contribution to the national revenue.</i>	
Significance Rating	<i>This is a low positive impact.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+19 (low positive)	+19 (low positive)
Mitigation measures	<i>No mitigations.</i>	

Investment in the local communities and economic development projects

Any renewable energy project approved by government will need to allocate a certain percentage of its revenue towards socio-economic (SED) and enterprise (ED) development activities in the local communities. The aim is to ensure that the proposed project will contribute to the sustainable development and upliftment of the communities located within a 50 km radius of the proposed site. RE IPPP bidders are required to commit at least 1% of the total revenue earned by each project to be spent on identified socio-economic development initiatives, and at least 0.6% on enterprise development. Given the expected revenue to be generated by the PV facility, the potential benefits of the local communities on an annual basis could amount to R0.8 million on an annual basis for the next 20 years. Proper investigation and planning would allow directing these funds to address the most pertinent challenges faced by the communities, which could substantially improve their livelihoods and standard of living.

Environmental Parameter	<i>SED and ED initiatives; as part of the RE IPPP programme, project owners are required to spend a portion of their turnover on the upliftment of the community where the project is located.</i>	
Issue/Impact/Environmental Effect/Nature	<i>Currently the economic base of Siyathemba LM is small, and the anticipated injection will have a significant positive impact on the standard of living of its community.</i>	
<i>Extent</i>	<i>The impact will affect the local municipality; it is envisaged to be geared towards Copperton and nearby villages due to their proximity to the site but could potentially be extended in the future.</i>	
<i>Probability</i>	<i>Definite - the impact will definitely take place.</i>	
<i>Reversibility</i>	<i>Irreversible.</i>	
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>	
<i>Duration</i>	<i>Long-term – throughout the operational period</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>Low – the project will make an average contribution to the local economy.</i>	
<i>Significance Rating</i>	<i>Low positive impact.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+17 (low positive)	+17 (low positive)
Mitigation measures	<i>It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.</i>	

Impact on sense of place

The largest alteration during the operational phase with regard to the sense of place will be through visual impact. However, few people reside in the area and little economic activity is taking place around the development site therefore it is expected that the visual impact will be of little significance.

As mentioned previously, the interviews with the land-owners and residents in the area revealed that they strongly support the proposed solar PV project being built in the area. The land-owners and residents in the area are willing to sacrifice the change in the sense of place that could be brought by the establishment of a PV plant, suggesting that they do not foresee the impact to be of notable significance but rather focus on the benefits of the project for the community. While not a strong concern for the community at present, it is advisable that all efforts be made to address the drivers to the change of the sense of place, such as visual effects, noise, and night illumination to make them less intrusive.

Environmental Parameter	<i>Sense of place, living and working conditions: these conditions are influenced by a variety of factors and can be quite subjective as each factor has a varying degree of influence for each person depending on what each individual's values are.</i>	
Issue/Impact/Environmental Effect/Nature	<i>Operation activities will have a significant visual impact on the areas in close proximity to the development site.</i>	
<i>Extent</i>	<i>The biggest impact will be felt close to the project site.</i>	
<i>Probability</i>	<i>Definite - the impact will definitely take place.</i>	
<i>Reversibility</i>	<i>Completely reversible.</i>	
<i>Irreplaceable loss of resources</i>	<i>No loss of resource.</i>	
<i>Duration</i>	<i>Long-term – throughout the operational period</i>	
<i>Cumulative effect</i>	<i>High, as there are a number of planned renewable energy developments in the area.</i>	
<i>Intensity/magnitude</i>	<i>Low</i>	
<i>Significance Rating</i>	<i>Low negative impact.</i>	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-13 (low negative)
Mitigation measures	<i>The mitigation measures proposed by the visual specialist should be adhered to.</i>	

7. Cumulative impact assessment

The cumulative impact assessment considers the project within the context of other similar land uses, in the local study area and greater regional context.

The Helena 3 Solar PV facility is one of the 14 renewable energy projects planned for the area. The potential for significant cumulative impacts is therefore likely to be high. Assuming that all the proposed projects are

approved, the local, regional and national economies could benefit substantially. Aspects that will potentially be significant include employment creation, and local procurement which will result in an increase in new business sales and value added. The introduction of a number of solar PV facilities could provide opportunities for local component manufacturing, and with an appropriate industrial policy it would be possible to leverage the country's existing industrial capacity. However, the amount of imported goods and services will be initially high, which will result in an increase in the trade deficit.

On the other hand, the cumulative impact in terms of loss of agricultural land could potentially be extensive due to the large land take required for PV power facilities. However, the agricultural potential of the land at the site and in the surrounding area is classified as low for crop production and moderate for grazing and therefore, these impacts are not likely to result in significant cumulative impacts. Overall, should adequate mitigation measures be implemented and adequate regional planning be applied, the cumulative impact on agricultural land is likely to be minor negative.

Table 7-1: Summary of potential cumulative impacts

Positive impacts	Negative impacts
Increase in production and GDP	Increase in crime through influx of workers
Employment creation	Increased pressure on infrastructure
Local economic development through socio-economic and enterprise development initiatives	Loss of agricultural land
Stimulation of the local manufacturing	Impact on rural sense of place
Improved standards of living of households benefiting from the projects	

8. Synopsis

The proposed Helena 3 Solar Photovoltaic Energy Facility is to be located near Copperton in the Siyathemba Local Municipality, Northern Cape Province. The construction of the facility will last for about one year to 18 months and will require an investment of about R1 500million. The facility's operations will generate about R50 million per year in revenue for about 20 years.

The national, provincial, and local government policy and strategy documents analysed in the report support the establishment of renewable energy projects as they have been recognised as potential stimulants of local economic growth, job creation, and also with regards to their contribution to sustainable development. The NCPGDS also notes that "sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation". In this regard, care needs to be taken to ensure that renewable energy facilities do not impact negatively on the region's natural environment. However, there will be no significant threats to the natural environment as has been noted during the impact assessment.

The economy of the Siyathemba LM is in need of diversification and the establishment of the solar PV plant in the area will offer such an opportunity. Furthermore, if the other proposed projects are approved, this

could contribute to the growth of this sector as well as stimulate economic development further. The project will have the potential to improve the standard of living of the communities located within a 50 km radius given the commitments towards socio-economic and enterprise development.

The construction and operation of the facility will result in various positive economic impacts.

- It is estimated that the capital expenditure on the 75 MW solar facility will be R1 500 million. Approximately, 129 employment opportunities will be created during the construction phase. The majority of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. It is thus assumed that 80% of the positions will be filled by local people.
- The annual revenue generated by the plant could amount to up to R50 million. Furthermore, it is expected that 43 jobs per annum will be created at the plant.

Table 8-1: Summary of impact assessment

Impact	Nature	Pre-mitigation significance	Post-mitigation significance
Construction phase			
Temporary increase in production	Positive	+64(high)	+64 (high)
Temporary increase in GDP	Positive	+48 (medium)	+48 (medium)
Temporary increase in employment	Positive	+48 (medium)	+48 (medium)
Impact on skills development	Positive	+42 (medium)	+45 (medium)
Temporary increase in household income	Positive	+48 (medium)	+48 (medium)
Increase in government revenue	Positive	+17 (low)	+17 (low)
Impact on balance of payment	Negative	-13 (low)	-12 (low)
Sterilisation of agricultural land	Negative	-15 (low)	-15 (low)
Increased pressure on basic services	Negative	-12 (low)	-12 (low)
Increase in social pathologies	Negative	-13 (low)	-12 (low)
Operational phase			
Sustainable increase in production	Positive	+36 (medium)	+36 (medium)
Sustainable increase in GDP	Positive	+36 (medium)	+36 (medium)
Impact on employment	Positive	+16 (low)	+16 (low)
Impact on skills development	Positive	+32 (medium)	+32 (medium)
Increase in household income	Positive	+18 (low)	+19 (low)
Increase in government revenue	Positive	+19 (low)	+19 (low)
Investment in local communities	Positive	+34 (medium)	+34 (medium)
Impact on sense of place	Negative	-13 (low)	-13 (low)

It is clear from the impact assessment that the proposed solar PV facility will have a significant positive effect on the national economy in terms of stimulation of domestic production, job creation, government

revenue, and export earnings. The project has the ability to increase the size of the local economy by about 5%, and reduce local unemployment. Furthermore, the project falls within the developmental priorities of the local municipality that have identified the promotion of the renewable energy sector as one of the means to reverse the current trends of decline and lack in diversity of the economy and alleviate electricity shortages. Based on the above, it can be safely concluded that the proposed project will be highly beneficial for the national economy and local communities. From a socio-economic perspective, it should be approved for development.

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**Appendix 7:
A3 Maps**



Appendix 8: Environmental Management Programme (EMPr)



BIO THERM ENERGY

**Proposed Construction of the
Helena 3 75MW Solar Photovoltaic
(PV) Energy Facility near
Copperton, Northern Cape Province**


**Draft Environmental Management
Programme**

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Signature:	
For:	SiVEST Environmental Division

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BIO THERM ENERGY

PROPOSED CONSTRUCTION OF THE HELENA 3 75MW PHOTOVOLTAIC (PV) ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

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Glossary of Terms:

Construction Phase: The activities pertaining to the preparation for and the physical construction of the proposed development.

Contractor: Persons/organisations contracted by BioTherm to carry out parts of the work for the proposed development.

Decommissioning: Means to take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily recommissioned.

Engineer (E)/ Project Manager (PM): Person/ organisation appointed by BioTherm to oversee the work of all consultants, sub-developers, contractors, residents and visitors.

Environmental Control Officer (ECO): Person/organisation appointed by BioTherm who will provide direction to the Project Manager concerning the activities within the Construction Zone, and who will be responsible for conducting the environmental audit of the project during the construction phase of the project according to the provisions of the Environmental Management Programme.

Environmental Management Programme (EMPr): The EMPr is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMP contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPr specifies how the construction of the project is to be carried out and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle.

Operational Phase (Post Construction): The period following the Construction Phase, during which the proposed development will be operational.

Pre-Construction Phase: The period prior to commencement of the Construction Phase, during which various activities associated with the preparation for the Construction Phase will be undertaken.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was in before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement re-vegetation of a disturbed area and the insurance of a stable land surface. Re-vegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Site Manager: The person, representing the Contractor, responsible for all the Contractor's activities on the site including supervision of the construction staff and activities associated with the Construction Phase. The Site Manager will liaise with the Project Manager in order to ensure that the project is conducted in accordance with the Environmental Management Programme

Abbreviations:

DEA	Department of Environmental Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EO	Environmental Officer
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
HOD	Head of Department
IFC	International Finance Corporation (World Bank Group)
I&APs	Interested and Affected Parties
MC	Main Contractor
MSDS	Material Safety Data Sheets
NEMA	National Environmental Management Act
OECD	Organisation for Economic Co-operation and Development
PM	Project Manager
SAHRA	South African Heritage Resources Agency

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE HELENA 3 75MW PHOTOVOLTAIC (PV) ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

1 INTRODUCTION

BioTherm Energy (Pty) Ltd (hereafter referred to as BioTherm) has appointed SiVEST to undertake the Environmental Impact Assessment (EIA) process and Environmental Management Programme (EMPr) for the proposed construction of the Helena 3 75MW solar photovoltaic (PV) energy facility near Copperton, Northern Cape Province. The objective of the project is to develop a solar PV energy facility in order to generate electricity to feed into the national grid. The project is also in line with the government's commitment to provide renewable energy as an alternative energy source to those currently utilised.

This EMPr has been compiled in line with the recommendations in the above-mentioned EIA, as well as from issues identified by SiVEST Environmental Division. More details will be provided by the contractors and engineers once the detailed design has been completed.

1.1 Details of the EAP

As per the requirements of the NEMA (2010), the details and level of expertise of the persons who prepared the EMPr are provided in Table 1 below.

Table 1: Consultant Team

Environmental Project Manager	SiVEST (Pty) Ltd – Rebecca Thomas
Contact Details	rebeccat@sivest.co.za
Qualifications	Bachelor of Science (Environmental Science): University of Witwatersrand, 2002, Postgraduate Diploma in Business Management (PDM): Wits Business School, 2011, GIBB's Project Leadership Programme, 2010
Expertise to carry out the EMPr	Rebecca is an Environmental Scientist with 11 years experience. She specialises in the overall management and compilation of Environmental Impact Assessments (EIAs) and Environmental Management Programmes

(EMPs) primarily related to energy generation and electrical transmission projects. She furthermore has been involved in undertaking and managing Public Participation Processes, Consultation, Environmental Scans and Fatal Flaw / Feasibility Studies and independent review of environmental projects. Some of the projects she has worked on recently include EIAs for the proposed 300 MW Caledon Wind Farm, proposed 30 MW Wind Farm at St. Helena Bay and the Bantamsklip 400 kV Transmission Power Lines all within the Western Cape Province. She was also recently appointed as one of the advisors in strategic environmental matters for ACSA. Rebecca has also completed a Post Graduate Diploma in Business Management (PDM), with the aim of bringing business and project management skills to her projects and division as a whole. From a business administration side, Rebecca is keenly involved in the financial performance, workload and resource planning, quality management and proposal administration for the Johannesburg Environmental Division.

Environmental Impact Assessments and Environmental Management Programmes:

- Moloto Development Corridor (MDC) Project, between the City of Tshwane Local municipality in Gauteng Province and Groblersdal, Limpopo Province, traversing Mpumalanga Province.
- Environmental Management Compliance for the Integrated Rapid Transit project for Polokwane Municipality.
- Thyspunt Transmission Lines Integration Project (TTLIP) for a conventional nuclear power station and associated infrastructure at the Thyspunt site in the Western Cape.
- Proposed 150 MW Renosterberg Wind Energy Company (RWEC) Wind Farm and 75 MW Solar Photovoltaic (PV) Plant, Northern Cape Province.
- Basic Assessment (BA) processes for the proposed construction of 132 kV power lines required to connect the Droogfontein 2 and Droogfontein 3 PV Plants to the National Electricity Grid.
- Eastside Junction Mixed Use Development near Delmas, Mpumalanga Province
- South African Nuclear Energy Corporation (Necsa) Dedicated Isotope Production Reactor (DIPR) at the Pelindaba Site near Hartebeespoort in the North West Province.
- Medupi Power Station in Lephalale, Limpopo Province.
- 25 MW Community Wind Farm in St Helena Bay, Western Cape Province.

	<ul style="list-style-type: none"> ▪ 300 MW Caledon Wind Farm, Western Cape Province. ▪ PRASA Rail Upgrade Project – Maintenance Depots and Staging Yards – 21 sites across Gauteng, Western Cape and KwaZulu Natal Provinces. ▪ ACSA OR Tambo International Airport Midfield Development Project. ▪ Transmission lines (Bantamsklip – Kappa 765 kV and Bantamsklip – Bacchus, Bacchus - Kappa and Bacchus – Muldersvlei 400 kV) for a conventional nuclear power station and associated infrastructure at the Bantamsklip site in the Western Cape (Nuclear 1). ▪ Watershed Mmabatho 132 kV transmission line, North West Province. ▪ Mulilo Coal Fired Power Station and associated transmission lines near Musina, Limpopo Province. ▪ Mmamantswe Coal Fired Power Station, associated transmission lines and coal mine, Kgatleng District, Botswana. ▪ Upgrade of the Metal Recovery Crushing and Screening Plant at the ArcelorMittal Vanderbijlpark Works, Gauteng Province. ▪ proposed extension of the hydra substation and the proposed construction of a new 765 kV transmission power line between the Hydra and Gamma Substations, Northern Cape Province. ▪ Proposed Mercury – Garona 400 kV transmission power line, traversing the Free State, North West and Northern Cape Province. ▪ Atlantis OCGT Power Station and associated 400 kV power lines, Western Cape Province. ▪ 132 kV sub transmission line from Mayfern Traction Substation to Delta Substation in Nelspruit, Mpumalanga Province. ▪ Proposed 132 kV sub transmission line between Witkloof Substation and the proposed new Thuli Substation, Carolina, Mpumalanga Province. ▪ Proposed 132 kV sub transmission line from Kabokweni Substation to the proposed new Hlau Hlau Substation, Mpumalanga Province. ▪ Proposed 132 kV sub transmission line from Kiepersol Substation to Hazyview Traction Substation and upgrading of Kiepersol Substation, Mpumalanga Province. ▪ Proposed 132 kV sub transmission lines and proposed new substation to Zandfontein, Mpumalanga Province. ▪ Orange Farm Roads Upgrade Project, Gauteng Province. ▪ Driezek Housing Upgrade Project, Gauteng Province. ▪ Proposed Phase 1 and 2 developments of the Gardner Ross Golf and Country Estate project, integrating the current Environmental Management Plan in place for phase 1.
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Environmental Assessment Practitioner	SiVEST (Pty) Ltd – Andrea Gibb
Contact Details	andrag@sivest.co.za
Qualifications	BSc (Hons) Environmental Management (University of South Africa 2008-2010), BSc Landscape Architecture (with distinction) (University of Pretoria 2004-2007), ArcGIS Desktop 1 (ESRI South Africa December 2010)
Expertise to carry out the EMPr	<p>Andrea joined SiVEST in August 2010 and holds the position of Environmental Practitioner in the Johannesburg Office. She has 7 years' work experience and specialises in undertaking and managing Environmental Impact Assessments (EIAs) and Basic Assessment (BAs), primarily related to energy generation and electrical distribution projects. She also specialises in undertaking visual impact and landscape assessments, by making use of ArcGIS technology and field surveys. She has extensive experience in overseeing public participation and stakeholder engagement processes and has been involved in environmental baseline assessments, fatal flaw / feasibility assessments and environmental negative mapping / sensitivity analyses. From a business and administrative side, Andrea is actively involved in maintaining good client relationships, mentoring junior staff and maintaining financial performance of the projects she leads.</p> <p>Environmental Impact Assessments and Environmental Management Programmes:</p> <ul style="list-style-type: none"> ▪ EIA for the proposed construction of a 75MW Solar Photovoltaic (PV) Power Plant near Dennilton, Limpopo Province. ▪ EIA for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province. ▪ BA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province. ▪ BA for the proposed construction of two 132kV power lines and associated infrastructure from Silverstreams DS to the Olien MTS near Lime Acres, Northern Cape Province. ▪ BA for the proposed Construction of the SSS1 5MW Solar Photovoltaic (PV) Plant on the Western Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province. ▪ BA for the proposed Construction of the SSS2 5MW Solar Photovoltaic (PV) Plant on the Eastern Part of Portion 6 (Portion of

	<p>Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province.</p> <ul style="list-style-type: none"> ▪ BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the proposed Bophirima Substation to the existing Schweizer-Reneke Substation, North West Province. ▪ BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the Mookodi Substation to the existing Magopela Substation, North West Province. ▪ BA for the proposed Mookodi Integration Phase 2: Proposed Construction of the Mookodi - Ganyesa 132kV power line, proposed Ganyesa Substation and Havelock LILO, North West Province. ▪ Amendment of the Final Environmental Impact Report for the Proposed Mookodi 1 Integration Project near Vryburg, North West Province. ▪ BA for the proposed 132kV power line and associated infrastructure for the proposed Redstone Solar Thermal Energy Plant near Lime Acres, Northern Cape Province. ▪ BA for the proposed construction of a 132kV power line and substation associated with the 75MW Photovoltaic (PV) Plant on the Farm Droogfontein (PV 3) in Kimberley, Northern Cape Province. ▪ BA for the proposed establishment of a Learning and Development Retreat and an Executive Staff and Client Lodge at Mogale's Gate, Gauteng Province. ▪ Amendment application in order to increase the output of the proposed 40MW PV Facility on the farm Mierdam to 75MW, Northern Cape Province. ▪ BA for the proposed construction of a power line and substation near Postmasburg, Northern Cape Province. ▪ BA for the proposed West Rand Strengthening Project – 400kV double circuit power line and substation extension in the West Rand, Gauteng. ▪ EIA for the proposed construction of a wind farm and PV plant near Prieska, Northern Cape Province. ▪ Public Participation assistance as part of the EIA for the proposed Thyspunt Transmission Lines Integration Project – EIA for the proposed construction of 5 x 400kV transmission power lines between Thyspunt to Port Elizabeth, Eastern Cape Province. ▪ EIA assistance for the proposed construction of three Solar Power Plants in the Northern Cape Province.
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	<ul style="list-style-type: none"> ▪ Public Participation as part of the EIA for the proposed Delareyville Kopela Power Line and Substation, North West Province. ▪ Public Participation as part of the EIA for the Middelburg Water Reclamation Project, Mpumalanga Province.
Junior Environmental Consultant	SiVEST (Pty) Ltd – Lynsey Rimbault
Contact Details	lynseyr@sivest.co.za
Qualifications	MSc Biodiversity, Conservation and Management (University of Oxford 2012-2013), BSc (Hons) Geography (University of the Witwatersrand 2011), BA Geography and English (University of the Witwatersrand 2008-2010)
Expertise to carry out the EMPr	<p>Lynsey joined SiVEST in August 2014 and holds the position of Environmental Consultant in the Johannesburg Office. She has 1 year of work experience and is specialising in the management and compilation of Environmental Impact Assessments (EIAs) and Basic Assessment (BAs) primarily related to energy generation and electrical distribution projects.</p> <p>Lynsey has worked previously for Kulima Integrated Development Solutions conducting research for a NEPAD project on Agricultural Adaptations to Climate Change. This involved four different farming sectors in four different provinces of South Africa. Prior to this Lynsey worked at Rayten Engineering Solutions in the field of air quality consulting, primarily in the mining sector.</p> <p>Environmental Impact Assessments and Environmental Management Programmes:</p> <ul style="list-style-type: none"> ▪ Basic Assessment for the Ermelo-Richards Bay Coal Line Upgrade Project: Proposed development of the Madlanzini Main Transmission Station and Associated 88kV and 400kV turn in power lines, Mpumalanga Province. ▪ Environmental Impact Assessment for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province. ▪ Basic Assessment for the proposed Construction of the Mookodi Integration Phase 2 132kV Power Line from the Mookodi MTS to the new proposed Ganyesa Substation, North West Province. ▪ Environmental Impact Assessment for the proposed construction of the Nokukhanya Solar Photovoltaic Power Plant near Dennilton, Limpopo Province.

1.2 Site Locality and Description

1.2.1 Regional Locality

The site is located approximately 10km south of Copperton, and 60km south-west of Prieska, and 280km south-west of Kimberley. Copperton is an abandoned town which previously serviced a mine that has subsequently closed. The proposed solar PV energy facility will be accessed by the R357 which transects the site. (Figure 1). The site is located within the Siyathemba Local Municipality of the greater Pixley ka Seme District Municipality.

The site that is proposed for the Helena 3 Solar PV energy facility near Copperton is located on the following farms:

- Portion 3 of Klipgats Pan No 117 (solar PV energy facility); and
- Portion 4 of Klipgats Pan No 117 (power lines).

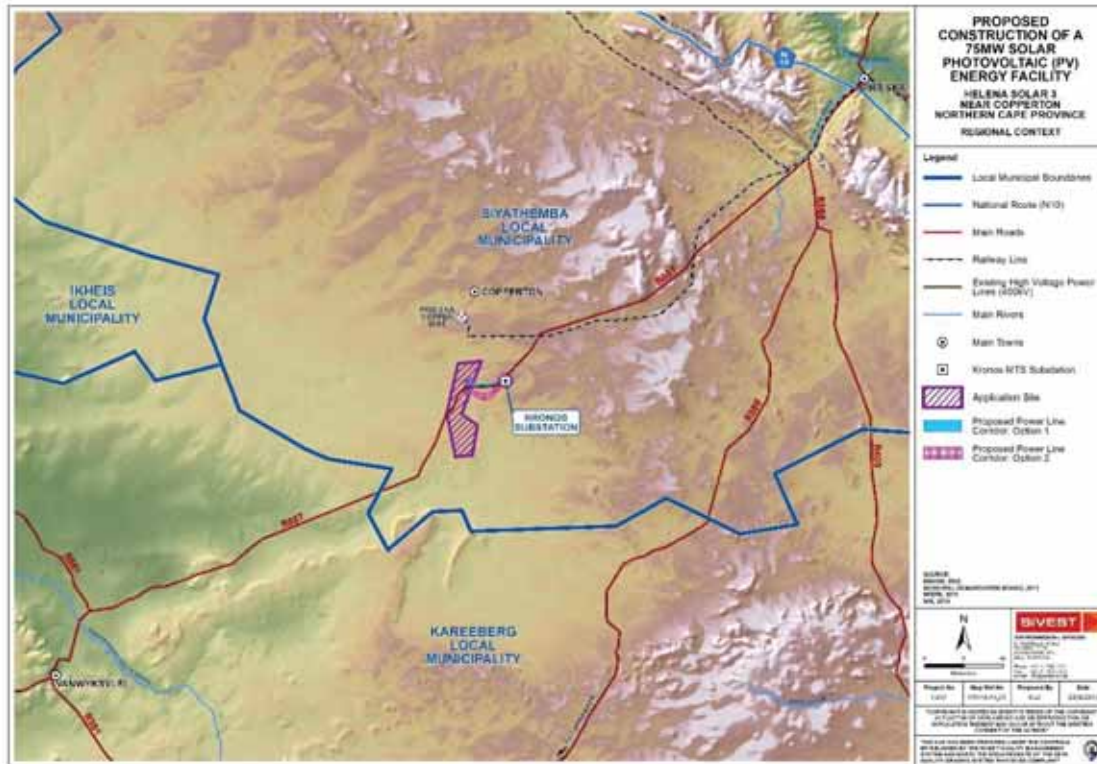


Figure 1: Site locality map

1.2.2 Study Site Description

The prevailing land use in the wider study area is classified as undeveloped low shrubland. The highly arid nature of the area's climate, has resulted in livestock rearing (of sheep) dominating within the area. As such, the typical low, woody shrub, karoo-type communities have been retained across the vast majority of the study area, as sheep graze on natural vegetation.

The nature of the climate and corresponding land use has also resulted in low stocking densities and relatively large farm properties across the area. Therefore the area is very sparsely populated, and little human-related infrastructure exists.

Built form is limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines, windmills, fences, the remnants of old workers' dwellings and derelict mining infrastructure including a mine dump and slimes dam.

The topography within and in the immediate vicinity of the proposed application site is characterised by a flat to gently undulating landscape (typical of much of the Karoo), that gently slopes down in a south-westerly direction. A slight variation in form can be seen to the north of the site where an old slimes dam is still present.

The topography in the wider area is characterised by a mix of very flat plains, as well as areas of slightly more undulating relief, including some low ridges and a number of isolated low koppies. A low mountain range also marks a change in topography; the Doringberge form a line of hills to the north-east of the site.

The site falls within the Nama-Karoo Biome and two vegetation types occur within the proposed project site. These are Bushmanland Basin Shrubland and Bushmanland Vloere. Bushmanland Basin Shrubland occurs in the Northern Cape Province on slightly irregular plains. The vegetation is a dwarf shrubland dominated by a mixture of low sturdy, spiny and sometimes succulent shrubs (*Rhigozum*, *Salsola*, *Pentzia* and *Erioccephalus*), white grasses and, in years of high rainfall, abundant annuals, such as *Gazania* and *Leysera*. Bushmanland Vloere is the vegetation of the salt pans and broad riverbeds of the central Bushmanland basin. It occurs in areas of flat and very even surfaces of pans and broad bottoms of intermittent dry rivers. Typically, the central parts are devoid of vegetation. Around this is loosely patterned scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, with a mixture of karroid dwarf shrubs. In places loose thickets of *Parkinsonia africana*, *Lebeckia linearifolia* and *Acacia karroo* may be found.

1.2.3 Climate

The climate of the study area (Monnik & Malherbe, 2005) can be regarded as warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 198 mm, of which 138 mm, or 69%, falls from November to April. Rainfall is erratic, both locally and

seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is over 2 100 mm per year, peaking at over 8.5 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 31.6°C and 11.8°C for January to 15.9°C and 1.0°C for July respectively. The extreme high temperature that has been recorded is over 42°C and the extreme low –10.0°C. Frost occurs most years on 30-40 days on average between early May and mid-September.

1.3 Overview of the proposed project

The proposed project will encompass the installation of a solar PV field and associated components, in order to generate electricity that is to be fed into the Eskom grid. The facility will have a maximum export capacity of 75MW. The total development area of the site for the proposed Helena 3 facility is 527 ha and each substation assessment site comprises of approximately 3 ha. The substation will occupy a footprint area of 2.25 ha. The Helena 3 PV array layout will require approximately 190 ha. The laydown area will require an area of 5.5 ha. The final design details are yet to be confirmed and will become available during the detailed design phase of Helena 3. The final preferred layout, including the identified environmentally sensitive areas, is presented in Figure 2 below.

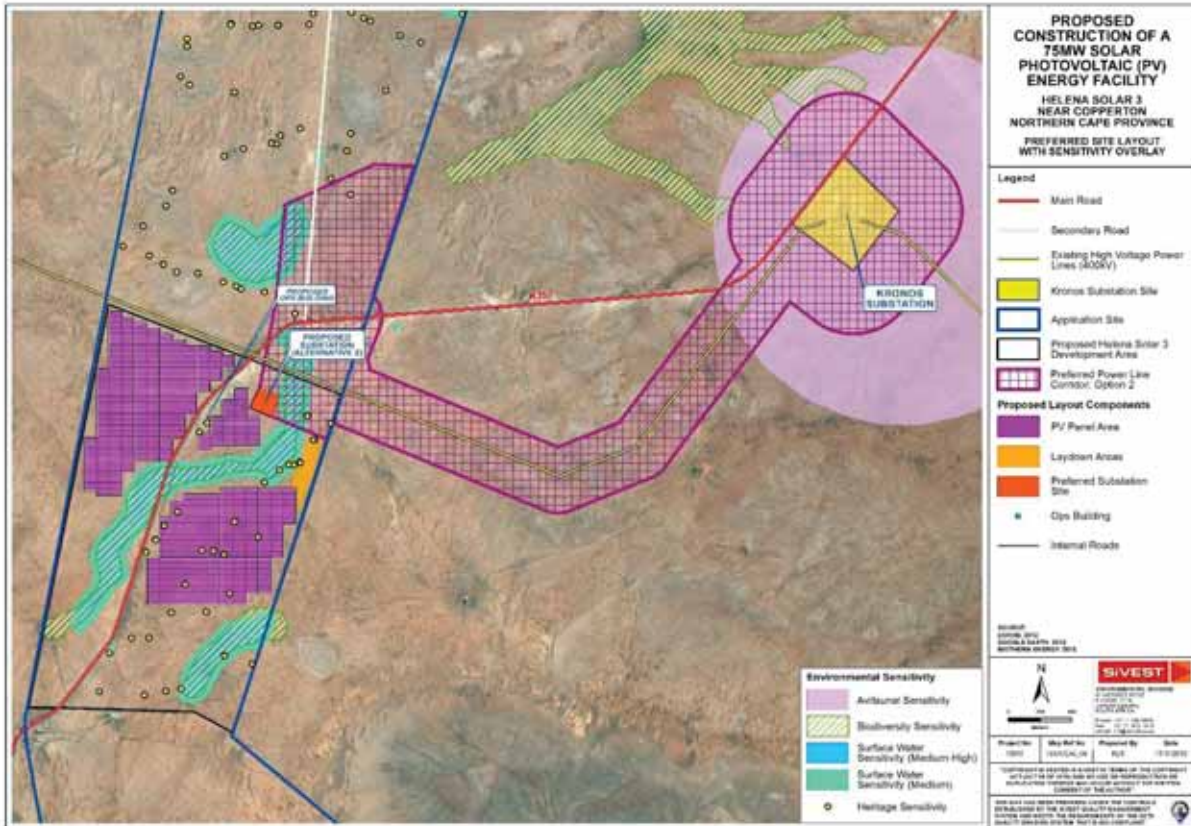


Figure 2: Final preferred layout showing sensitive areas

The generated electricity will be fed into the national distribution network at Kronos Substation via a 132kV power line with a length of approximately 7km. The objective of the solar project is to generate electricity to feed into the national grid.

The key technical details and infrastructure required is presented in the table below (Table 2).

Table 2: Helena Solar 3 summary

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for each phase
Helena Solar 3	14/12/16/3/3/2/767	Portion 3 of Klipgats Pan No 117 (PV site) and Portion 4 of Klipgats Pan No 117 (power lines)	<ul style="list-style-type: none"> Approximately 275 000 solar PV panels with a total export capacity of 75MW; Panels will be either fixed axis mounting or single axis tracking solutions, and will be either crystalline silicon or thin film technology;

		<p>Development Area: 527 ha</p>	<ul style="list-style-type: none"> ▪ Onsite switching station, with the transformers for voltage step up from medium voltage to high voltage; ▪ The panels will be connected in strings to inverters, approximately 43 inverter stations will be required throughout the site. Inverter stations will house 2 x 1MW inverters and 1 x 2MVA transformers; ▪ DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22 or 33kV (medium voltage) in the transformers. ▪ The 22 or 33kV cables will be run underground in the facility to a common point, unless there are environmental or technical concerns that result in the need for an overhead line, before being fed to the onsite substation where the voltage will typically be stepped up to 132kV. ▪ Grid connection is to the Kronos substation. A power line with a voltage of 132kV is proposed and will run from the onsite substation to the Eskom Kronos substation. The distance will be about 5km. The final grid connection voltage will be below 275kV. ▪ A laydown area for the temporary storage of materials during the construction activities; ▪ Access roads and internal roads; ▪ Construction of a car park and fencing around Helena 3; and ▪ Administration, control and warehouse buildings
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This proposed PV energy facility forms one of three PV energy facilities with a 75MW export capacity that BioTherm are proposing to develop on Portion 3 of the farm Klipgats Pan No 117. In order to accommodate the Department of Energy's (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa each PV energy facility will be developed under a separate

Special Purpose Vehicle (SPV) and therefore each requires a separate Environmental Authorisation. However, the possibility to allow shared associated infrastructure will be considered.

The key components of the project are detailed below.

1.3.1 *Solar Field*

Solar PV panels are usually arranged in rows or 'arrays' consisting of a number of PV panels. The area required for the PV panel arrays will likely need to be entirely cleared or graded. Where tall vegetation is present, this vegetation will be removed from the PV array area.

Approximately 275 000 solar PV panels will be required for the project for a total export capacity of 75MW. Support structures will be either fixed axis mounting or single axis tracking solutions and the modules will be either crystalline silicon or thin film technology. The solar PV panels are variable in size, and are affected by advances in technology between project inception and project realisation. The actual size of the PV panels to be used will be determined in the final design stages of Helena 3. The PV panels are mounted onto metal frames which are usually aluminium. For foundations, concrete footings or rammed piles are commonly used to support the panel arrays (Figure 3).

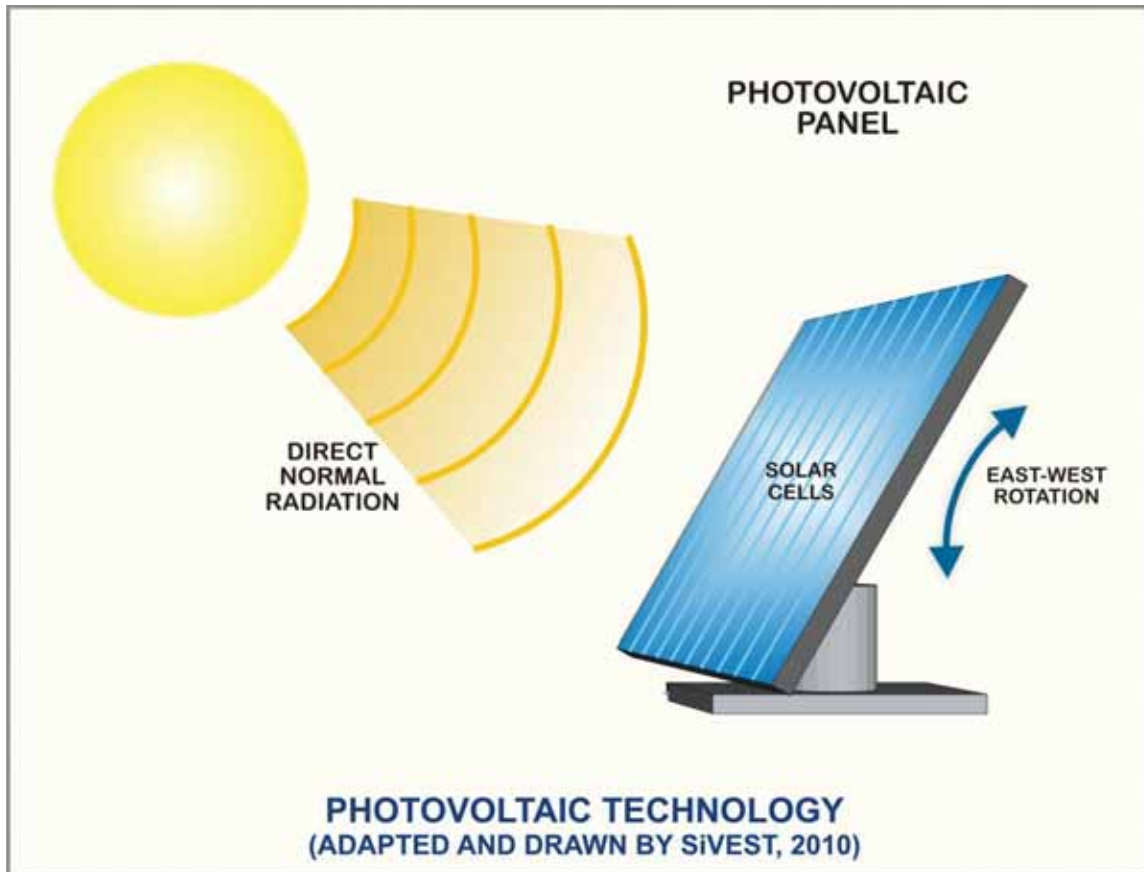


Figure 3: Example of a Photovoltaic Panel with tracking capability.

1.3.2 Electrical Infrastructure

The solar PV panel arrays are connected to each other in strings, which are in turn connected to inverters. For a 75MW size facility, typically 2MW inverter stations which are containerised stations housing 2x1MW inverters and 1x2MVA transformers will be used; therefore approximately 43 inverter stations will be required throughout the site for the proposed solar PV energy facility (Figure 4). DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22 or 33kV (medium voltage) in the transformers. The 22 or 33kV cables will be run underground in the facility, unless there are environmental or technical concerns that result in the need for an overhead line, to a common point before being fed to the onsite substation and switching station where the voltage will typically be stepped up to 132kV. A Power line with a voltage of up to 132kV will run from the onsite substation to the existing Kronos substation. The distance will be about 5km.

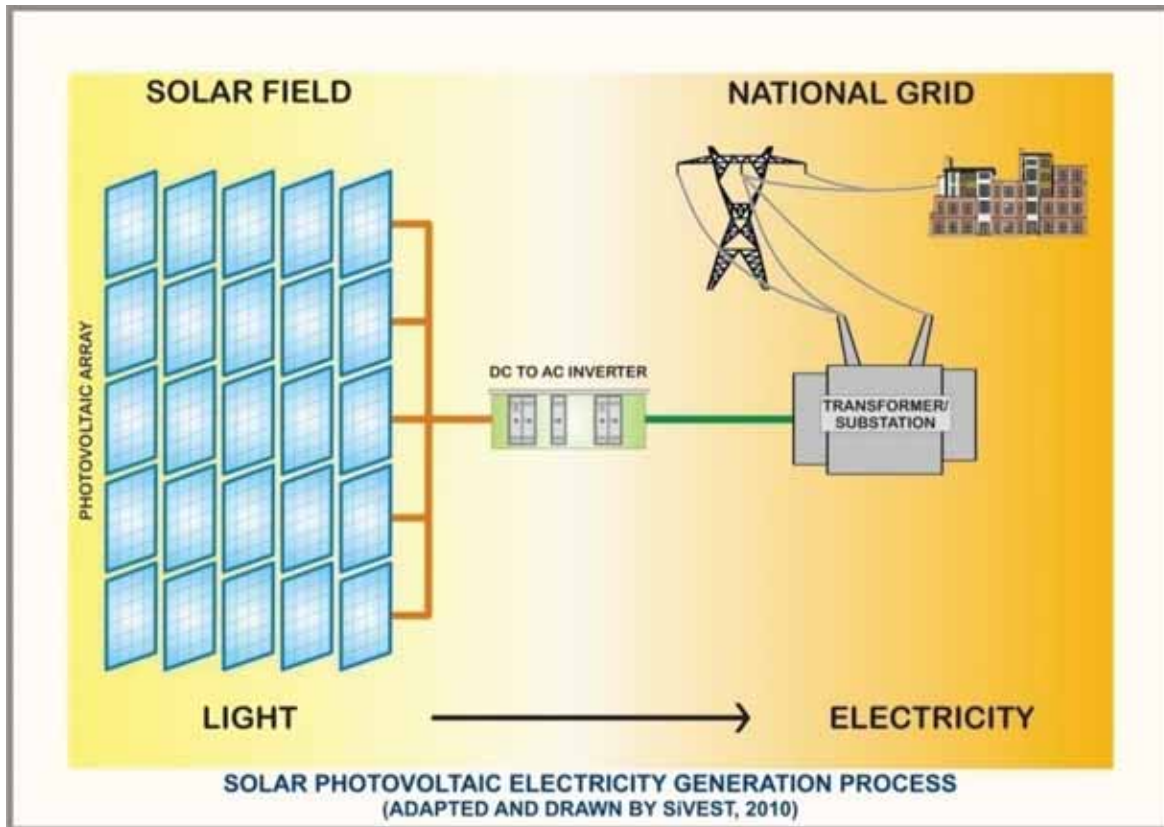


Figure 4: PV process

1.3.3 Buildings

The solar field will require onsite buildings which will be used in the daily operation of the energy facility and includes an administration building (office). The location for the administration building was determined during the EIA process based on environmental constraints identified and design factors that need to be considered. The footprint of the buildings will be approximately 225m². The buildings will likely be single storey buildings which will be required to accommodate the following:

- Control room
- Workshop
- High Voltage (HV) switchgear
- Mess Room
- Toilets
- Warehouse for storage

1.3.4 Construction Lay-down Area

A general construction lay-down area will be required for the construction phase of the proposed solar PV energy facility. The size of this area is approximately 5.5 hectares. The location of the construction lay-

down area was determined during the EIA process based on environmental constraints identified and design factors that need to be considered.

1.3.5 *Other Associated Infrastructure*

Other associated infrastructure includes the following:

- Access roads and internal roads;
- A car park; and
- Fencing around Helena 3.

1.4 Alternatives

As per Chapter 1 of the EIA regulations (2010), feasible and reasonable alternatives are required to be considered during the EIA process. Alternatives are defined as “different means of meeting the general purpose and requirements of the activity” These alternatives may include:

- (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.

Each of these alternatives is discussed in relation to the proposed project in the sections below.

1.4.1 *The property on which or location where it is proposed to undertake the activity*

The placement of solar PV installations is dependent on several factors, all of which are favourable at the proposed site location. These include solar resource, climate, topography, grid connections and access to the site. Prior to site selection a site screening process was undertaken by BioTherm, the entire area around Copperton was assessed due to a high solar resource potential, and grid availability for the PV facility. The assessment included pre-feasibility studies conducted by BioTherm including an estimation of the solar energy resource as well as weather, dust, dirt, and surface albedo. Grid connection and land availability were also important initial considerations. Based on the solar resource, grid connection location, topography, available land, and competition, the farm Klipgats was selected as the preferred site. On the farm Klipgats, the southern or northern portions were comparatively assessed as potential sites for the facility. On a high level screening it was decided that the southern portion of the farm had higher environmental sensitivities as it is located further from the grid. The project site has highly advantageous grid connection potential,

with the existing Eskom Kronos substation approximately 4km to the north-east. The site is also easily accessible as the R357 transects the farm. Hence it was decided that the northern portion of the farm would be most suitable. Following the site selection screening process the EIA was initiated on the environmentally preferred northern site. The site is therefore considered highly suitable for the proposed development and no other locations are being considered during the EIA.

1.4.2 *The type of activity to be undertaken*

Renewable energy development in South Africa is highly desirable from a social, environmental and development point of view. Prior to project initiation BioTherm considered various renewable energy sources for the development. Wind energy installations were found not to be feasible on the site as there is not enough of a wind resource. Concentrated solar power (CSP) installations are also not feasible because they have a high water requirement and the project site is located in an arid area. Solar PV is therefore the preferred activity being considered for the proposed site. No other activity alternatives are being considered during the EIA.

1.4.3 *The design or layout of the activity*

Design or layout alternatives are being considered in the EIA process. Various environmental specialists assessed the site during the scoping phase. Their assessments encompassed the entire proposed development site and included the identification of sensitive areas. These sensitive areas were used during the scoping phase to guide layout design for the proposed solar PV energy facility (**Error! Reference source not found.**). These layouts have been extensively investigated in the EIA phase of the project. The design and layout alternatives included; power line routes, internal roads and alternative locations for the substation. The layout alternatives were based on both environmental constraints and design factors.

The alternatives took the sensitive areas identified by the specialists in the Scoping phase into account and these were precluded from the buildable areas. Sensitivity maps were compiled based on the negative mapping / sensitivity assessment exercise that was undertaken by all the specialists.

Due to the elimination of all sensitive areas from the potential buildable area, the proposed layouts were severely constrained in terms of the area available. It was therefore not possible to have two layout alternatives for the PV array area, however the two substation alternatives were positioned as far apart as possible and the two power line alternatives follow entirely different routes. Identifying two relatively similar layouts that are both environmentally feasible was considered more beneficial to the EIA process than only considering one alternative against the option of not implanting the activity or no-go alternative.

1.4.1 The technology to be used in the activity

There are very few technological alternatives for PV technology. For the Helena 3 solar energy facility the mounting structures will be either fixed axis mounting or single axis tracking solutions, and the modules will be either crystalline silicon or thin film technology. The impacts on the environment of the different types of PV technology are the same during construction, operation and decommissioning. Therefore no technology alternatives will be considered during the EIA. The choice of technology used will ultimately be determined by technological and economic factors at a later stage.

1.4.2 The operational aspects of the activity

No operational alternatives were assessed in the EIA, as none are available for solar PV installations.

1.4.3 The option of not implementing the activity

The option of not implementing the activity, or **the 'no-go' alternative, is considered in the EIA**. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although solar power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed solar PV energy facility would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project could contribute to addressing the problem. Additionally, the project will uplift the community in terms of job creation and local investment into the area, not implementing the activity would remove this positive impact. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

1.5 Specific Conditions Pertaining to Authorisations

Should the Department of Environmental Affairs (DEA) issue an Environmental Authorisation (EA), this EMPr will be updated to include all the pre-construction, construction, operation and decommissioning conditions stipulated in the EA.

Specific conditions pertaining to regulatory processes, or Licensee / Holder of the Authorisation requirements, have not been included within the EMPr. These conditions are to be undertaken by the Licensee / Holder of the Authorisation prior to the commencement of construction related activities.

1.6 Project Responsibilities

The roles and responsibilities of all the key role players involved in the EMPr are represented below.

1.6.1 *The Project Company*

The Project Company (BioTherm Energy) will be responsible for the overall control of the project site in environmental terms during the pre-construction, construction, operation, decommissioning and rehabilitation phases of the proposed project. These responsibilities include the following:

- Appointing an independent ECO for the duration of the Contract and notify the DEA of their contact details;
- Being fully familiar with the EIA Report, EA conditions and the EMPr;
- Notifying the DEA of changes in the developments that result in significant environmental impacts;
- Notifying the DEA within 30 days of change of ownership;
- Notifying the DEA of any change of address of the owner/Project Company;
- The overall implementation of the EMPr;
- Ensuring compliance, by all parties, and the imposition of penalties for noncompliance
- Implementing corrective and preventive actions, where required;
- Preventing pollution and actions that will harm or may cause harm to the environment;
- Ensuring the activity does not commence within 30 days of the EA being issued;
- Notifying the DEA within 30 days that construction activity will commence;
- Notifying the DEA in writing within 24 hours if any condition in the EA cannot be or is not adhered to; and
- Notifying the DEA 14 days prior to commencement of the operational phase.

1.6.2 *Construction Team*

Several professionals will form part of the construction team. The most important from an environmental perspective are the Project Manager (PM), the Contractor Project Manager (CPM), the Main Contractor (MC), the Environmental Control Officer (ECO), the Environmental Officer (EO) and the Social Officer (SO).

The PM is responsible for the implementation of the EMPr on the site during the pre-construction and construction phases of the project.

The CPM is responsible for the establishment and management of contracts for the Main Contractor and the Sub-contractors.

The MC is responsible for abiding by the mitigation measures of the EMPr which are implemented by the Project Manager during the construction phase.

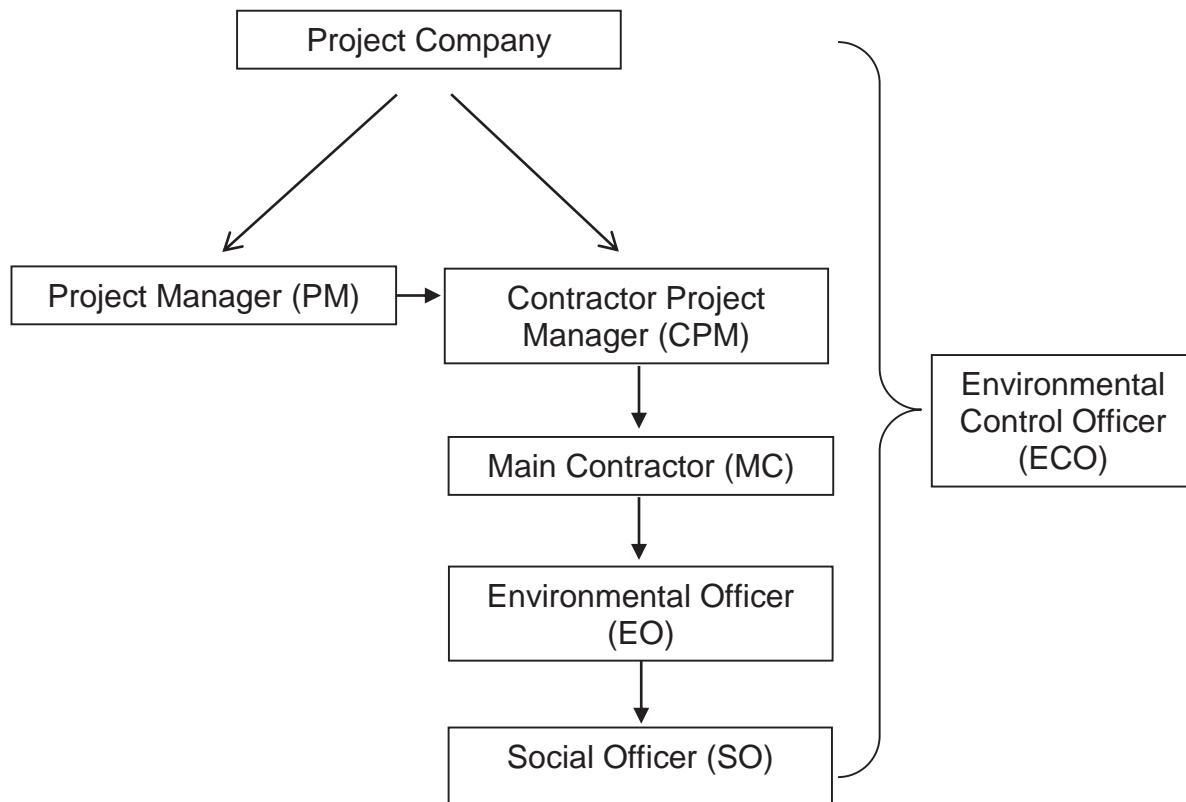
The MC is also responsible for the implementation of the EMPr during the operational and decommissioning phases of the project. However, it must be noted that the MC may change for each phase of the project. The EMPr will therefore be applicable to the relevant MC appointed for each phase of the project.

The ECO is responsible for monitoring the implementation of the EMPr during the design, pre-construction and construction phases of the project.

The EO is responsible for managing the daily onsite implementation of the EMPr.

The SO is responsible for managing the daily on-site implementation of the social aspects of the EMPr.

Basic Organogram:



1.6.3 Project Manager

The PM is responsible for overall construction management of the project as well as the implementation of the EMPr. The following tasks will fall within his / her responsibilities:

- Be aware of the findings and conclusions of the Environmental Impact Assessment and the conditions stated within the Environmental Authorisation;
- Be familiar with the recommendations and mitigation measures of this EMPr, and implement these measures;
- Monitor site activities on a daily basis for compliance;
- Confine the construction site to the demarcated area; and
- Rectify transgressions through the implementation of corrective action.

The Project Manager will assume ultimate responsibility. However, the abovementioned tasks can be delegated to the on-site manager for daily management.

1.6.4 Contractor Project Manager

The CPM will undertake overall project contracts management between of the Main Contractor and the appointed Sub-Contractors. The following tasks will fall within his / her responsibilities:

- Responsible for establishing contractual agreements with the Main Contractor and Sub-Contractors, and ensuring that sub-contractors adhere to the EMPr;
- One of the key contracts will be for the supply, transport, erection and commissioning of the Solar Panel Arrays.

1.6.5 Main Contractor

The MC is responsible for the implementation and compliance with recommendations and conditions set out in the EMPr. This requires that the MC be familiar with the EIA report, EA conditions and the EMPr. This encompasses the following activities:

- Ensuring compliance with the EMPr at all times during construction;
 - Ensuring that all subcontractors have a copy of and understand the contents of the EMPr, to ensure environmental best practice.
- Preventing pollution and avoid actions that will impact or harm the surrounding environment;
- Responsible for the construction activities to be carried out for the duration of the project (will subcontractors and contract workers);
- Implementing corrective and preventive actions, where required;
- Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
 - Public involvement / complaints;

- Health and safety incidents;
- Hazardous materials stored on site; and
- Non-compliance incidents.
- Development of specific method statements prior to commencement of environmentally sensitive constructions activities as identified in the EMPr.

1.6.6 *Environmental Control Officer*

The ECO is responsible for the implementation of the EMPr during the construction phase and liaison between the Contractor and the Landowners. The ECO should have a minimum of two years of relevant experience as well as a relevant environmental degree or relevant tertiary qualification. The ECO is also to be an independent party. The ECO will liaise and report to the Contractor and authorities, thus the ECO should have effective communication and negotiating skills. The following tasks will fall within his / her responsibilities:

- Be aware of the findings and conclusions of the Environmental Impact Assessment and the conditions stated within the environmental authorisation.
- Work with the construction team to review relevant risk/ method statements from an environmental perspective;
- Be familiar with the recommendations and mitigation measures of this EMPr;
- Conduct monthly audits of the construction site according to the EMPr and EA. A monthly report will be produced detailing the findings of the audit highlighting any non-compliance issues. Positive compliance with the EMPr will also be noted;
- Educate the construction team about the management measures of the EMPr and EA.
- Regular liaison with the construction team and the project leader;
- Recommend corrective action for any environmental non-compliance incidents on the construction site;
- The affected parties shall always be kept informed about any changes to the construction programme should they be involved. If the ECO is not on site the Contractor should keep the affected parties informed. The contact numbers of the Contractor and the ECO shall be made available to the affected parties. This will ensure open channels of communication and prompt response to queries and claims; and
- Liaising with the heritage specialist in the case of unearthing of artefacts and/ or graves.

The ECO is responsible for providing an independent evaluation of compliance with the EMPr and not for enforcement of conditions of the EMPr. The Project Company is responsible for enforcement of the conditions of the EMPr.

The Contractor and the EO are accountable to the ECO for non-compliance with the EMPr. The ECO provides feedback to the Project Company and I&APs, as required. Issues of noncompliance raised by the

ECO must be taken up by the Project Company's Representative and resolved with the Contractor as per the conditions of his/her contract.

The ECO will remain employed for the full duration of the contract until all snag items have been resolved, rehabilitation measures have been completed, and the site is handed over to the Operator, thereby indicating the start of the operational phase.

1.6.7 Environmental Officer

The EO must be appointed by the Contractor and is responsible for managing the daily onsite implementation of the EMPr, and for the compilation of weekly environmental monitoring reports. In addition, the EO must act as liaison and advisor on all environmental and related issues, seek advice from the ECO when necessary, and ensure that any complaints received from I&APs are duly processed and addressed and that conflicts are resolved in an acceptable manner and timely manner. The EO shall be full time dedicated member of the Contractor's team and must be approved by the Project Company.

The following qualifications, qualities and experience are recommended for the individual appointed as the EO:

- A relevant environmental diploma or degree in natural sciences, as well as a minimum of three years' experience in construction site monitoring, excluding health and safety;
- A level-headed and firm person with above-average communication and negotiating skills. The ability to handle and address conflict management situations will be an advantage; and
- Relevant experience in environmental site management and EMPr compliance monitoring.

The EO's responsibilities include:

- Monitoring, on a daily basis, environmental specifications on site and compliance with the conditions of the EA, environmental legislation and EMPr;
- Keeping a register of compliance / non-compliance with the environmental specifications;
- Identifying and assessing previously unforeseen, actual or potential impacts on the environment;
- Ensuring that a brief weekly environmental monitoring report is submitted to the ECO;
- Conducting site inspections during the defects liability period, and bringing any environmental concerns to the attention of the ECO and Contractor;
- Advising the Contractor on the rectification of any pollution, contamination or damage to the construction site, rights of way and adjacent land;
- Attending site meetings (scheduled and *ad hoc*);
- Presenting the environmental awareness training course to all staff, Contractors and Sub contractors, and monitoring the environmental awareness training for all new personnel on-site, as undertaken by the Contractor;
- Ensuring that a copy of the EA and the latest version of the EMPr are available on site at all times;

- Ensuring that the Contractor is made aware of all applicable changes to the EMPr that are approved by the DEA;
- Assisting the Contractor in drafting environmental method statements and/or the Environmental Policy where such knowledge/expertise is lacking;
- Undertaking daily environmental monitoring to ensure the Contractor's activities do not impact upon the receiving environment. Such monitoring shall include dust, noise and water monitoring; and
- Maintaining the following on site:
 - A weekly site diary.
 - A non-conformance register.
 - An I&Ap communications register, and
 - A register of audits.

The EO will remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is handed over to the Operator.

1.6.8 *Social Officer*

The SO shall be employed by the Contractor and will be responsible for managing the daily on-site implementation of the social aspects of the EMPr. The SO shall liaise with landowners and relevant I&APs regarding construction activities for the duration of construction and will ensure that any discussions and complaints received from the public are addressed and that conflicts are resolved in an acceptable manner within 10 days.

The SO(s) shall be full time dedicated member(s) of the Contractor's team and must be accepted by the Project Company. The SO shall report to the Contractor's Project Manager, seeking advice from the ECO when necessary.

The SO may be the same person as the EO, but will assume all the responsibilities of the dual roll.

The following qualifications, qualities and experience are recommended for the individual appointed as the Contractor's SO:

- A person with communication and negotiating skills;
- Report writing skills; and
- Fluency in English, Afrikaans and any other local language as and where required.

The responsibilities and functions of the Construction SO will include:

- Implement and manage the daily social and communication aspects of the construction process according to the EMPr;
- Liaise and maintain good relations with I&APs;
- Monitor social aspects in terms of the specifications;

- Implement mitigation and corrective measures;
- Submit a monthly environmental report to the Contractor's Project Manager;
- Conduct site inspections during the defects notification period, and bring any social concerns to the attention of the Contractor;
- Attend site meetings (scheduled and ad hoc);
- Maintain a filing system meeting the project's quality management plan;
- Assist the Contractor in the drafting of social methods statements where such knowledge/expertise is lacking;
- Maintain the following on site:
 - A daily site diary;
 - A public complaints and communications register; and
 - A register of audits.
- Remain employed until the end of the end of construction.

1.6.9 Responsible Parties and Auditing Process

As described above, Table 3 below provides a summary of the responsible parties and the auditing process to be carried out.

Table 3: Responsible Parties and Auditing Process

TITLE	PARTY	ROLE DURING CONSTRUCTION	ROLE DURING OPERATION
Project Company	BioTherm Energy	Assume ultimate responsibility	Assume ultimate responsibility
Grid Connection Owner	Eskom	N/A	Assume ultimate responsibility
Project Manager	To be appointed by proponent	Construction management	N/A
Contractor's Project Manager	Balance of Plant Contractor	Project management	N/A

Main Contractor/s	There will be multiple contracts placed and managed by the Contractor's Project Manager for the construction phase. These will cover civil earthworks and concrete, structural mechanical and electrical / instrumentation (CI). Then there could also be the construction camp management contract.	Main Contractor will undertake day to day construction activities covering aspects such as civil earthworks and concrete, structural mechanical and electrical / instrumentation (CI).	N/A
Environmental Officer	To be appointed by Main Contractors	Day to day environmental responsibility, point of contact for ECO	N/A
Environmental Control Officer	To be appointed by proponent	Monthly audits	Annual audits
Social Officer	To be appointed by Main Contractors	Day to day environmental responsibility, point of contact for landowners and I&APs's	Monthly Audits
Determining Authority	National Department of Environmental Affairs (DEA)	Conduct site visits when necessary.	Conduct site visits when necessary

The following are the environmental management responsibilities (Table 4) of the various parties during construction and operational phases. Unless otherwise stated, the EMPr will be adhered to as follows:

- The EO will be the responsible party for all daily compliance of this EMPr during the construction phase;
- The monitoring party will be the ECO;
- Method of record keeping will be monthly audits undertaken by the ECO;
- Audit Technique will be the review of records and documentation (including EMPr/EA) that will be kept on site by the EO and/ or site inspections; and
- The Project Company will bear ultimate responsibility.

Table 4: Environmental Management Responsibilities

ITEM	PROJECT COMPONENT AND ACTIVITY	RESPONSIBLE PARTY	MONITORING PARTY	AUDIT TECHNIQUE
1.1	PRE-CONSTRUCTION (SITE ESTABLISHMENT)			
1.1.1	Site preparation	PROJECT COMPANY, MC, EO, ECO	PROJECT COMPANY, ECO	SITE VISIT
1.1.2	Consultation	MC, SO	EO, ECO	SITE VISIT
1.1.3	Cumulative impacts	MC,	EO, ECO	SITE VISIT
1.1.4	Social and Environmental Management Systems	MC,	EO, ECO, SO	SITE VISIT
2.1	CONSTRUCTION ACTIVITIES			
2.1.1	Site Clearing	MC,	EO, ECO	SITE VISIT
2.1.2	Construction traffic and access	MC, EO	ECO	SITE VISIT
2.1.3	Construction Camp	MC, EO, ECO	ECO	SITE VISIT
2.1.4	Environmental Education and Training	PROJECT COMPANY, MC	PROJECT COMPANY	SITE VISIT
2.1.5	Soils and Geology	MC, EO	ECO	SITE VISIT
2.1.6	Erosion Control	EO	ECO	SITE VISIT
2.1.7	Water Use and Quality	EO	ECO	SITE VISIT
2.1.8	Surface and Groundwater	EO	ECO	RECORDS REVIEW
2.1.9	Waste Management	EO	ECO	SITE VISIT
2.1.10	Flora	EO	ECO	SITE VISIT
2.1.11	Fauna	EO	ECO	RECORDS REVIEW, SITE VISIT
2.1.12	Air Quality	EO	ECO	RECORDS REVIEW
2.1.13	Noise and Vibrations	EO	ECO	RECORDS REVIEW
2.1.14	Energy use	EO	ECO	RECORDS REVIEW
2.1.15	Climate Change	EO	ECO	RECORDS REVIEW

2.1.16	Agricultural Potential	EO	ECO	RECORDS REVIEW
2.1.17	Employment	PROJECT COMPANY, MC	ECO	RECORDS REVIEW
2.1.18	Occupational Health and Safety	MC, EO	SO	SITE VISIT
2.1.19	Health and Safety	MC, EO	SO	SITE VISIT
2.1.20	Security	MC, EO	ECO	SITE VISIT
2.1.21	Social Environment	PROJECT COMPANY, MC, SO	ECO	RECORDS REVIEW, SITE VISIT
2.1.22	Community Engagement	SO	ECO	SITE VISIT
2.1.23	Visual Impact	EO	ECO	SITE VISIT
2.1.24	Heritage Impact	PROJECT COMPANY, MC, EO	ECO	SITE VISIT
2.1.25	Avi-fauna Impact	PROJECT COMPANY, MC, EO	ECO	SITE VISIT
3.1	OPERATION ACTIVITIES			
3.1.1	Construction Site Decommissioning	PROJECT COMPANY	ECO	RECORDS REVIEW
3.1.2	Operation and Maintenance	PROJECT COMPANY, ESKOM	ECO	RECORDS REVIEW
3.1.3	Surface and Groundwater	MC	ECO	RECORDS REVIEW
3.1.6	Pollution Control	PROJECT COMPANY, ESKOM, MC	ECO	RECORDS REVIEW
3.1.7	Biodiversity	EO	ECO	RECORDS REVIEW
3.1.8	Waste Management	EO	ECO	RECORDS REVIEW
3.1.9	Health and Safety	MC, EO	ECO	RECORDS REVIEW
3.1.10	Visual Impact	EO	ECO	RECORDS REVIEW
3.1.11	Avi-fauna Impact	EO	ECO	RECORDS REVIEW AND SITE VISIT

4.1	DECOMMISSIONING ACTIVITIES OF PROPOSED DEVELOPMENT			
4.1.1	Ongoing Stakeholder involvement	PROJECT COMPANY, ESKOM, SO	PROJECT COMPANY, ESKOM	SITE VISIT
4.1.2	Community health and safety	PROJECT COMPANY, ESKOM, SO	PROJECT COMPANY, ESKOM	RECORDS REVIEW
4.1.3	Waste management	PROJECT COMPANY, ESKOM, EO	PROJECT COMPANY, ESKOM	RECORDS REVIEW AND SITE VISIT
4.1.4	Surface and groundwater	PROJECT COMPANY, ESKOM, EO	PROJECT COMPANY, ESKOM	RECORDS REVIEW AND SITE VISIT
4.1.5	Biodiversity	PROJECT COMPANY, ESKOM, EO	PROJECT COMPANY, ESKOM	RECORDS REVIEW AND SITE VISIT
4.1.6	Air quality	PROJECT COMPANY, ESKOM, EO	PROJECT COMPANY, ESKOM	RECORDS REVIEW AND SITE VISIT

1.6.10 Environmental Audits

Table 5 below provides an outline of the generic process involved in the auditing process. It briefly describes the activities of the process initially beginning with defining the objectives and scope of the auditing process as well as the responsibilities of the various parties. The procedure for the auditing process is explained through to the production of audit findings and the compliance (or non-compliance) of the audit findings.

Table 5: Example of Procedure for Conducting Audits

Objective	To ensure that formal audits of the EMPr are scheduled and performed so as to verify compliance with the requirements of the EMPr.
Scope	This procedure describes the sequence of events required to perform a compliance audit and the verification of implemented corrective action.
Responsibilities	The ECO or a person authorised and appointed by him, is responsible for the maintenance of the Environmental Audit System

	<p>The ECO is responsible for the scheduling and execution of the audit, as well as the verification of the implementation of corrective action. At his/her discretion, this authority may be delegated to responsible company personnel or to an independent Environmental Auditing Authority to perform the audit on his/her behalf.</p> <p>Auditors shall have no direct responsibility in the area/system being audited.</p> <p>They will be trained in techniques for auditing environmental management systems.</p> <p>The head of department (HOD)/ supervisor for an area/system to be audited (or a responsible person nominated by him/ her) will assist the audit team in the execution of the audit. The HOD will also be responsible for timely corrective actions based on the findings of the audit.</p>
Planning the audit	<p>The ECO or his authorised delegate, shall plan the audit of a particular environmental area or system as follows:</p> <ul style="list-style-type: none"> ▪ He shall inform, in writing, the contractor to be audited of the intention to conduct an audit at least two weeks prior to the audit. This notification should include the audit objective, scope and duration and any assistance required from the contractor. ▪ On completion of the audit, an audit findings report shall be prepared and submitted to the Project Company, project manager and construction team. ▪ Corrective actions shall be implemented, within four weeks after the audit, where possible.
Audit Check List	<p>Auditing will be performed by collecting evidence for verification through interviews, relevant documentation and observation of activities and conditions. Instances of non-conformity to EMPr criteria should be recorded. An environmental audit checklist can be used as a guide to address all relevant issues.</p>
Audit Compliance	<p>See below.</p>

<p>Audit Findings and Reporting of non-compliances</p>	<p>The audit team shall review all evidence of their audit findings to decide on non-compliance. Audit findings of non-compliance must be documented and supported by evidence in the Audit Findings Report.</p> <p>The non-compliance findings will be communicated to the Project Manager and his representatives during an audit feedback meeting.</p>
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1.7 Layout of Environmental Management Programme

1.7.1 Introduction

This EMPr addresses both generic issues as well as specific issues. The generic and specific issues are each separated into different phases. Each phase has specific issues unique to that period of the development and operation of the solar energy facility as well as associated infrastructure. The impact is identified and given a brief description. The phases of the development are then identified as below:

- Pre-construction (Site Establishment)
- Construction (including associated rehabilitation of affected environment)
- Operation Phase
- Decommissioning

This EMPr seeks to manage and keep to a minimum the negative impacts of a development and at the same time, enhance the positive and beneficial impacts.

The EMPr specifies mitigation measures for the following environmental aspects:

1.7.2 Pre-construction (Site establishment)

- Site preparation
- Consultation
- Site clearing
- Social and Environmental Management Systems

1.7.3 *Construction*

- Construction Camp
- Construction Traffic and Access
- Environmental Education and Training
- Soils and Geology
- Erosion Control
- Water Use and Quality
- Surface and Groundwater
- Waste Management
- Flora
- Fauna
- Air Quality
- Noise and Vibrations
- Energy Use
- Employment
- Occupational Health and Safety
- Security
- Social Environment
- Cultural and Heritage Artefacts
- Community Engagement
- Visual Impact

1.7.4 *Operation*

- Construction Site Decommissioning
- Operation and Maintenance
- Surface and Groundwater
- Biodiversity
- Waste Management
- Health and Safety
- Visual Impact
- Avifauna
- Social

1.7.5 *Decommissioning Phase*

- Ongoing Stakeholder involvement

- Community health and safety
- Waste Management
- Surface and Groundwater
- Biodiversity
- Air Pollution

1.8 Objectives of an EMPr

The objectives of this EMPr are to:

- Identify a range of mitigation measures which could reduce and mitigate the potential impacts to minimal or insignificant levels
- To identify measures that could optimise beneficial impacts
- To create management structures that address the concerns and complaints of I&APs with regards to the development
- To establish a method of monitoring and auditing environmental management practices during all phases of development
- Ensure that the construction and operational phases of the project continues within the principles of Integrated Environmental Management and Environmental Management System (EMS) ISO 14001 Principles
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project.
- Ensure that the safety recommendations are complied with.
- Propose mechanisms for monitoring compliance with the EMPr and reporting thereon.
- Specify time periods within which the measures contemplated in the EMPr are implemented, where appropriate.

The EMPr Seeks to highlight the following:

- Avoiding impacts by not performing certain actions
- Minimising impacts by limiting aspects of an action
- Rectifying impacts through rehabilitation, restoration, etc. of the affected environment
- Compensating for impacts by providing substitute resources or environments
- Minimising impacts by optimising processes, structural elements and other design features
- Provide ongoing monitoring and management of environmental impacts of a development and documenting of any digressions /good performances
- The EMPr is a legally binding document that all parties involved in the project must be made aware of.

1.8.1 Environmental monitoring

A monitoring programme will be implemented for the duration of the lifecycle of proposed development. This programme will include:

- Monthly audits according to the EMPr conditions will be conducted by the Environmental Control Officer. These audits can be conducted randomly and do not require prior arrangement with the project manager.
- Compilation of an audit report with a rating of the compliance with the EMPr. This report will be submitted to the relevant authorities.
- An annual audit will also be undertaken by an external specialist.

The ECO shall keep a photographic record of any damage to areas outside the demarcated site area. The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable. All claims for compensation emanating from damage should be directed to the ECO for appraisal. A register shall be kept of all complaints from the landowner or community (Annexure A). All complaints / claims shall be handled immediately to ensure timeous rectification / payment by the responsible party.

A copy of the EMPr must be kept on site during the life of the solar energy facility. The EMPr will be made binding on all contractors operating on the site and must be included within the Contractual Clauses. Those responsible for environmental damage must pay the repair costs both to the environment and human health and the preventative measures to reduce or prevent further pollution and/or environmental damage (the polluter pays principle).

1.9 Applicable Legislation, Development Strategies and Guidelines

The following legislation applies:

- Constitution of South Africa (Act No. 108 of 1996)
- National Environmental Management Act (Act No 107 of 1998) – NEMA
- Environment Conservation Act (Act No 73 of 1989)
- National Heritage Resources Act (Act No 25 of 1999)
- National Water Act (Act No 36 of 1998)
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)
- National Environmental Management: Biodiversity (Act No. 10 of 2004)
- National Forests Act, 1998 (Act No. 84 of 1998)
- Conservation of Agricultural Resources Act No. 43 of 1983)
- Subdivision of Agricultural Land (Act No. 70 of 1970, as amended)

- National Road Traffic (Act No. 93 of 1996, as amended)
- Civil Aviation Act (Act No.13 of 2009)
- Occupational Health and Safety Act No. 85 of 1993
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- Development Facilitation Act No. 67 of 1995
- National Protected Areas Act (Act No. 25 of 2003)
- Astronomy Geographic Advantage Act No. 21 of 2007

Several regulations will be applicable to the construction phase of the project. These guidelines are mentioned in the EMP tables. Also of significance in this EMP are:

- World Bank International Finance Corporation (IFC),
- EHS Guidelines and
- Equator Principles

1.9.1 *The Equator Principles*

The Equator Principles (2013) are a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing. A number of banks, exchanges and organisations worldwide have adopted the Principles as requirements to be undertaken for project funding on application and approval. Furthermore, certain funding institutions have not formally adopted the Principles, but require clients to be compliant with them in order to qualify for loans.

Under Principle 3, the Equator Principles establish the International Finance Corporations (IFC) Performance Standards (April 30, 2006) and associated General and Sector Specific Environmental, Health and Safety Guidelines as the applicable social and environmental standards that a project should comply with if the project is located in a non-OECD country or OECD country that is not designated as high income.

The social and environmental assessment that is undertaken for a project establishes whether or not the project is in compliance with the IFC Performance Standards¹.

According to these principles, the performance standards relevant to the proposed development are summarised in Table 6.

Table 6: IFC Performance Standards

Performance Standard	Intent and objective
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¹ NB A project does not seek compliance with the Equator Principles per se but the standards that the EP refers to. A financial institution that has adopted the EP must ensure that any projects it is financing meet the standards referred to and that it adopts an appropriate risk management system to ensure this.

<p>Social & Environmental Assessment Management Systems (1)</p>	<ul style="list-style-type: none"> ▪ Adverse and beneficial impacts should be identified within the projects Area of Influence. Emphasis on integrated assessment of social and environmental impacts. ▪ Compliance with national legislation and IFC PS and EHS guidelines as appropriate. ▪ Emphasis on avoidance of impacts wherever practical and where this is not feasible, minimizes, mitigate and compensate. ▪ To ensure effective and ongoing stakeholder engagement ▪ To assess specifically the capacity and commitment of clients to manage risks and opportunities over the course of the transaction.
<p>Labour working conditions (2)</p>	<ul style="list-style-type: none"> ▪ Looks at the working conditions by following these principles; ▪ To establish and maintain the worker- management relationship (including specifically a human resources policy). ▪ To promote fair treatment, non-discrimination and equal opportunity of employees (and some contractors) and meet national employment laws. ▪ To protect the workforce by addressing child labour and forced labour. ▪ To promote healthy and safe working conditions.
<p>Pollution, Prevention and Abatement (3)</p>	<ul style="list-style-type: none"> ▪ To avoid and minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. ▪ To promote the reduction of emissions that contributes to climate change.
<p>Community Health, Safety and security (4)</p>	<ul style="list-style-type: none"> ▪ To avoid or minimise risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances. ▪ To ensure that the use of security personnel is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.
<p>Land Acquisition & Involuntary Settlement (5)</p>	<ul style="list-style-type: none"> ▪ To avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs. ▪ To mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by; (i) providing compensation for loss of assets at replacement cost, and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information,

	<p>consultation, and the informed participation of those affected.</p> <ul style="list-style-type: none"> ▪ To improve or at least restore the livelihoods and standards of living of displaced persons. ▪ To improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.
Biodiversity Conservation & Sustainable Natural Resources Management (6)	<ul style="list-style-type: none"> ▪ To promote and conserve biodiversity. ▪ To avoid the introduction of alien invasive species. ▪ To promote sustainable management and use of natural resources (NRM).
Indigenous people (7)	<ul style="list-style-type: none"> ▪ To foster full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples (IP). ▪ To avoid impacts or where avoidance is not feasible, minimize, mitigate and compensate in a culturally appropriate fashion and within the framework of successful good faith negotiation (a form of stakeholder engagement requiring approval of both parties). ▪ To establish and maintain effective relationships with IPs over the course of the project.
Cultural Heritage (8)	<ul style="list-style-type: none"> ▪ To protect cultural heritage from adverse impacts of project activities and support its preservation. ▪ To promote the equitable sharing of benefits from the use of cultural heritage in business activities.

(Source; IFC Guidelines, 2006)

2 ENVIRONMENTAL DOCUMENTATION, REPORTING AND COMPLIANCE

2.1 Documentation

The Contractor must ensure the following documentation is kept on the project site for the full duration of the contract:

- Final Environmental Management Programme once approved by the DEA;
- EA issued by the DEA;
- Environmental Policy of the Contractor;
- Environmental method statements compiled by the Contractor;
- Weekly environmental monitoring records;
- Minutes and record of attendance of all environmental meetings;
- Environmental incident book;
- Communications register;
- Register of audits;
- Non-conformance reports; and
- Waste manifests.

2.1.1 *Weekly Environmental Monitoring Report*

The EO will be required to provide the Main Contractor with a brief weekly environmental monitoring report covering the onsite events which occurred during the past week. This will highlight key performance areas and provide feedback on corrective and preventive actions taken. The EO will have the weekly reports submitted by the Contractor's Manager prior to submission to The Project Company for monthly reporting.

2.1.2 *Site Meetings*

Weekly site meetings are undertaken which include environmental matters. This meeting shall be chaired by a Senior Site Representative with the Project Company, Contractor(s), the EO ('s), and SO ('s) in attendance. Where practical or necessary, the ECO will need to attend if possible.

2.1.3 Method Statements

It is a statutory requirement to ensure the wellbeing of employees and of the environment. Therefore, the Contractor shall submit a Method Statement to the Project Company and the ECO for approval prior to the commencement of construction works.

A Method Statement is a document detailing how a particular process will be carried out. It should detail the possible dangers/risks associated with the particular part of the project and the methods of control to be established and to show how the work will be managed in a safe and environmentally responsible manner. The method statement shall also include the following information, where applicable:

- The type of construction activity;
- Timing and location of the activity;
- Construction procedures;
- Materials and equipment to be used;
- Transportation of the equipment to and from site;
- How the equipment/material will be moved while on site;
- Location and extent of construction site office and storage areas;
- Identification of impacts that might result from the construction activity;
- Population impacts;
- Community/institutional arrangements;
- Conflicts between local residents and newcomers;
- Individual and family level impacts;
- Community infrastructure needs;
- Intrusion impacts;
- Methodology and/or specifications for impact prevention or containment and for environmental monitoring;
- Emergency/disaster incident and reaction procedures (required to be demonstrated); and
- Rehabilitation procedures and continued maintenance of the impacted environment.

The Contractor will be accountable for all actions taken in non-compliance of the approved method statements. The Contractor shall keep all the method statements and subsequent revisions on file, copies of which must be distributed to all relevant personnel for implementation.

The Contractor will be required to submit, as a minimum, the relevant method statements as requested by the ECO which are to be compliant with the conditions of the EMPr for review prior to the start of that specific activity.

2.1.4 *Communications Register*

All complaints or communications that are received from I&APs or any other stakeholder must be recorded in a communications register. These complaints and communications will be brought to the attention of the Project Company, whereupon it will be investigated and a response to the Complainant, I&APs or stakeholder will be given within 10 days. The communications register shall include the following information:

- Record the time and date of the complaint/communication;
- A detailed description of the complaint/communication;
- Action and resources used to correct the complaint;
- Photographic evidence of the complaint (where possible);
- A written response to the complainant indicating rectification of the complaint; and
- Information regarding the relevant authority that was contacted or notified in writing where applicable (person, time and date).

The relevant authorities include:

- Department of Water and Sanitation (e.g. for any incidents involving the contamination of water resources).
- DEA (e.g. for any significant incident of pollution of the soil and air).
- Department of Agriculture, Forestry and Fisheries (e.g. uses of appropriate herbicides for eradication of alien invasive species, and permits for trees of special concern).
- Department of Health (e.g. for incidents such as contamination of water resources, accidental spill of hazardous substances).
- Department of Transport (e.g. for the diversion of traffic due to construction activities).
- Department of Labour (e.g. for labour disputes).

2.1.5 *Photographic Record*

The EO and SO will be required to compile a photographic record (dated) of all activities on site prior to construction related activities starting, during the construction process and on completion of construction related works. This photographic record will include:

- A pre-construction site record
- Monthly environmental audit reports;
- Weekly environmental monitoring reports;
- Corrective action;
- Progress of environmental works; and
- Incidences of non-conformance.

2.1.6 Waste Manifests

The Contractor shall ensure that all solid (including any hazardous) waste removed from site is disposed of at a registered landfill site or nearby waste transfer station with capacity to accept the project generated waste. The waste manifest shall be kept on record for auditing purposes.

2.1.7 Good Housekeeping

The Contractor is to practice good housekeeping throughout the construction phase. This should eliminate disputes about responsibility, facilitate efficient and timeous running of the project. Over and above practicing accepted construction methods in accordance with SANS 10120, this should include measures to preserve the environment inside the work area. Records of such actions taken to ensure the maintenance and management of housekeeping must be recorded.

The Contractor shall record and report upon environmental management measures undertaken to mitigate assessed impacts upon the environment.

2.1.8 Management and Control

The Contractor is to implement environmental management in a reasonable manner and should such management not prove effective, shall implement measures to the satisfaction of the Project Company. Appropriate measures shall include:

- Appointment of necessary resources to monitor and manage environmental requirements;
- Implement aspect-specific method statements to deal with emergency situations;
- Provision of adequate emergency response equipment to mitigate and manage an incident or emergency; and
- Provision of specific training related to implementation of environmental management requirements.

2.1.9 Recording And Reporting

The Contractor shall maintain detailed records of parameters monitored. These detailed records shall demonstrate the effectiveness of the management actions implemented to mitigate potential impacts. The Contractor shall submit a monthly database/report of management works implemented to the Project Company, as part of the Contractors monthly report.

2.1.10 Monitoring

The Contractor shall submit an Environmental Monitoring Method Statement which details the scope, nature, process, schedule and templates for environmental monitoring. The monitoring results shall be used to determine the effectiveness of the management programme. All complaints, compliments or other comments relating to environmental management parameters are to be recorded in the site issues register of the Contractor for inclusion in the project issues register held by the Project Company.

Monitoring results and the associated required management and mitigation actions for the coming monitoring period are to be presented in the monitoring section of the Contractors monthly report. The daily and weekly reports are to detail observations and information relating to requested management actions and their effectiveness.

The Contractor shall monitor and maintain the following on an ongoing basis:

- Re-growth of alien invasive vegetation;
- Validity of the pest control officer certificate;
- Fire break requirements associated to construction related activities;
- Stormwater systems;
- Topsoil and backfill volumes;
- Access road condition;
- Dust generated from stockpiles;
- Noise;
- Water quality;
- Erosion prevention; and
- Landscaping requirements for rehabilitation.

The Contractor shall submit a monthly database of inter alia the following works to the Project Company. This data base is to include as a minimum:

- Extent of alien invasive clearing operations;
- Volumes of herbicide used on the project;
- Stockpile volumes of chipped material, topsoil, fertile soil and subsoil;
- Volume of recyclable waste removed from site;
- Water volumes recycled and used for dust suppression; and
- Maintenance of chemical toilets.

All complaints, compliments or other comments relating to construction related works are to be recorded by the Contractor in the communications register of the receiving party for inclusion in the project issues register. Site clearance monitoring results and the associated required management and mitigation actions for the coming monitoring period are to be presented in the monitoring section of the Contractors monthly

report. The weekly report are to detail observations and information relating to requested management actions and their effectiveness.

2.2 Compliance with the EMPr

The Contractor/s is/are deemed not to have complied with the EMPr if:

- Within the boundaries of the site, site extensions and access roads there is evidence of contravention of clauses;
- If environmental damage ensues due to negligence;
- The contractor fails to comply with corrective or other instructions issued by the ECO or Authorities within a specified time; and
- The Contractor fails to respond adequately to complaints from the public.

The Project Company is deemed not to have complied with the EMPr if:

- Within the boundaries of the site there is evidence of contravention of clauses;
- If environmental damage ensues due to negligence; and
- They fail to respond adequately to complaints from the public.

2.2.1 Non-Conformance Report

A Non-Conformance Report (NCR) will be issued to the Contractor as a final step towards rectifying a failure in complying with a requirement of the EMPr. This will be issued to the Contractor in writing. Preceding the issuing of the NCR, the Contractor will be presented with an opportunity to rectify the outstanding issue in a timely manner.

Preceding requirements to the submitting of the NCR will entail an issue that has been highlighted to the Contractor in the audits for corrective action. Should this issue not be corrected or completed to the satisfaction of the Project Company and ECO, the issue is escalated to an NCR.

Should the ECO assess an incident / issue and find it to be significant (e.g. non-repairable damage upon the environment), it will be reported to the DEA and immediately escalated to the level of an NCR. This will be done in consultation with the Project Company. The following information should be recorded in the NCR:

- Details of non-conformance;
- Any plant or equipment involved;

- Any chemicals or hazardous substances involved;
- Work procedures not followed;
- Any other physical aspects;
- Nature of the risk;
- Actions agreed to by all parties following consultation that should adequately address the identified non-conformance. This may take the form of specific control measures and should take the hierarchy of controls into account. This must accompany the NCR for filing purposes;
- The agreed timeframe by which the Contractor should have implemented the actions documented in the NCR; and
- The ECO should verify that the agreed actions have taken place on or soon after the agreed completion date. Where the actions are complete, the ECO and Contractor should sign the Close Out portion of the Non-Conformance Form and file it with the contract documentation.

2.2.2 Environmental Emergency Response

The Contractor's environmental emergency procedures must ensure that there will be an appropriate response to unexpected or accidental actions or incidents that could cause environmental impacts. Such incidents may include:

- Accidental discharges to water (i.e. into a water resource) and land;
- Accidental spillage of hazardous substances (typically oil, petrol, and diesel);
- Accidental toxic emissions into the air;
- Specific environmental and ecosystem effects from accidental releases or incidents;
- The Environmental Emergency Response Plan is separate to the Health and Safety Plan as it is aimed at responding to environmental incidents and must ensure and include the following:
 - Construction employees shall be adequately trained in terms of incidents and emergency situations;
 - Details of the organisation (manpower) and responsibilities, accountability and liability of personnel;
 - A list of key personnel and contact numbers;
 - Details of emergency services (e.g. the fire department, spill cleanup services) shall be listed;
 - Internal and external communication plans, including prescribed reporting procedures;
 - Actions to be taken in the event of different types of emergencies;
 - Incident recording, progress reporting and remediation measures to be implemented; and
 - Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.

The Contractor(s) will comply with the environmental emergency preparedness and incident and accident-reporting requirements, as required by the Occupational Health and Safety Act (Act No. 85 of 1993), the National Environmental Management Act (Act No. 107 of 1998), the National Water Act (Act No. 36 of 1998), and/or any other relevant legislation.

2.2.3 Non-compliance

Non-conformance will be issues to the Contractor for incidents of non-compliance. The Contractor (through the Environmental Officer) shall also take the necessary steps (e.g. training) to prevent a recurrence of the infringement. The Contractor is also advised that the imposition of non-conformance does not replace any legal proceedings the authorities, landowners and/or members of the public may institute against the Contractor. The Contractor shall be required to make good any damage caused as a result of the infringement at his own expense. A preliminary list of infringements for which non-conformance will be imposed is as follows:

- Using areas outside the working areas without permission/accessing “no-go areas”;
- Clearing and/or leveling area outside of the working areas;
- Littering of the site and surrounds;
- Burying/burning waste on site and surrounds;
- The undertaking of informal ablutions
- Making fires on site;
- Spillage onto the ground or water bodies of oil, diesel, or any other potential pollutants;
- Picking/damaging plant material, especially that from the residual areas of natural bush on the site;
- Damaging/killing wild or domestic animals/birds;
- Discharging effluent and/or stormwater onto the ground or into surface water;
- Repeated contravention of the specification or failure to comply with instruction

The Senior Site Supervisor, on recommendation from the ECO, may also order the Contractor to suspend part or all the works if the Contractor repeatedly causes damage to the environment by not adhering to the EMPr (i.e. more than 3 cases of infringements). The suspension will be enforced until such time as the offending actions, procedure or equipment is corrected. No extension of time will be granted for such delays and all costs will be borne by the Contractor.

2.2.4 Training and awareness

The Main Contractor is to take responsibility for the management of their staff and subcontractors on the project site during the construction phase and supervise them closely at all times. The onus is on the Contractor to make sure that all their staff and subcontractors fully comprehend the contents of the EMPr. The Contractor shall organise environmental awareness training programmes, which should, be targeted at the two levels of employment: management and labour.

2.2.4.1 *Training of construction workers*

The construction workers must receive basic training in environmental awareness, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution. They must be informed of how to recognise historical / archaeological artefacts that may be uncovered. They must also be appraised of the EMPr's requirements. Environmental awareness training programmes need to be formulated for these levels and must comprise:

- A record of all names, positions and duties of staff to be trained;
- A framework for the training programmes;
- A summarised version of the training course(s); and
- An agenda for the delivery of the training courses.

Such programmes will set out the training requirements, which need to be conducted prior to any construction works occurring and will include:

- Acceptable behaviour with regard to flora and fauna;
- Management and minimising of waste, including waste separation;
- Maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, lubricants, cement, mortar and other chemicals;
- Responsible handling of chemicals and spills;
- Environmental emergency procedures and incident reporting; and
- General code of conduct towards I&APs.

The ECO may be requested to provide additional training (in a first language) on-site regarding environmental aspects that are unclear to the construction personnel. A translator may be required and requested to assist in this additional training. The cost for the translator will be borne by the Contractor.

2.2.4.2 *Contractor performance*

The Main Contractor must ensure that the conditions of the EMPr are adhered to. Should the Main Contractor require clarity on any aspect of the EMPr, the Main Contractor must contact the Environmental Control Officer for advice.

3 MITIGATION GUIDELINES

3.1 Introduction

Mitigation guidelines are addressed through four phases namely Pre-construction (Site Establishment) Phase; Construction Phase (and associated rehabilitation of affected environment); Operational Phase (Post-Construction) as well as Decommissioning Phase. Each phase has specific issues unique to that period of the development and operation of the solar PV energy facility and the associated infrastructure. The impact is identified and given a brief description. The four phases of the development are then identified as below:

3.2 Pre-construction (Site Establishment)

Requirements for the pre-construction phase

- Proper and continuous liaison between the ECO, the Contractor and Landowners to ensure all parties are appropriately informed at all times.
- The Contractor must adhere to all conditions of the contract including the Environmental Management Programme.
- Adequate planning of the construction programme to allow for disruptions due to rain and very wet conditions.
- Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. This will allow for easy assessment of any damage to the roads which may result from the construction process. If necessary some repairs should be done to prevent damage to equipment. All roads no matter what the condition need to be documented prior to construction.
- Proper documentation and record keeping of all complaints and actions taken.
- Appointment of an Environmental Control Officer to implement this EMP.
- Regular site inspections by the ECO and good control over the construction process throughout the construction period.
- Independent Environmental Audits to be carried out during and upon completion of construction. A formal communications protocol should be set up during the construction phase. The aim of the protocol should be to ensure that effective communication on key issues that may arise during this phase be maintained between key parties such as the ECO, project manager and contractor. The protocol should also ensure that concerns / issues raised by I&APs are formally recorded and considered and where necessary acted upon. If necessary, a forum for communicating with key stakeholders on a regular basis may need to be set up. This could be done through an Environmental Monitoring Committee that would meet on a regular basis. The communications protocol should be maintained throughout the construction phase.

3.3 Pre Construction Phase

3.3.1 Site preparation

Table 7: Site preparation

IMPACT	SITE PREPARATION This section deals with the preparation of the site and actions that need to be implemented before construction commences	RESPONSIBILITY
PHASE	SITE ESTABLISHMENT	MC, ELO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>Specialist Investigations</p> <ol style="list-style-type: none"> 1. A preconstruction walk down must be undertaken by the biodiversity specialist to identify the number of protected trees and plants requiring a permit for removal. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. If possible protected plants should be rescued and planted in appropriate places surrounding the site. 2. A preconstruction walk down of the areas to be impacted by the project as well as the final pylon positions must be undertaken by the Heritage specialist to demarcate the heritage features and develop appropriate mitigation measures. <p>Appoint construction team and suitable manager</p> <ol style="list-style-type: none"> 3. Appoint an Environmental Control Officer and Environmental Officer. The EO is from the contractor's side while the ECO is from the client's side. 	

Site demarcation and compliance

4. Before construction begins, all areas to be developed must be clearly demarcated with fencing or orange construction barrier where applicable.
5. All Construction Camps are to be fenced off in such a manner that unlawful entry is prevented and access is controlled. Signage shall be erected at all access points in compliance with all applicable occupational health and safety requirements. All access points to the Construction Camp should be controlled by a guard or otherwise monitored, to prevent unlawful access.
6. The contractor and ECO must ensure compliance with conditions described in the EA.
7. Records of compliance/ non-compliance with the conditions of the authorisation must be kept and be available on request.
8. Records of all environmental incidents must be maintained and a copy of these records be made available to provincial department on request throughout the project execution.

Construction Camp

9. Site establishment shall take place in an orderly manner and all required amenities shall be installed at camp sites before the main workforce move onto site.
10. All construction equipment must be stored within this construction camp.
11. All associated oil changes etc. (no servicing) must take place within this camp over a sealed surface such as a concrete slab.
12. An area for the storage of hazardous materials must be established that conforms to the relevant safety requirements and that provides for spillage prevention and containment
13. All Construction Camps shall be provided with portable fire extinguishing equipment, in accordance with all relevant legislation and must be readily accessible.
14. The Contractor must provide sufficient ablution facilities, in the form of portable / VIP toilets, at the Construction Camps, and shall conform to all relevant health and safety standards and codes. No pit latrines, French drain systems or soak away systems

shall be allowed and toilets may not be situated within 100 meters of any surface water body or 1:100 year flood line. A sufficient number of toilets shall be provided to accommodate the number of personnel working in the area.

15. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed.

16. No fires will be allowed and the Contractor must make alternative arrangements for heating. LP Gas may be used, provided that all required safety measures are in place. The Contractor shall take specific measures to prevent the spread of veld fires, caused by activities at the campsites. These measures may include appropriate instruction of employees about fire risks and the construction of firebreaks around the site perimeter.

Labour

17. All unskilled labourers for pre-site construction should be drawn from the local market and where possible use should be made of local semiskilled and skilled personnel.

Training of site staff

18. Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts.

19. Project manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks.

20. Staff operating equipment (such as loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks.

21. No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by the Project Manager.

22. Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training.

	<p>23. Staff must be trained in the hazards and required precautionary measures for dealing with these substances</p> <p>24. Spillage packs must be available at construction areas.</p>	
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3.3.2 Consultation

Table 8: Consultation

IMPACT	CONSULTATION This section deals with the public consultation of the site and actions that need to be implemented before construction commences	RESPONSIBILITY
PHASE	PRE-CONSTRUCTION	MC, SO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>Consultation</p> <ol style="list-style-type: none"> 1. Provide a mechanism through which information could be exchanged between the project proponent and stakeholders. 2. Identify relevant stakeholders and engage them at applicable stages of the EIA process. 3. Inform the public about the proposed construction process. 4. Surrounding communities must be kept informed, through the identified and agreed consultation channels, of the commencement of construction. 5. Solicit views and concerns from the public and allow them to suggest mitigations and enhancement measures 6. Determine stakeholder satisfaction levels. 	
	SITE SPECIFIC	
	<ol style="list-style-type: none"> 7. Before any construction or removal of soils and vegetation in any delineated surface water resources is undertaken, the relevant water use license must be obtained should development need to take place directly in wetlands. 	

3.3.3 Site Clearing

Table 9: Site Clearing

IMPACT	SITE CLEARING This section deals with site clearing and actions that need to be implemented before construction commences	RESPONSIBILITY
PHASE	PRE-CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	Site clearing <ol style="list-style-type: none"> 1. Site clearing must take place in a phased manner, as and when required. 2. Areas which are not to be constructed on within two months must not be cleared to reduce erosion risks. 3. The area to be cleared must be clearly demarcated and this footprint strictly maintained. 4. Spoil that is removed from the site must be removed to an approved spoil site or a licensed landfill site. 5. The necessary silt fences and erosion control measures must be implemented in areas where these risks are more prevalent. 	

3.3.4 Social and Environmental Management Systems

Table 10: Social and Environmental Management Systems

IMPACT	SOCIAL AND ENVIRONMENTAL MANAGEMENT SYSTEMS This section deals with the Social and Environmental Management Systems and actions that need to be implemented before construction commences	RESPONSIBILITY
PHASE	SITE ESTABLISHMENT	MC, SO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>Social</p> <ol style="list-style-type: none"> 1. Performance Standard One underscores the importance of managing social and environmental performance throughout the life of a project. 2. An effective social and environmental management system is a dynamic, continuous process initiated by management and involving communication between the client, its workers and the local communities directly affected by the project. 3. The client will establish and maintain a Social and Environmental Management System, appropriate to the nature and scale of the project and commensurate to the level of social and environmental risks and impacts. The management system will incorporate the following elements: <ul style="list-style-type: none"> o Social and Environmental Assessment o Management program o Organizational capacity o Training o Community Engagement o Monitoring and Reporting 	

3.4 Construction Phase

3.4.1 Construction Camp

Table 11: Construction Camp

IMPACT	CONSTRUCTION CAMP This section deals with construction camp (equipment and batching camp) and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC / ELO / ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<p>Site of construction camp</p> <ol style="list-style-type: none"> 1. The size of the construction camp must be minimized. 2. Adequate parking must be provided for site staff and visitors. The Contractor must attend to drainage of the camp site to avoid standing water and / or sheet erosion. 3. Suitable control measures over the Contractor's yard, facility and material storage to mitigate any visual impact of the construction activity must be implemented. <p>Storage of materials (including hazardous materials)</p> <ol style="list-style-type: none"> 4. Choice of location for storage areas must take into account prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary. 5. Storage areas must be designated, demarcated and fenced if necessary. 6. Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by unauthorised persons i.e. children / animals etc. 7. Fire prevention facilities must be present at all storage facilities. 8. Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). These 	

	<p>pollution prevention measures for storage must include a bund wall high enough to contain at least 110% of any stored volume, and this must be sited away from drainage lines in a site with the approval of the Project Manager. The bund wall must be high enough to contain 110% of the total volume of the stored hazardous material with an additional allocation for potential stormwater events.</p> <ol style="list-style-type: none"> 9. All fuel storage areas must be roofed to avoid creation of dirty stormwater 10. These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas and that will not infiltrate into the ground in order to ensure that accidental spillage does not pollute local soil or water resources. 11. Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals to be used on site. Where possible the available, MSDS's must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes. 12. Storage areas containing chemical substances / materials must be clearly sign posted. 13. Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures. 14. An approved waste disposal contractor must be employed to remove and recycle waste oil, if practical. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training. 15. All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site. 16. All major spills as specified in the contractor emergency response procedure of any materials, chemicals, fuels or other potentially hazardous or pollutant substances must be cleaned immediately and the cause of the spill investigated. Preventative measures must be identified and submitted to the MC and ECO for information. Emergency response procedures to be followed and implemented. 	
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	<p>Drainage of construction camp</p> <p>17. Surface drainage measures must be established in the Construction Camps so as to prevent</p> <ul style="list-style-type: none">▪ Ponding of water;▪ Erosion as a result of accelerated runoff; and,▪ Uncontrolled discharge of polluted runoff.	
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3.4.2 Construction traffic and access

Table 12: Construction Traffic and Access

IMPACT	CONSTRUCTION TRAFFIC AND ACCESS This section deals with construction traffic and access and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ELO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>Construction traffic</p> <ol style="list-style-type: none"> 1. Construction routes and required access roads must be clearly defined. 2. Recommendations of the stormwater management plan must be implemented. 3. Delivery of equipment must be undertaken with the minimum amount of trips to reduce the carbon footprint of these activities 4. Access of all construction and material delivery vehicles should be strictly controlled, especially during wet weather to avoid compaction and damage to the topsoil structure. 5. Damping down of the un-surfaced roads must be implemented to reduce dust and nuisance. 6. Vehicles and equipment shall be serviced regularly to avoid the contamination of soil from oil and hydraulic fluid leaks etc. 7. Servicing must be done in dedicated service areas on site or else off site if no such area exists. 8. Oil changes must take place on a concrete platform and over a drip tray to avoid pollution. 9. Soils compacted by construction shall be deep ripped to loosen compacted layers and re-graded to even running levels. <p>Access</p> <ol style="list-style-type: none"> 10. The main routes on the site must be clearly sign posted and printed delivery maps must be issued to all suppliers and Sub-contractors. 	

	<p>11. Planning of access routes to the site for construction purposes shall be done in conjunction with the Contractor and the Landowner. All agreements reached should be documented and no verbal agreements should be made. The Contractor shall clearly mark all access roads. Roads not to be used shall be marked with a "NO ENTRY for construction vehicles" sign.</p> <p>12. Access to the site must be via secondary roads as requested by SANRAL.</p> <p>Road maintenance</p> <p>13. Where necessary suitable measures shall be taken to rehabilitate damaged areas.</p> <p>14. Contractors should ensure that access roads are maintained in good condition by attending to potholes, corrugations and stormwater damages as soon as these develop.</p> <p>15. If necessary, staff must be employed to clean surfaced roads adjacent to construction sites where materials have spilt.</p> <p>16. Recommendations of the surface water report must be taken into consideration.</p> <p>General</p> <p>17. The contractor shall meet safety requirements under all circumstances. All equipment transported shall be clearly labelled as to their potential hazards according to specifications. All the required safety labelling on the containers and trucks used shall be in place.</p> <p>18. The Contractor shall ensure that all the necessary precautions against damage to the environment and injury to persons are taken.</p> <p>19. Care for the safety and security of community members crossing access roads should receive priority at all times.</p>	
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3.4.3 Environmental Education and Training

Table 13: Environmental Education and Training

IMPACT	ENVIRONMENTAL EDUCATION AND TRAINING This section deals with the environmental training of construction employees who will work at the proposed energy facility	RESPONSIBILITY
PHASE	CONSTRUCTION	PROJECT COMPANY, PM, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<p>Environmental training</p> <ol style="list-style-type: none"> 1. The project company must appoint an ECO prior to construction. 2. Ensure that all site personnel have a basic level of environmental awareness training. The Contractor must submit a proposal for this training to the ECO for approval. Topics covered should include: <ul style="list-style-type: none"> ▪ What is meant by “Environment” ▪ Why the environment needs to be protected and conserved ▪ How construction activities can impact on the environment ▪ What can be done to mitigate against such impacts ▪ Awareness of emergency and spills response provisions ▪ Social responsibility during construction e.g. being considerate to local residents 3. Training should be undertaken by a party such as the ECO who has sufficient expertise and knowledge of environmental issues. 4. It is the Contractor’s responsibility to provide the site foreman with no less than 1 hour’s environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff. 5. Training should be provided to the staff members in the use of the appropriate fire-fighting equipment. Translators are to be used where necessary. 6. Use should be made of environmental awareness posters on site. 	

	<p>7. The need for a “clean site” policy also needs to be explained to the workers.</p> <p>8. Staff operating equipment (such as loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their tasks.</p> <p>Monitoring of environmental training</p> <p>9. The Contractor must monitor the performance of construction workers to ensure that the points relayed during their introduction have been properly understood and are being followed. If necessary, the ECO and / or a translator should be called to the site to further explain aspects of environmental or social behaviour that are unclear. Toolbox talks are recommended.</p>	
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3.4.4 Soils and Geology

General guidelines for management of soils are provided in annexure B

Table 14: Soils and Geology

IMPACT	SOILS AND GEOLOGY This section deals with soils and geology and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>Topsoil</p> <p>1. The contractor should, prior to the commencement of earthworks determine the average depth of topsoil (if any), and agree on this with the ECO. The full depth of topsoil should be stripped from areas affected by construction and related activities prior to the commencement of foundations. This should include the building footprints, working areas and storage areas. Topsoil must be reused at the where possible to rehabilitate disturbed surface areas.</p>	

2. Care must be taken not to mix topsoil and subsoil during stripping.
3. Should any topsoil become polluted the contractor must remove the polluted soil to the full depth of pollution and replace it at his own expense with clean topsoil.
4. Removed polluted topsoil should be transported to a licensed landfill site.
5. The topsoil must be conserved on site in and round the pit area

Soil Stripping

6. No soil stripping must take place on areas within the site that the contractor does not require for construction works or areas of retained vegetation.
7. Subsoil and overburden in all construction and lay down areas should be stockpiled separately to be returned for backfilling in the correct soil horizon order.
8. Construction vehicles must only be allowed to utilize existing tracks or pre-planned access routes.

Soil Stockpiles

9. Stockpiles should not be situated such that they obstruct natural water pathways.
10. Stockpiles should not exceed 2m in height unless otherwise permitted by the Engineer.
11. If stockpiles are exposed to windy conditions or heavy rain, they should be covered either by vegetation or geofabric, depending on the duration of the project. Stockpiles may further be protected by the construction of berms or low brick walls around their bases.
12. Stockpiles should be kept clear of weeds and alien vegetation growth by regular weeding.
13. Where contamination of soil is expected, analysis must be done prior to disposal of soil to determine the appropriate disposal route. Proof from an approved waste disposal site where contaminated soils are dumped if and when a spillage / leakage occurs should be attained and given to the project manager.

Fuel storage

	<p>14. Topsoil and subsoil to be protected from contamination. This should be monitored on a monthly basis by a visual inspection of diesel/oil spillage and pollution prevention facilities.</p> <p>15. Fuel and material storage must be away from stockpiles.</p> <p>16. Concrete and chemicals must be mixed on an impervious surface and provisions should be made to contain spillages or overflows into the soil.</p> <p>17. Any storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material.</p> <p>Concrete mixing</p> <p>18. Should a concrete batching plant be required, it must be contained within a bunded area.</p> <p>19. Concrete mixing must only take place within designated areas.</p> <p>20. Ready mixed concrete must be utilised where possible.</p> <p>21. No vehicles transporting concrete to the site may be washed on site.</p> <p>22. If a batching plant is necessary, run-off should be managed effectively to avoid contamination of other areas of the site. Run-off from the batch plant must not be allowed to enter the storm water system.</p> <p>Earthworks</p> <p>23. Soils compacted during construction should be deeply ripped to loosen compacted layers and re-graded to even running levels. Topsoil should be re-spread over landscaped areas. According to specifications by a landscape architect, the area should be re-vegetated upon completion of construction activities.</p>	<p><i>Main contractor / ECO</i></p>
SITE SPECIFIC		
	<p>24. Minimise removal of surface vegetation</p> <p>25. Re-vegetate with local species as soon as possible</p>	

	26. Ensure all access roads/tracks are surfaced/treated to increase cohesion	
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3.4.5 Erosion Control

Table 15: Erosion Control

IMPACT	EROSION CONTROL This section deals with erosion and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<ol style="list-style-type: none"> 1. Wind screening and stormwater control should be undertaken to prevent soil loss from the site. 2. The use of silt fences and sand bags must be implemented in areas that are susceptible to erosion. 3. Other erosion control measures that can be implemented are as follows: <ul style="list-style-type: none"> ▪ Brush packing with cleared vegetation ▪ Mulch or chip packing ▪ Planting of vegetation ▪ Hydroseeding / hand sowing 4. Sensitive areas need to be identified prior to construction so that the necessary precautions can be implemented. 5. All erosion control mechanisms need to be regularly maintained. 6. Seeding of topsoil and subsoil stockpiles to prevent wind and water erosion of soil surfaces. 7. Retention of vegetation where possible to avoid soil erosion 8. Vegetation clearance should be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time. 	

	<p>9. Re-vegetation of disturbed surfaces should occur immediately after construction activities are completed. This should be done through seeding with indigenous grasses.</p> <p>10. No impediment to the natural water flow other than approved erosion control works is permitted.</p> <p>11. To prevent stormwater damage, the increase in stormwater run-off resulting from construction activities must be estimated and the drainage system assessed accordingly.</p> <p>12. Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion.</p>	
SITE SPECIFIC MITIGATION MEASURES		
	<p>13. Stockpiled soils will need to be protected from wind and water erosion. Stockpiled soils are not to exceed a 3m height and are to be banded by suitable materials. Stacked bricks surrounding the stockpiled soils can be adopted. Alternatively, wooden planks pegged around the stockpiled soils can be used.</p> <p>14. Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future.</p> <p>15. An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.</p> <p>16. In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the building structure footprints can also be used to reduce run-off and onset of erosion. Where required more permanent structures such as attenuation ponds and gabions can be constructed if needs be. All impacted areas are to be adequately sloped to prevent the onset of erosion.</p>	

	<p>17. Any hardstand area, building or substation inside or within 50m proximity to a surface water resource must have energy dissipating structures on the perimeter of the structures to prevent increased run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft structures such as grass blocks for example.</p> <p>18. Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off entering adjacent areas or surface water resources.</p> <p>19. Access roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every two months. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified.</p> <p>20. Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required.</p>	
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3.4.6 Water Use and Quality

Table 16: Water Use and Quality

IMPACT	WATER USE AND QUALITY This section deals with water use and quality as well as actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, ECO, EO, SO
MITIGATION METHOD STATEMENT	Water Use	Engineer

	<ol style="list-style-type: none"> 1. Develop a sustainable water supply management plan to minimize the impact to natural systems by managing water use, avoiding depletion of aquifers and minimizing impacts to water users. 2. Water must be reused, recycled or treated where possible. 3. Consultation with key stakeholders to understand any conflicting water use demands and the community's dependency on water resources and conservation requirements within the area. <p>Water Quality</p> <ol style="list-style-type: none"> 4. The quality and quantity of effluent streams discharged to the environment including stormwater should be managed and treated to meet applicable effluent discharge guidelines. 5. Efficient oil and grease traps or sumps should be installed and maintained at refuelling facilities, workshops, fuel storage depots, and containment areas and spill kits should be available with emergency response plans. <p>Stormwater</p> <ol style="list-style-type: none"> 6. The site must be managed in order to prevent pollution of drains, downstream watercourses or groundwater, due to suspended solids and silt or chemical pollutants. 7. Silt fences should be used to prevent any soil entering the stormwater drains. 8. Temporary cut off drains and berms may be required to capture stormwater and promote infiltration. 9. Promote a water saving mind set with construction workers in order to ensure less water wastage. 10. New stormwater construction must be developed strictly according to specifications from engineers in order to ensure efficiency. 11. Hazardous substances (fuel) must be stored at least 100m from any water bodies on site to avoid pollution. 12. The installation of the stormwater system must take place as soon as possible to attenuate stormwater from the construction phase as well as the operation phase. 	<p>ECO, MC</p> <p>ECO</p> <p>Contractor</p>
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	<p>13. Earth, stone and rubble is to be properly disposed of, or utilized on site so as not to obstruct natural water path ways over the site. I.e. these materials must not be placed in stormwater channels, drainage lines or rivers.</p> <p>14. There should be a periodic checking of the site's drainage system to ensure that the water flow is unobstructed.</p> <p>15. If a batching plant is necessary, run-off should be managed effectively to avoid contamination of other areas of the site. Untreated runoff from the batch plant must not be allowed to get into the storm water system or nearby streams, rivers or erosion channels or dongas.</p> <p>Sanitation</p> <p>16. Adequate sanitary facilities and ablutions must be provided for construction workers (1 toilet per every 15 workers).</p> <p>17. The facilities must be regularly serviced to reduce the risk of surface or groundwater pollution.</p> <p>Concrete mixing</p> <p>18. Concrete contaminated water must not enter soil or any natural drainage system as this disturbs the natural acidity of the soil and affects plant growth.</p> <p>Public areas</p> <p>19. Food preparation areas should be provided with adequate washing facilities and food refuse should be stored in sealed refuse bins which should be removed from site on a regular basis.</p> <p>20. The contractor should take steps to ensure that littering by construction workers does not occur and persons should be employed on site to collect litter from the site and immediate surroundings, including litter accumulating at fence lines.</p> <p>21. No washing or servicing of vehicles on site.</p>	
SITE SPECIFIC MITIGATION MEASURES		

	<p>22. No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas. The study site is to contain sufficient spill contingency measures throughout the construction process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage areas must be bunded to prevent oil or fuel contamination of the ground and/or nearby surface water resources or associated buffer zones.</p> <p>23. No water is to be extracted unless a water use license is granted for specific quantities for a specific water resource, where applicable.</p> <p>24. No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive areas. Appropriate safety measures as stipulated above must be implemented.</p> <p>25. No cement mixing directly on the surface is allowed in the highly sensitive areas.</p> <p>26. If a substation is to be located in close proximity to surface water resources, the substation is to contain adequate bunding structures around any oil containing structure to prevent any oil leakage from leaving the substation site. Oil leak monitoring must take place on a regular basis to ensure that where leaks are identified, these can be dealt with appropriately. Oil spill kits must be available at the substation site to deal with ad hoc oil spills.</p>	
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3.4.7 Surface and Groundwater

Table 17: Surface and Groundwater

IMPACT	SURFACE WATER AND GROUNDWATER This section deals with surface and groundwater and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, ECO, EO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>Sanitation</p> <ol style="list-style-type: none"> 1. Adequate sanitary facilities and ablutions must be provided for construction workers (1 toilet per every 15 workers). 2. The facilities must be regularly serviced to reduce the risk of surface or groundwater pollution. <p>Hazardous materials</p> <ol style="list-style-type: none"> 3. Use and or storage of materials, fuel and chemicals which could potentially leak into the ground must be controlled. 4. All storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material. 5. Any hazardous substances must be stored at least 20m from any of the water bodies on site. 6. The Contractor (monitored by the ECO or ELO) should be responsible for ensuring that potentially harmful materials are properly stored in a dry, secure, ventilated environment, with concrete or sealed flooring and a means of preventing unauthorised entry. 7. Contaminated wastewater must be managed by the Contractor to ensure existing water resources on the site are not contaminated. All wastewater from general activities in the camp shall be collected and removed from the site for appropriate disposal at a licensed commercial facility. 	

	<p>Concrete mixing</p> <p>8. Concrete contaminated water must not enter soil or any natural drainage system as this disturbs the natural acidity of the soil and affects plant growth</p> <p>Public areas</p> <p>9. Food preparation areas should be provided with adequate washing facilities and food refuse should be stored in sealed refuse bins which should be removed from site on a regular basis.</p> <p>10. The contractor should take steps to ensure that littering by construction workers does not occur and persons should be employed on site to collect litter from the site and immediate surroundings, including litter accumulating at fence lines.</p> <p>11. No washing or servicing of vehicles on site.</p> <p>Water resources</p> <p>12. Site staff shall not be permitted to use any other open water body or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing or for any construction or related activities.</p> <p>13. Municipal water (or another source approved by the ECO) should instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting, etc.</p> <p>14. Relevant departments and other emergency services should be contacted in order to deal with spillages and contamination of aquatic environments.</p>	
SITE SPECIFIC MITIGATION MEASURES		
	<p>15. Surface water resources and the associated buffer zones are to be designated as “highly sensitive areas”. Vehicle access must avoid the highly sensitive areas, as far as possible..</p> <p>16. Construction workers are only allowed in designated construction areas and not into the surface water resources designated as highly sensitive. The highly</p>	

	<p>sensitive areas are to be clearly demarcated and no access beyond these areas is to be allowed unless authorised.</p> <p>17. No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from any surface water resource where required. Temporary chemical sanitation facilities must be placed over a bunded or a sealed surface area and adequately maintained to prevent pollution impacts.</p> <p>18. Ideally, to minimise any impact to surface water resources, the proposed development should seek to avoid all surface water resources as far as possible. Where this is not possible a single access route or “Right of Way” (RoW) is to be established to the desired construction area in the surface water resources. The environmentally authorized and license permitted construction area is to be demarcated and made visible. The establishment of the RoW likewise must be demarcated and made visible. The width of the RoW must be limited to the width of the vehicles required to enter the surface water resource (no more than a 3m width). An area around the locations of the proposed development structures, buildings, infrastructure will be required in order for construction vehicles and machinery to operate/maneuver. This too must be limited to the smallest possible area (no bigger than 100m²) and made visible by means of demarcation.</p> <p>19. Should the necessary authorisations be obtained for the solar PV panels, buildings or structures and other associated infrastructure to be placed in surface water resources, excavated topsoils should be stockpiled separately from subsoils so that it can be replaced in the correct order for rehabilitation purposes post-construction. Soils removed from surface water resources must only be removed if absolutely required. Furthermore, any removed soils and vegetation that are not required for rehabilitation should be taken to a registered landfill site that has sufficient capacity to assimilate the spoil. The topsoil is to be used for rehabilitation purposes and should not be removed</p>	
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	<p>unless there is surplus that cannot be utilised. It is important that when the soils are reinstated, the subsoils are to be backfilled first followed by the topsoil.</p> <p>20. Where the soils are excavated from the sensitive areas, it is preferable for them to be stockpiled adjacent to the excavation pit to limit vehicle and any other movement activities around the excavation areas.</p> <p>21. Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed from the surface water resource(s), and the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion until vegetation can re-establish where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped.</p>	
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3.4.8 Waste Management

Table 18: Waste Management

IMPACT	WASTE MANAGEMENT This section deals with waste management and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<p>Litter management</p> <ol style="list-style-type: none"> 1. Refuse bins must be placed at strategic positions to ensure that litter does not accumulate within the construction site. 2. The Contractor shall supply waste collection bins where such is not available and all solid waste collected shall be disposed of at registered/licensed landfill. 	

3. A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site.
 4. If possible and feasible, all waste generated on site must be separated into glass, plastic, paper, metal and wood and recycled. An independent contractor can be appointed to conduct this recycling.
 5. Littering by the employees of the Contractor shall not be allowed under any circumstances. The ECO shall monitor the neatness of the work sites as well as the Contractor campsite.
 6. Skip waste containers should be maintained on site. These should be kept covered and arrangements made for them to be collected regularly.
 7. All waste must be removed from the site and transported to a landfill site promptly to ensure that it does not attract vermin or produce odours.
 8. Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.
 9. A certificate of disposal shall be obtained by the Contractor and kept on file, if relevant.
 10. Under no circumstances may solid waste be burnt on site.
 11. All waste must be removed promptly to ensure that it does not attract vermin or produce odours.
- Hazardous waste***
12. All waste hazardous materials, if present, must be carefully stored as advised by the ECO, and then disposed of off-site at a licensed landfill site, where practical. Incineration may be used where relevant.
 13. Contaminants to be stored safely to avoid spillage.
 14. Machinery must be properly maintained to keep oil leaks in check
 15. All necessary precaution measures shall be taken to prevent soil or surface water pollution from hazardous materials used during construction and any spills shall immediately be cleaned up and all affected areas rehabilitated

	<p>Sanitation</p> <p>16. The Contractor shall install mobile chemical toilets on the site.</p> <p>17. Staff shall be sensitised to the fact that they should use these facilities at all times. No indiscriminate sanitary activities on site shall be allowed.</p> <p>18. Ablution facilities shall be within proximity from workplaces and not closer than 100m from any natural water bodies or boreholes. There should be enough toilets available to accommodate the workforce (minimum requirement 1: 15 workers). Male and females must be accommodated separately where possible.</p> <p>19. Toilets shall be serviced regularly and the ECO shall inspect toilets regularly.</p> <p>20. Toilets should be no closer than 100m or above the 1:100 year flood line from any natural or manmade water bodies or drainage lines or alternatively located in a place approved of by the Engineer.</p> <p>21. Under no circumstances may open areas, neighbours fences or the surrounding bush be used as a toilet facility.</p> <p>22. The construction of “Long Drop” toilets are forbidden. Rather, portable toilets are to be used.</p> <p>23. Potable water must be provided for all construction staff.</p> <p>Remedial actions</p> <p>24. Depending on the nature and extent of the spill, contaminated soil must be either excavated or treated on-site.</p> <p>25. Excavation of contaminated soil must involve careful removal of soil using appropriate tools/machinery to storage containers until treated or disposed of at a licensed hazardous landfill site.</p> <p>26. The ECO must determine the precise method of treatment for polluted soil. This could involve the application of soil absorbent materials as well as oil-digestive powders to the contaminated soil.</p> <p>27. If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent material.</p>	
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	<p>28. If necessary, oil absorbent sheets or pads must be attached to leaky machinery or infrastructure.</p> <p>29. Materials used for the remediation of petrochemical spills must be used according to product specifications and guidance for use.</p> <p>30. Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of petrochemicals to the environment, and stored in adequate containers until appropriate disposal.</p>	
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3.4.9 Flora

Table 19: Flora

IMPACT	FLORA This section deals with flora and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<p>Existing vegetation</p> <ol style="list-style-type: none"> 1. Vegetation removal must be limited to the construction site 2. Vegetation to be removed as it becomes necessary rather than removal of all vegetation throughout the site in one step 3. Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected. 4. No vegetation to be used for firewood. <p>Rehabilitation</p> <ol style="list-style-type: none"> 5. All damaged areas shall be rehabilitated upon completion of the contract 6. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction. 	

7. All natural areas impacted during construction must be rehabilitated with locally indigenous species typical of the representative botanical unit.
8. Rehabilitation must take place in a phased approach as soon as possible.
9. Rehabilitation process must make use of species indigenous to the area. Seeds from surrounding seed banks can be used for re-seeding.
10. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.
11. Planting of indigenous tree species in areas not to be cultivated or built on must be encouraged.

Demarcation of construction and laydown areas

12. All plants not interfering with the operation of the solar PV energy facility construction shall be left undisturbed, clearly marked and indicated on the site plan.
13. The construction area must be well demarcated and no construction activities must be allowed outside of this demarcated footprint.
14. Vegetation removal must be phased in order to reduce impact of construction.
15. Construction site office and laydown areas must be clearly demarcated and no encroachment must occur beyond demarcated areas.
16. Strict and regular auditing of the solar PV energy facility construction process to ensure containment of the construction and laydown areas.
17. Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora.

Utilisation of resources

18. Gathering of firewood, fruit, multi plants, or any other natural material onsite or in areas adjacent to the site is prohibited unless with prior approval of the ECO.

Exotic vegetation

	<p>19. Alien vegetation on the site will need to be controlled.</p> <p>20. The contractor should be responsible for implementing a programme of weed control (particularly in areas where soil has been disturbed); and grassing of any remaining stockpiles to prevent weed invasion.</p> <p>21. The spread of exotic species occurring throughout the site should be controlled.</p> <p>Herbicides</p> <p>22. Herbicide use shall only be allowed according to contract specifications. The application shall be according to set specifications and under supervision of a qualified technician. The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used.</p> <p>23. The use of pesticides and herbicides on the site must be discouraged as these can impact on important pollinator species of indigenous vegetation.</p>	
SITE SPECIFIC MITIGATION MEASURES		
	<p>24. Avoid patches of indigenous vegetation if possible, or place infrastructure as close as possible to boundaries.</p> <p>25. A preconstruction walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. This information may be required for a permit application to the Provincial authorities.</p> <p>26. It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants. Due to the season of the field survey and the extremely dry condition of the vegetation, it was not possible to establish this information at this stage. Plants lost to the development</p>	

	can be rescued and planted in appropriate places in surrounding areas, where possible. This will reduce the irreplaceable loss of resources as well as the cumulative effect.	
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3.4.10 Fauna

Table 20: Fauna

IMPACT	FAUNA This section deals with fauna and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<ol style="list-style-type: none"> 1. Demarcation of sensitive areas must be verified on site by the ECO prior to construction activities starting. 2. Use of appropriate construction techniques 3. Rehabilitation to be undertaken as soon as possible after construction has been completed. 4. No trapping or snaring to fauna on the construction site is allowed. 5. No faunal species are to be harmed by maintenance staff during any routine maintenance at the development. 6. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition. 	

3.4.11 Avifauna

Table 21: Avifauna Impact

IMPACT	Avifauna This section deals with avifaunal issues and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<ol style="list-style-type: none"> 1. Ensure that key areas of conservation importance and sensitivity are avoided. 2. Implement appropriate working practices to protect sensitive habitats. 3. Provide adequate briefing for site personnel and, in particularly sensitive locations, employing an on-site ecologist during construction. 4. Implement an agreed post-development monitoring programme. 5. Where possible, install transmission cables underground (subject to habitat sensitivities and in accordance with existing best practice guidelines for underground cable installation). 6. Mark overhead cables using deflectors where required and avoiding use over areas of high bird concentrations, especially for species vulnerable to collision. 7. Time construction to avoid sensitive periods. 8. Implement habitat enhancement for species using the site. 	
SITE SPECIFIC MITIGATION		
	<ol style="list-style-type: none"> 9. Visibility devices should be placed on overhead power lines, if the monitoring identifies that collisions are an issue during operation. 10. Construction activity should be restricted to the immediate footprint of the infrastructure. 11. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. 12. . To protect the Martial Eagle nest site located Tower 519 of the Hydra-Kronos 400kV line, it shall be necessary to relocate the nest site to a more distant, less disturbed area (e.g. Jenkins et al. 2007, 2013). A dedicated structure, should be strategically situated off the power line network aggregated around the Kronos substation. 	

3.4.12 Air Quality

Table 22: Air Pollution

IMPACT	AIR POLLUTION This section deals with air pollution and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<p>Dust control</p> <ol style="list-style-type: none"> 1. Wheel washing and damping down of un-surfaced and un-vegetated areas must be undertaken if required. 2. Retention of vegetation where possible will reduce dust travel. 3. Clearing activities must only be done during agreed working times and permitting weather conditions to avoid drifting of sand and dust into neighbouring areas. 4. Damping down of all exposed soil surfaces with a water bowser or sprinklers when necessary to reduce dust. 5. The Contractor shall be responsible for dust control on site to ensure no nuisance is caused to the neighbouring communities. 6. A speed limit of 30km/h must not be exceeded on site. 7. Any complaints or claims emanating from the lack of dust control shall be attended to immediately by the Contractor. 8. Any dirt roads that are utilised by the workers must be regularly maintained to ensure that dust levels are controlled. <p>Odour control</p> <ol style="list-style-type: none"> 9. Regular servicing of vehicles in order to limit gaseous emissions. 10. Regular servicing of on-site toilets to avoid potential odours. 11. Allocated cooking areas must be provided. 	

	<p>12. The contractor must make alternative arrangements (other than fires) for cooking and/ or heating requirements. LP gas cookers may be used provided that all safety regulations are followed.</p> <p>Rehabilitation</p> <p>13. The contractor should commence rehabilitation of exposed soil surfaces as soon as practical after completion of earthworks.</p> <p>Fire prevention</p> <p>14. No open fires shall be allowed on site under any circumstance. All cooking shall be done in demarcated areas that are safe and cannot cause runaway fires.</p> <p>15. The Contractor shall have operational fire-fighting equipment available on site at all times. The level of firefighting equipment must be assessed and evaluated through a typical risk assessment process.</p>	
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3.4.13 Noise and Vibrations

Table 23: Noise and Vibrations

IMPACT	NOISE	RESPONSIBILITY
	This section deals with noise and actions that need to be implemented during construction	
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION / METHOD STATEMENT	<p>1. The construction phase must aim to adhere to the relevant noise regulations and limit noise to within standard working hours in order to reduce disturbance of surrounding farms.</p> <p>2. Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities should be located well away from noise sensitive areas. Once the proposed final layouts are made available by the contractor(s), the sites must be evaluated in detail and specific measures designed in to the system.</p>	

	<ol style="list-style-type: none"> 3. Truck traffic should be routed away from noise sensitive areas, where possible. 4. Noise levels must be kept within acceptable limits. 5. Noisy operations should be combined so that they occur where possible at the same time. 6. Construction activities are to be contained to reasonable hours during the day and early evening. Night-time activities near noise sensitive areas should not be allowed. 7. Construction workers to wear necessary ear protection gear. 8. Noisy activities to take place during allocated construction hours 9. Noise from labourers must be controlled. 10. Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order. Should the vehicles or equipment not be in good working order, the contractor may be instructed to remove the offending vehicle or machinery from site 11. The contractor must take measures to discourage labourers from loitering in the area and causing noise disturbance. Where possible labour shall be transported to and from the site by the contractor or his Sub-Contractors by the contractors own transport. 12. Implementation of enclosure and cladding of processing plants 13. Applying regular and thorough maintenance schedules to equipment and processes. An increase in noise emission levels very often is a sign of the imminent mechanical failure of a machine. 14. Route construction traffic as far as practically possible from potentially sensitive receptors; 15. Ensure a good working relationship between the developer and all potentially sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them. Information that should be provided to the potential sensitive receptor(s) include: <ul style="list-style-type: none"> ▪ Proposed working times; ▪ how long the activity is anticipated to take place; ▪ what is being done, or why the activity is taking place; ▪ contact details of a responsible person where any complaints can be lodged should there be an issue of concern. 	
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	<p>16. When working near (within 500 meters – potential construction of access roads and trenches) to a potential sensitive receptor(s), limit the number of simultaneous activities to the minimum as far as possible;</p> <p>17. When working near to potentially sensitive receptors, coordinate the working time with periods when the receptors are not at home where possible. An example would be to work within the 08:00 to 14:00 time-slot to minimize the significance of the impact because:</p> <ul style="list-style-type: none"> ▪ Potential receptors are most likely at school or at work, minimizing the probability of an impact happening; ▪ Normal daily activities will generate other noises that would most likely mask construction noises, minimizing the probability of an impact happening. <p>18. Reduce the noise impact during the construction phase by:</p> <ul style="list-style-type: none"> ▪ Using the smallest/quietest equipment for the particular purpose. For modelling purposes the noise emission characteristics of large earth-moving equipment (typically of mining operations) were used, that would most likely over-estimate the noise levels. The use of smaller equipment therefore would have a significantly lower noise impact; ▪ Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures. 	
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3.4.14 Energy use

Table 24: Energy use

IMPACT	ENERGY USE	RESPONSIBILITY
	This section deals with energy use and actions that need to be implemented during construction	
PHASE	CONSTRUCTION	MC, EO, ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		

MITIGATION METHOD STATEMENT	/	<ol style="list-style-type: none"> 1. Energy saving lighting must be implemented across the board. 2. Water saving measures must be implemented across the facility to ensure little wastage. 3. Minimal lighting, while maintaining health and safety regulations, must be kept on during the night operations. 4. Equipment not in use must be switched off and unplugged to save on unnecessary energy costs. 	
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3.4.15 Employment

Table 25: Employment

IMPACT		EMPLOYMENT This section deals with employment and actions that need to be implemented during construction	RESPONSIBILITY
PHASE		CONSTRUCTION	PM, MC, EO, SO
ENVIRONMENTAL MANAGEMENT PROGRAMME			
MITIGATION METHOD STATEMENT	/	<p>Labour</p> <ol style="list-style-type: none"> 1. The use of labour intensive construction measures should be used where appropriate. 2. Training of labour to benefit individuals beyond completion of the project. <p>Recruitment Plan</p> <ol style="list-style-type: none"> 3. All unskilled labourers should be drawn from the local market and where possible use should be made of local semiskilled and skilled personnel. 4. Local suppliers to be used where possible. 5. The Project Manager must ensure that all staff working on the proposed project are in possession of a South African Identity Document or a relevant work permit. 	

	<ol style="list-style-type: none"> 6. Ensure adequate advertising in the project community areas, local papers for skilled labour. Adverts are to be placed in each area where the public meetings were conducted. 7. Local community leaders must be utilised to source labour. 8. The recruitment process must be equitable and transparent. A concerted effort will be made to guard against nepotism and/or any form of favouritism during the process 9. The recruitment of skilled labour will follow standard advertising process in national newspapers and interview based selection 10. A record of official complaints by employees is to be maintained and submitted to authorities i.e. Labour and Social Security. 	
SITE SPECIFIC MITIGATION		
	<ol style="list-style-type: none"> 11. Procure construction materials, goods, and products from local suppliers if feasible and possible. 12. Employ local contractors where possible. 13. Recruit local labour where possible. 14. Sub-contract to local construction companies where possible. 15. Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew. 16. Employ labour-intensive measures in construction, where possible. 17. Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour. 	

3.4.16 Occupational Health and Safety

Table 26: Occupational Health and Safety

IMPACT	HEALTH AND SAFETY This section deals with health and safety and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC / EO / ECO / SO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<p>Worker safety</p> <ol style="list-style-type: none"> 1. Implementation of safety measures, work procedures and first aid must be implemented on site. 2. Workers should be thoroughly trained in using potentially dangerous equipment 3. Contractors must ensure that all equipment is maintained in a safe operating condition. 4. A safety officer must be appointed. 5. A record of health and safety incidents must be kept on site. 6. Any health and safety incidents must be reported to the Project Manager immediately. 7. First aid facilities must be available on site at all times and a number of employees trained to carry out first aid procedures. 8. Workers have the right to refuse work in unsafe conditions. 9. The Contractor shall take all the necessary precautions against the spreading of disease such as measles, foot and mouth, etc. especially under livestock. 10. A record shall be kept of drugs administered or precautions taken and the time and dates when this was done. This can then be used as evidence in court should any claims be instituted against BioTherm or the Contractor. 	

11. The contractor must ensure that all construction workers are well educated about HIV/ AIDS and the risks surrounding this disease. The location of the local clinic where more information and counselling is offered must be indicated to workers.
12. Material stockpiles or stacks must be stable and well secured to avoid collapse and possible injury to site workers / local residents.

Worker facilities

13. Eating areas should be regularly serviced and cleaned to ensure the highest possible standards of hygiene and cleanliness.
14. Fires are not to be allowed outside controlled areas.

Hazardous substances

15. Working areas should be provided with adequate ventilation and dust/fume extraction systems to ensure that inhalation exposure levels for potentially corrosive, oxidizing, reactive or siliceous substances are maintained and managed at safe levels.

Machinery and Equipment

16. Use of contrast colouring on equipment/ machinery including the provision of reflective markings to enhance visibility.
17. Use of moving equipment/machinery equipped with improved operator sight lines.
18. Issuing workers with high visibility clothing
19. Use of reflective markings on structures, traffic junctions, and other areas with a potential for accidents.
20. Installing safety barriers in high risk locations

Fitness for work

21. Review shift management systems to minimize risk of fatigue. Establish alcohol and other drugs policy for the operation.

	<p>Travel and remote site health</p> <p>22. Develop programs to prevent both chronic and acute illnesses through appropriate sanitation and vector control systems.</p> <p>23. Where food is prepared on site, food preparation storage and disposal should be reviewed regularly and monitored to minimise risk of illness.</p> <p>Protective gear</p> <p>24. Personal Protective Equipment (PPE) must be made available to all construction staff and must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn where necessary i.e. dust masks, ear plugs etc.</p> <p>25. No person is to enter the site without the necessary PPE.</p> <p>Site safety</p> <p>26. The construction camp must remain fenced for the entire construction period.</p> <p>27. Potentially hazardous areas are to be demarcated and clearly marked</p> <p>28. Adequate warning signs of hazardous working areas.</p> <p>29. Emergency numbers for local police and fire department etc. must be placed in a prominent area.</p> <p>30. Firefighting equipment must be placed in prominent positions across the site where it is easily accessible. This includes fire extinguishers, a fire blanket as well as a water tank.</p> <p>31. Suitable conspicuous warning signs in English and all other applicable languages must be placed at all entrances to the site.</p> <p>32. All speed limits must be adhered to.</p> <p>Construction equipment safety</p> <p>33. All equipment used for construction, including drills, TLB's must be in good working order with up to date maintenance records.</p> <p>Hazardous Material Storage</p>	
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34. All storage tanks containing hazardous materials (fuel) must be placed in banded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material. These areas should be roofed to avoid contamination of stormwater.
35. Material Safety Data Sheets (MSDS) which contain the necessary information pertaining to a specific hazardous substance must be present for all hazardous materials stored on the site.

Procedure in the event of a petrochemical spill

36. A spill kit needs to be kept on site to address any unforeseen spillages.
37. The individual responsible for or who discovers the petrochemical spill must report the incident to the Project Manager, Contractor or ECO.
38. The problem must be assessed and the necessary actions required will be undertaken.
39. The immediate response must be to contain the spill.
40. The source of the spill must be identified, controlled, treated or removed wherever possible.

Fire management

41. Firefighting equipment should be present on site at all times.
42. All construction staff must be trained in fire hazard control and firefighting techniques.
43. All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances.
44. No open fires will be allowed on site.
45. Smoking may only be conducted in demarcated areas.

Safety of surrounding residents

46. All I & AP's should be notified in advance of any known potential risks associated with the construction site and the activities on it. Examples of these are:

	<ul style="list-style-type: none"> ○ Blasting ○ Earthworks / earthmoving machinery on steep slopes above houses / infrastructure ○ Risk to residence along haulage roads / access routes <p>Emergency evacuation plan</p> <p>47. Upon completion of the construction phase, an emergency preparedness plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency.</p> <p>48. All permanent staff must undergo safety training.</p> <p>Maintenance</p> <p>49. The solar PV energy facility and surrounding areas are to be regularly maintained. A maintenance schedule must be drawn up and records of all maintenance kept.</p>	
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3.4.17 Security

Table 27: Security

IMPACT	SECURITY This section deals with security and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC / EO / ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	<ol style="list-style-type: none"> 1. A security company should be employed to guard the construction site and monitor access. This company should also be utilised for the operation phase. 2. Labour should be transported to and from the site to discourage loitering in adjacent areas and possible increase in crime or disturbance. 3. Unsocial activities such as consumption or illegal selling of alcohol, drug utilisation or selling and prostitution on site shall be prohibited. Any persons found to be engaged in such activities should receive disciplinary or criminal action taken against them. 4. Only pre-approved staff must be permitted to stay within the staff accommodation which will be provided. 5. The site shall be fenced, where necessary to prevent any loss or injury to persons during the construction phase. 6. No alcohol/ drugs are to be present or taken on site. 7. No firearms allowed on site or in vehicles transporting staff to / from site (unless used by security personnel). 8. No harvesting of firewood from the site or from the business property adjacent to it without prior consent from the ECO. 9. Construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bush as a toilet facility are forbidden). 	

	<p>10. Trespassing on private / commercial properties adjoining the site is forbidden.</p> <p>11. Driving under the influence of alcohol is prohibited.</p> <p>12. All employees must undergo the necessary safety training and wear the necessary protective clothing.</p> <p>13. The site must be secured in order to reduce the opportunity for criminal activity in the locality of the construction site.</p>	
	SITE SPECIFIC MITIGATION	
	<p>14. Control the movement of workers between the site and areas of residence to minimise loitering.</p>	

3.4.18 Social Environment

Table 28: Social Environment

IMPACT	SOCIAL ENVIRONMENT This section deals with social environment and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC / EO / ECO / SO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. All contact with the affected parties shall be courteous at all times. The rights of the affected parties shall be respected at all times. 2. A complaints register should be kept on site. Details of complaints should be incorporated into the audits as part of the monitoring process. This should be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the Contractor. 3. Damage to infrastructure shall not be tolerated and any damage shall be rectified immediately by the Contractor. A record of all damage and remedial actions shall be kept on site. 	

	4. Care must be taken not to damage irrigation equipment, lines, channels and crops.	
	SITE SPECIFIC MITIGATION	
	5. Contractors should provide learnerships and on-job training, if possible. 6. Where specialist training can be provided, candidates from local communities should be prioritised for training. 7. Share knowledge with the sub-contracting companies during the construction period. 8. Goods and services should be procured domestically instead of being imported, where possible. 9. The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. 10. Health awareness campaigns should be implemented to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.	

3.4.19 Heritage

Table 29: Heritage

IMPACT	CULTURAL AND HERITAGE ARTEFACTS This section deals with the impact that the new development has on potential archaeological artefacts of the site	RESPONSIBILITY
PHASE	CONSTRUCTION	MC / EO / ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT	1. Any finds must be reported to the nearest National Monuments office to comply with the National Heritage Resources Act (Act No 25 of 1999) and to DEA.	

	<ol style="list-style-type: none"> 2. Local museums as well as the South African Heritage Resource Agency (SAHRA) should be informed if any artefacts are uncovered in the affected area. 3. The contractor must ensure that his workforce is aware of the necessity of reporting any possible historical or archaeological finds to the ECO so that appropriate action can be taken. 4. Any discovered artefacts shall not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained and the site has been mapped and noted. Permits shall be obtained from the South African Heritage Resources Association (SAHRA) should the proposed site affect any world heritage sites or if any heritage sites are to be destroyed or altered. 5. Should any archaeological sites / graves be uncovered during construction, their existence shall be reported to MRP immediately. 	
SITE SPECIFIC MITIGATION MEASURES		
	<ol style="list-style-type: none"> 6. Due to the large amount of Stone Age material present on site it is recommended that the ECO must have an archaeological background or undergo training, as appropriate, to identify newly discovered sites. Should the finds be significant, an archaeologist may need to be appointed to determine appropriate mitigation measures. 7. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on: <ol style="list-style-type: none"> a. Heritage; b. Graves; c. Archaeological finds; and d. Historical Structures. 8. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted. 9. Upon the accidental discovery of archaeological material, a buffer of at least 20 meters should be implemented. 	

	<ol style="list-style-type: none"> 10. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures. 11. Feedback reports should be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. 12. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA. 13. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed. 14. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist. 15. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made. 16. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process. 17. In the case where a grave is identified during construction the following measures must be taken: <ul style="list-style-type: none"> • Upon the accidental discovery of graves, a buffer of at least 50 meters should be implemented. • If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied for from SAHRA (Section 36 of the NHRA) and other relevant authorities (National Health Act and its 	
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	<p>regulations). The local South African Police Services must immediately be notified of the find.</p> <ul style="list-style-type: none"> • Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed. 	
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3.4.20 Community Engagement

Table 30: Community Engagement

IMPACT	COMMUNITY ENGAGEMENT This section deals with surrounding community and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	EO / ECO / SO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. A communication guideline to be drafted and agreed upon with authority representatives and affected communities. 2. Open and transparent community engagement to be followed as culturally appropriate. 3. Records (written) are to be kept of all community engagements (e.g. complaints, resolutions, etc.). 	
	SITE SPECIFIC MITIGATION MEASURES	
	<ol style="list-style-type: none"> 4. Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers. 	

	<p>5. Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads).</p> <p>6. Local small businesses should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation.</p>	
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3.4.21 Visual Impact

Table 31: Visual Impact

IMPACT	VISUAL This section deals with visual issues and actions that need to be implemented during construction	RESPONSIBILITY
PHASE	CONSTRUCTION	MC / EO / ECO
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION METHOD STATEMENT /	<ol style="list-style-type: none"> 1. Construction activities must not occur at night and lighting should only be erected where absolutely necessary. 2. Construction traffic must stick to designated routes or access roads. 3. Construction areas are to be kept clean and tidy. 4. Measures must be taken to suppress dust arising from construction activities 5. Labour being transported to the site must take cognisance of litter and waste concerns. 6. Equipment being transported to the site must be covered with tarps should they be fines etc. 7. Topsoil stockpiles must be well managed and seeded when possible if not utilised within three months 	

	<p>8. It is recommended that equipment be stored discreetly so as not to increase visual impacts</p> <p>9. Construction must be conducted in the shortest possible time in order to reduce visual impacts.</p>	
	SITE SPECIFIC MITIGATION MEASURES	
	<p>10. Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.</p> <p>11. Maintain a neat construction site by removing rubble and waste materials regularly.</p> <p>12. Make use of existing gravel access roads where possible.</p> <p>13. Ensure that dust suppression techniques are implemented on all access roads.</p> <p>14. All reinstated cable trenches should be re-vegetated with the same vegetation that existing prior to the cable being laid.</p> <p>15. The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.</p>	

3.5 Operation Phase

3.5.1 Construction Site Decommissioning

Table 32: Construction Site Decommissioning

IMPACT	CONSTRUCTION SITE DECOMMISSIONING	RESPONSIBILITY
PHASE	OPERATION	MC / PROJECT COMPANY / ECO / EO/ ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<p>Removal of equipment</p> <ol style="list-style-type: none"> 1. All structures comprising the construction camp are to be removed from site. 2. The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc., and these shall be cleaned up. 3. All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area shall be top soiled and regressed using the guidelines set out in the re-vegetation that forms part of this document. <p>Temporary services</p> <ol style="list-style-type: none"> 4. The Contractor must arrange the cancellation of all temporary services. 5. Temporary roads must be closed and access across these, blocked. 6. All areas where temporary services were installed are to be rehabilitated to the satisfaction of the ECO. <p>Associated infrastructure</p> <ol style="list-style-type: none"> 7. Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the Engineer. 8. All surfaces hardened due to construction activities are to be ripped and imported material thereon removed. 	

	<p>9. All rubble is to be removed from the site to an approved disposal site as approved by the Engineer. Burying of rubble on site is prohibited.</p> <p>10. The site is to be cleared of all litter.</p> <p>11. The Contractor is to check that all watercourses are free from building rubble, spoil materials and waste materials.</p> <p>12. Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Engineer.</p> <p>13. All residual stockpiles must be removed to spoil or spread on site as directed by the Engineer.</p> <p>14. All leftover building materials must be returned to the depot or removed from the site.</p> <p>15. The Contractor must repair any damage that the construction works has caused to neighbouring properties, specifically, but not limited to, damage caused by poor storm water management.</p> <p>Rehabilitation plan</p> <p>16. Rehabilitate and re-vegetate cleared areas with indigenous plant species.</p>	
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3.5.2 Operation and Maintenance

Table 33: Operation and Maintenance

IMPACT	OPERATION AND MAINTENANCE	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	Maintenance 1. All applicable standards, legislation, policies and procedures must be adhered to during operation.	

	<p>2. Regular ground inspection of the energy facilities must take place to monitor their status.</p> <p>Public awareness</p> <p>3. The emergency preparedness plan must be ready for implementation at all times should an emergency situation arise.</p>	
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3.5.3 Surface and Groundwater

Table 34: Surface and Groundwater

IMPACT	SURFACE AND GROUNDWATER	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<p>Surface water</p> <ol style="list-style-type: none"> 1. Correct drainage of the site should ensure that contaminants do not impact upon surface water. 2. The stormwater system on the proposed site needs to be regularly maintained to ensure effective working. <p>Monitoring and Reporting</p> <ol style="list-style-type: none"> 3. Specific activities that should be monitored include: <ul style="list-style-type: none"> ▪ Erosion potential (specifically in and around roads and storm-water discharge points). ▪ Stormwater management and design ▪ Identified problem areas 	
	SITE SPECIFIC MITIGATION MEASURES	

	<ol style="list-style-type: none"> 4. Access roads will have to be regularly monitored and checked for erosion. Monitoring should be conducted on a monthly basis. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion and rehabilitation measures will need to be employed. 5. Where erosion begins to take place, this must be dealt with immediately to prevent severe erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified surface water specialist must be obtained in this respect. 6. Any hardstand area, building or substation inside or within 100m proximity to a surface water resource must have energy dissipating structures on the perimeter of the structures to prevent increased run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft structures such as grass blocks for example. 7. Alternatively, a suitable operational storm water management design or plan must account for and implement the use of appropriate alternative structures or devices that will prevent increased run-off entering adjacent areas or surface water resources. 	
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3.5.4 Biodiversity

Table 35: Biodiversity

IMPACT	BIODIVERSITY (FAUNA AND FLORA)	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		

MITIGATION	<p>Vegetation</p> <ol style="list-style-type: none"> 1. Indigenous vegetation must be maintained and all exotics removed as they appear and disposed of appropriately. 2. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction. 3. Vegetative re-establishment shall, as far as possible, make use of indigenous or locally occurring plant varieties within a 20-metre radius of the site. 4. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas during and following rehabilitation. <p>Other fauna</p> <ol style="list-style-type: none"> 5. No faunal species must be harmed by maintenance staff during any routine maintenance at the development. 	
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3.5.5 Waste Management

Table 36: Waste Management

IMPACT	WASTE MANAGEMENT	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<p><i>Recycling and litter management</i></p> <ol style="list-style-type: none"> 1. The site should be kept clear of litter at all times. 2. Solid waste separation and recycling should take place for the duration of the operational phase for the development at the administration block. 	

	<ol style="list-style-type: none">3. All waste must be removed promptly to ensure that it does not attract vermin or produce odours.4. In house treatment procedures must be followed strictly.5. Solid waste should be collected on a regular basis.6. Package treatment plant must be regularly serviced.	
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3.5.6 Health and Safety

Table 37: Health and Safety

IMPACT	HEALTH AND SAFETY	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<p>Emergency evacuation plan</p> <ol style="list-style-type: none"> 1. Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency. <p>Maintenance</p> <ol style="list-style-type: none"> 2. The solar PV energy facility is to be regularly maintained. A maintenance schedule must be drawn up and records of all maintenance kept. <p>Fire safety</p> <ol style="list-style-type: none"> 3. Firefighting equipment in the form of fire hydrants or fire extinguishers must be available on the site. These must be regularly maintained by an appropriate company. <p>Storage and handling of hazardous waste</p> <ol style="list-style-type: none"> 4. Transformer oil containers must be regularly maintained to ensure that leaks do not occur. 5. A spill kit needs to be kept on site to address any unforeseen spillages. 6. Transport of all hazardous substances must be in accordance with the relevant legislation. 7. The bund wall surrounding the transformer oil containers must be regularly maintained to ensure that any spills are completely contained. 	

3.5.7 Visual Impact

Table 38: Visual Impact

IMPACT	VISUAL IMPACT	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<p><i>Maintenance and lighting</i></p> <ol style="list-style-type: none"> 1. Lighting must be kept to a minimum and restricted to low level, downward facing lights to reduce light spill; 2. Lighting must be inward and downward pointing to reduce glare in surrounding areas. 3. The solar PV energy facility area and surrounds must be kept clean, tidy and well maintained to reduce negative visual impacts; 4. Rehabilitation of surrounding areas must take place with indigenous species; 5. Surrounding roads must be well maintained; 6. Regular maintenance of exteriors and associated infrastructure must be undertaken. 	
	SITE SPECIFIC MITIGATION MEASURES	
	<ol style="list-style-type: none"> 7. If the operations and maintenance buildings are unstaffed they should not be illuminated at night. 8. 	

3.5.8 Avifauna

Table 39: Avifauna

IMPACT	AVIFAUNA	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. Once the solar PV energy facility has been constructed monitoring should be implemented to assess mortalities. 2. Maintenance staff should not be allowed to access other parts of the property unless it is necessary project related work. 3. If actual displacement levels of priority species prove to be high, appropriate off-sets should be considered. 	
SITE SPECIFIC MITIGATION MEASURES		
	<ol style="list-style-type: none"> 4. An avifaunal specialist must be appointed to oversee all aspects of operational phase monitoring (including carcass searches) and assist with the on-going management of bird impacts that may emerge as the monitoring programme progresses. Formal operational phase monitoring should be implemented once the solar arrays have been constructed. The purpose of this would be to establish to what extent displacement of priority species have taken place. The exact time when operational phase monitoring should commence, will depend on the construction schedule, and will be agreed upon with the site operator once these timelines have been finalised. 5. As an absolute minimum, operational phase monitoring should be undertaken for the first two years of operation, and then repeated again in year 5, and again every five years thereafter. This is necessary to account for inter-annual variations in avifaunal activity as the result of varying rainfall patterns which can be highly erratic in this arid habitat. The exact scope and nature of the operational phase monitoring will be informed by the results of the monitoring on an ongoing basis and the EMPr will be updated accordingly. 	

	<ol style="list-style-type: none"> 6. Carcass searches should be implemented to search the ground between arrays of solar panels on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. Searches should be done on foot. Searches should be conducted randomly or at systematically selected arrays of solar panels to the extent that equals 33% or more of the project area. Detection trials should be integrated into the searches. 7. Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, including minor modifications of panel and mirror design to reduce the illusory characteristics of solar panels. What is considered to be significant will have to be established on a species specific basis by the avifaunal specialist, in consultation with Birdlife South Africa. 8. The exact protocol to be followed for the carcass searches and operational phase monitoring must be compiled by the avifaunal specialist in consultation with the plant operator and Environmental Control Officer before the commencement of operations. 9. The 132kV grid connection should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the frequency of inspections will be informed by the results of the first two years. 10. The detailed protocol to be followed for the inspections should be compiled by the avifaunal specialist prior to the first inspection. 11. The proposed transmission line for evacuation of the electricity generated by the PVs should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, alternating black and white. See the avifaunal specialist report for the type of BFD which is recommended. 	
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3.5.9 Social

Table 40: Social

IMPACT	SOCIAL	RESPONSIBILITY
PHASE	OPERATION	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
SITE SPECIFIC MITIGATION MEASURES		
MITIGATION	<p>12. In order to improve the chances of skills being developed during the operational period it is recommended that vocational skills transfer/training programmes be developed and knowledge sharing among employees encouraged.</p> <p>13. It is recommended that the project owner develops practical Socio-Economic Development (SED) and Enterprise Development (ED) programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.</p>	

3.6 Decommissioning phase

The mitigation measures presented below are of relevance to the decommissioning of the solar PV energy facility. Furthermore, mitigation measures implemented during construction with regards to the construction camp and equipment, and social impacts, will remain the same for the decommissioning phase when a construction camp will need to be established again.

3.6.1 Ongoing Stakeholder involvement

This is the process that is recommended when the proposed solar PV energy facility is decommissioned.

Table 41: Ongoing Stakeholder involvement

IMPACT	ONGOING STAKEHOLDER INVOLVEMENT	RESPONSIBILITY
PHASE	DECOMMISSIONING	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. Community to be notified, as culturally appropriate, timeously of the planned decommissioning, e.g.: <ul style="list-style-type: none"> ▪ Proposed decommissioning start date; and ▪ Process to be followed. 2. Recommend that a meeting with community leader(s) be held before decommissioning commence to inform them: <ul style="list-style-type: none"> ▪ What activities will take place during the decommissioning phase. ▪ How these activities will impact upon the communities and/or their properties. ▪ Regarding the timeframes of scheduled activities 3. Regular interaction between BioTherm and community leader(s) during the decommissioning phase 4. A reporting office/ channel to be established should community members experience problems with contractors/ sub-contractors during the decommissioning phase. 5. A register to be kept of problems reported by community members and the steps taken to address / resolve it. 	

3.6.2 Community health and safety

Table 42: Community health and safety

IMPACT	COMMUNITY HEALTH AND SAFETY	RESPONSIBILITY
PHASE	DECOMMISSIONING	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. Demarcated routes to be established for construction vehicles to ensure the safety of communities, especially in terms of road safety and communities to be informed of these demarcated routes. 2. Where dust is generated by trucks passing on gravel roads, dust mitigation to be enforced. 3. Any infrastructure that would not be decommissioned must be appropriately locked and/or fenced off to ensure that it does not pose any danger to the community. 	

3.6.3 Waste Management

Table 43: Waste Management

IMPACT	WASTE MANAGEMENT	RESPONSIBILITY
PHASE	DECOMMISSIONING	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. All decommissioned equipment must be removed from site and disposed of at a registered land fill. Records of disposal must be kept. 2. Solar panels must be returned to the manufacturer or relevant recycling agent to be recycled. 	

3.6.4 Surface and Groundwater

Table 44: Surface and Groundwater

IMPACT	SURFACE AND GROUNDWATER	RESPONSIBILITY
PHASE	DECOMMISSIONING	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. Removal of any historically contaminated soil as hazardous waste must be undertaken. 2. Removal of hydrocarbons and other hazardous substances by a suitable contractor to reduce contamination risks must be undertaken. 3. Removal of all substances which can result in groundwater (or surface water) contamination must be undertaken. 4. Re-vegetation of exposed soil surfaces to ensure no erosion in these areas is to be undertaken. 	

3.6.5 Biodiversity

Table 45: Biodiversity

IMPACT	BIODIVERSITY	RESPONSIBILITY
PHASE	DECOMMISSIONING	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	<ol style="list-style-type: none"> 1. Rehabilitation of exposed surfaces with indigenous species. 	

	<ul style="list-style-type: none"> 2. Adherence to surface and groundwater mitigation measures to prevent secondary impacts on biodiversity. 3. Prevention of expansion of current footprints. 	
	SITE SPECIFIC MITIGATION	
	<ul style="list-style-type: none"> 4. De-commissioning activity should be restricted to the immediate footprint of the infrastructure. 5. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. 6. Measures to control noise and dust should be applied according to current best practice in the industry. 7. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. 8. The recommendations of the ecological, avifaunal and botanical specialist studies must be strictly implemented, especially as far as limitation of the de-commissioning footprint and rehabilitation of disturbed areas is concerned. 	

3.6.6 Air Quality

Table 46: Air Pollution

IMPACT	AIR POLLUTION	RESPONSIBILITY
PHASE	DECOMMISSIONING	PROJECT COMPANY, ESKOM
ENVIRONMENTAL MANAGEMENT PROGRAMME		
MITIGATION	1. Regular maintenance of equipment to ensure reduced exhaust emissions	

4 MANAGEMENT PLANS

4.1 Alien Invasive Management Plan

Table 47: Alien Invasive Management Plan

ALIEN INVASIVE MANAGEMENT PROGRAMME	
MITIGATION MEASURES	<ol style="list-style-type: none"> 1. Stockpiles should be kept clear of weeds and alien vegetation growth by regular weeding. 2. Alien vegetation and the spread of exotic species on the site will need to be controlled. 3. The contractor should be responsible for implementing a programme of weed control (particularly in areas where soil has been disturbed); and grassing of any remaining stockpiles to prevent weed invasion. 4. Herbicide use shall only be allowed according to contract specifications. The application shall be according to set specifications and under supervision of a qualified technician. The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used. 5. The use of pesticides and herbicides on the site must be discouraged as these can impact on important pollinator species of indigenous vegetation. 6. Six monthly checks of the area should take place for the emergence of invader species. 7. Mitigation measures mentioned for the construction phase above must be implemented for any maintenance of the development that may be undertaken during the operation phase. 8. Correct rehabilitation with locally indigenous species. 9. Monitoring programme to ensure that rehabilitation efforts are successful to ensure that risks such as erosion, spread of exotic species and the edge effect are avoided. 10. Constant maintenance of the area to ensure re-colonisation of floral species. 11. Regular removal of alien species which may jeopardise the proliferation of indigenous species.

4.2 Plant Rescue Protection Plan

Table 48: Plant Rescue Protection Plan

PLANT RESCUE PROTECTION PLAN	
MITIGATION MEASURES	<ol style="list-style-type: none"> 1. Vegetation clearing should only commence after the walk down has been conducted and necessary permits obtained. 2. Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. 3. Vegetation removal must be limited to the construction site 4. Vegetation to be removed as it becomes necessary rather than removal of all vegetation throughout the site in one step 5. Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected. 6. No vegetation to be used for firewood. 7. Gathering of firewood, fruit, muti plants, or any other natural material onsite or in areas adjacent to the site is prohibited unless with prior approval of the ECO. 8. Only vegetation within the study area must be removed. 9. Vegetation removal must be phased in order to reduce impact of construction. 10. Construction site office and laydown areas must be clearly demarcated and no encroachment must occur beyond demarcated areas. 11. All natural areas impacted during construction must be rehabilitated with locally indigenous plant species. 12. A buffer zone should be established in areas where construction will not take place to ensure that construction activities do not extend into these areas. 13. Construction areas must be well demarcated and these areas strictly adhered to. 14. The use of pesticides and herbicides in the study area must be discouraged as these impacts on important pollinator species of indigenous vegetation. 15. Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora. 16. Soil stockpiles must not become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation in the soil.

4.3 Re-Vegetation and Habitat Rehabilitation Plan

Table 49: Re-Vegetation and Habitat Rehabilitation Plan

RE-VEGETATION AND HABITAT REHABILITATION PLAN	
MITIGATION MEASURES	<ol style="list-style-type: none"> 1. Re-vegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment 2. Re-vegetation of disturbed surfaces should occur immediately after construction activities are completed. This should be done through seeding with indigenous grasses. 3. All damaged areas shall be rehabilitated upon completion of the contract 4. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction. 5. All natural areas impacted during construction must be rehabilitated with locally indigenous species typical of the representative botanical unit. 6. Rehabilitation must take place in a phased approach as soon as possible. 7. Rehabilitation process must make use of species indigenous to the area. Seeds from surrounding seed banks can be used for re-seeding. 8. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas. 9. Planting of indigenous tree species in areas not to be cultivated or built on must be encouraged. 10. Habitat destruction should be limited to what is absolutely necessary for the construction of the infrastructure, including the construction of new roads. In this respect, the recommendations from the Ecological Specialist Study should be applied strictly. Personnel should be adequately briefed on the need to restrict habitat destruction, and must be restricted to the actual construction area. 11. Monitoring programme to ensure that rehabilitation efforts are successful to ensure that risks such as erosion, spread of exotic species and the edge effect are avoided.

4.4 Open Space Management Plan

Table 50: Open Space Management Plan

OPEN SPACE MANAGEMENT PLAN

<p>MITIGATION MEASURES</p>	<ol style="list-style-type: none"> 1. A buffer zone should be established in areas where construction will not take place to ensure that construction activities do not extend into these areas. 2. Vehicle movement should be restricted to authorised access roads. 3. Before construction begins, all areas to be developed must be clearly demarcated with fencing or orange construction barrier where applicable. 4. All Construction Camps are to be fenced off in such a manner that unlawful entry is prevented and access is controlled. Signage shall be erected at all access points in compliance with all applicable occupational health and safety requirements. All access points to the Construction Camp should be controlled by a guard or otherwise monitored, to prevent unlawful access. 5. The contractor and ECO must ensure compliance with conditions described in the EA. 6. Records of compliance/ non-compliance with the conditions of the authorisation must be kept and be available on request. 7. Records of all environmental incidents must be maintained and a copy of these records be made available to provincial department on request throughout the project execution. 8. Site establishment shall take place in an orderly manner and all required amenities shall be installed at camp sites before the main workforce move onto site. 9. All construction equipment must be stored within this construction camp. 10. An area for the storage of hazardous materials must be established that conforms to the relevant safety requirements and that provides for spillage prevention and containment 11. The Contractor must provide sufficient ablution facilities, in the form of portable / VIP toilets, at the Construction Camps, and shall conform to all relevant health and safety standards and codes. No pit latrines, French drain systems or soak away systems shall be allowed and toilets may not be situated within 100 meters of any surface water body or 1:100 year flood line. A sufficient number of toilets shall be provided to accommodate the number of personnel working in the area. 12. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed. 13. No fires will be allowed and the Contractor must make alternative arrangements for heating. LP Gas may be used, provided that all required safety measures are in place. The Contractor shall take specific measures to prevent the spread of veld fires, caused by activities at the campsites. These measures may include
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	<p>appropriate instruction of employees about fire risks and the construction of firebreaks around the site perimeter.</p> <p>14. Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts.</p> <p>15. Project manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks.</p> <p>16. Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training.</p> <p>17. Staff must be trained in the hazards and required precautionary measures for dealing with these substances</p>
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4.5 Erosion Management Plan

Table 51: Erosion Management Plan

EROSION MANAGMENT PLAN	
MITIGATION MEASURES	<ol style="list-style-type: none"> 1. To prevent erosion, material stockpiled for long periods (2 weeks) should be retained in a bermed area. 2. Areas which are not to be constructed on within two months must not be cleared to reduce erosion risks. 3. The area to be cleared must be clearly demarcated and this footprint strictly maintained. 4. The necessary silt fences and erosion control measures must be implemented in areas where these risks are more prevalent. 5. Wind screening and stormwater control should be undertaken to prevent soil loss from the site. 6. The use of silt fences and sand bags must be implemented in areas that are susceptible to erosion. 7. Other erosion control measures that can be implemented are as follows: <ol style="list-style-type: none"> a. Brush packing with cleared vegetation b. Mulch or chip packing c. Planting of vegetation d. Hydroseeding / hand sowing 8. Sensitive areas need to be identified prior to construction so that the necessary precautions can be implemented.

	<ol style="list-style-type: none"> 9. All erosion control mechanisms need to be regularly maintained. 10. Seeding of topsoil and subsoil stockpiles to prevent wind and water erosion of soil surfaces. 11. Retention of vegetation where possible to avoid soil erosion 12. Vegetation clearance should be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time. 13. Re-vegetation of disturbed surfaces should occur immediately after construction activities are completed. This should be done through seeding with indigenous grasses. 14. No impediment to the natural water flow other than approved erosion control works is permitted. 15. To prevent stormwater damage, the increase in stormwater run-off resulting from construction activities must be estimated and the drainage system assessed accordingly. 16. Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion.
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4.6 Storm Water Management Plan

A Storm Water Management Plan cannot be compiled until the detailed designs are complete, which will only take place if the solar PV energy facility is authorised by the DEA and issued with a license by the DoE. It is stipulated in the in this EMP that a Storm Water Management Plan must be compiled before any construction commences and implemented during the construction phase. This plan must indicate how all surface runoff generated as a result of the project and associated activities (during both the construction and operational phases) will be managed (e.g. artificial wetlands/stormwater and flood retention ponds) prior to entering any natural drainage system or wetland and how surface water runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.

4.7 Monitoring System

Table 52: Monitoring System

MONITORING SYSTEM	
MITIGATION MEASURES	1. Monitoring should be undertaken to evaluate the success of mitigation measures. Monitoring methods must be in accordance with features that need to be monitored

2. An area for the storage of hazardous materials must be established that conforms to the relevant safety requirements and that provides for spillage prevention and containment.
3. Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control.
4. Spillage packs must be available at construction areas.
5. Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). These pollution prevention measures for storage should include a bund wall high enough to contain at least 110% of any stored volume, and this should be sited away from drainage lines in a site with the approval of the Project Manager. The bund wall must be high enough to contain 110% of the total volume of the stored hazardous material with an additional allocation for potential storm water events.
6. These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources.
7. An approved waste disposal contractor must be employed to remove and recycle waste oil, if practical. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.
8. Where contamination of soil is expected, analysis must be done prior to disposal of soil to determine the appropriate disposal route. Proof from an approved waste disposal site where contaminated soils are dumped if and when a spillage / leakage occur should be attained and given to the project manager.
9. Topsoil and subsoil to be protected from contamination. This should be monitored on a monthly basis by a visual inspection of diesel/oil spillage and pollution prevention facilities.
10. Concrete and chemicals must be mixed on an impervious surface and provisions should be made to contain spillages or overflows into the soil.
11. Relevant departments and other emergency services should be contacted in order to deal with spillages and contamination of aquatic environments.
12. Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora.

4.8 Traffic and Transportation Management Plan

Table 53: Traffic and Transportation Management Plan

TRAFFIC MANAGEMENT PLAN	
MITIGATION MEASURES	<ol style="list-style-type: none"> 1. All vehicles used during the transport of materials and in the construction activities are required to be roadworthy per the National Road Traffic Act (NRTA) and display all pertinent certificates as required. 2. For any vehicles that operate under an exemption permit, a roadworthy certificate may not be required; however the exemption permit will require that the vehicle is fit for operation on public roadways. 3. All vehicles travelling to and from the site shall adhere to all laws imposed by the law enforcement agencies, and shall comply with any requests made by the law enforcement officials. 4. For each convoy of abnormal vehicles/loads a designated safety officer shall be nominated. 5. All abnormal vehicles and loads to be transported are required to have a valid permit before any trip is begun. 6. The route should be assessed to determine if any structures or vegetation need to be temporarily or permanently relocated so as to avoid damage to the load as well as public and private property during the trips. 7. A designated transport coordination manager should be appointed to oversee and manage the traffic safety officers. Additionally, the designated transport coordination manager should inform and keep up-to-date the interested and affected parties of all the activities taking place that may have a direct impact on them. 8. A traffic safety officer shall be nominated to make all the necessary arrangements to maintain the required traffic measures for the duration of the project as outlined in the "Standard Specifications for Road and Bridge Works for State Road Authorities," 1998 edition. The safety officer shall liaise daily with the transportation coordination manager to keep them apprised of the state of all the traffic arrangements. 9. All construction vehicles that are entering the site shall also be available via radio or telephone communication to the transport coordination manager. So that in the event of an emergency, all vehicles can be accounted for. 10. All vehicles shall comply with the posted speed limits on public roads as well as the speed limits within the development. For additional speed limits that are imposed on the construction traffic, refer to the South African Road Traffic Signs Manual (SARTSM), Volume 2, June 1999 for the restrictions.

	<ol style="list-style-type: none"> 11. All construction traffic shall comply with the legal load requirements as outlined in the National Road Traffic Act and National Road Traffic Regulations. 12. Construction traffic entering the site along public roads should be limited to times when peak hour traffic can be avoided. The peak traffic occurs during 7h00 to 8h30, and 16h00 to 17h30. Construction traffic can also be restricted further to avoid travelling on public holidays, long weekends, or at night. 13. The South African Road Traffic Signs Manual (SARTSM), Volume 2, June 1999 is to be used for all traffic during the construction activities of the proposed project. 14. During periods of high construction traffic entering and exiting the site, it is recommended that flagmen help direct the traffic. This will enable the safe movement of construction and public traffic at the entrance and reduce the number of potential conflicts.
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4.9 Fire Management Plan

Table 54: Fire Management Plan

FIRE MANAGEMENT PLAN	
MITIGATION MEASURES	<ol style="list-style-type: none"> 1. All Construction Camps shall be provided with portable fire extinguishing equipment, in accordance with all relevant legislation and must be readily accessible. 2. No fires will be allowed and the Contractor must make alternative arrangements for heating. LP Gas may be used, provided that all required safety measures are in place. The Contractor shall take specific measures to prevent the spread of veld fires, caused by activities at the campsites. These measures may include appropriate instruction of employees about fire risks and the construction of firebreaks around the site perimeter. 3. Fire prevention facilities must be present at all storage facilities. 4. No open fires shall be allowed on site under any circumstance. All cooking shall be done in demarcated areas that are safe and cannot cause runaway fires. 5. The Contractor shall have operational fire-fighting equipment available on site at all times. The level of firefighting equipment must be assessed and evaluated through a typical risk assessment process. 6. Fires are not to be allowed outside controlled areas. 7. Emergency numbers for local police and fire department etc. must be placed in a prominent area.

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| | <ol style="list-style-type: none">8. Firefighting equipment must be placed in prominent positions across the site where it is easily accessible. This includes fire extinguishers, a fire blanket as well as a water tank.9. All construction staff must be trained in fire hazard control and firefighting techniques. Translators are to be used where necessary.10. All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances.11. Smoking may only be conducted in demarcated areas.12. Firefighting equipment must be regularly maintained by an appropriate company. |
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5 CONCLUSION

The environmental and social impacts of the project were identified through the four project phases (pre-construction, construction, operation and decommissioning). Both positive and negative project impacts have been identified. The following section briefly describes some of the major impacts and proposed mitigation measures within each of the project phases.

5.1 Pre-Construction Phase

The first site activities before mobilization of equipment will be a survey, required for final design of solar PV energy facility foundations and other infrastructure. There will be negative impacts on land associated with the construction of camps (temporary loss) and storage of construction materials (temporary loss), and foundations for the buildings (permanent loss) and panel arrays. Expectations of improvement in livelihood among locals should be addressed through public participation. Construction contracts will include environmental monitoring and management procedures and requirements. These must be in place prior to the commencement of any construction activities. Once the final site has been selected for the solar PV energy facility and the layout plans have been finalised a detailed geotechnical investigation should be undertaken.

5.2 Construction Phase

This phase of the activity will have both positive and negative impacts. The positive impacts are employment opportunities offered to the construction workers and any other labourer who will be hired to provide their services during the construction phase. The negative impacts would include wastes generated, accidents, health and safety, air, dust and noise pollution, vegetation clearance, soil erosion, socio-environmental issues, loss of vegetation, and compaction of soil. Most of the negative impacts are minor and temporary and the significance of the impacts can be greatly reduced by the implementation of mitigation measures, which are outlined in this EMP. The contractor shall ensure that all staff have adequate protective clothing and are adequately trained.

5.3 Operational Phase

The proposed project will have minimal negative effects which mainly relates to loss of aesthetic value and habitat. The habitat that will be lost is not regarded as pristine and therefore, is not viewed as significant.

Most of the negative impacts are minor and the significance of the impacts can be greatly reduced by the implementation of mitigation measures, which are outlined in this EMPr.

5.4 Decommissioning Phase

As with any project, the facilities used in this project will have a lifetime after which they may no longer be cost effective to continue with operation. At that time, the project would be decommissioned, and the existing equipment removed.

Potential environmental impacts caused during decommissioning are those, which will be mitigated as provided by the Environmental Management Programme. These include: noise and emissions to the surrounding environment, removal of hazardous waste and substances, fire, oil spills, wastes and public safety.

The disposal of materials from the decommissioned facility is not viewed as high risk. Much of the material would be recyclable (steel structures etc.) or inert (concrete foundations, etc.). These materials would however, need to be disposed of at a formal waste disposal or recycling centre.

Based on the above information, it is unlikely that the Project will have significant adverse social and environmental impacts. Most adverse impacts will be of a temporary nature during the construction phase and can be managed to acceptable levels with implementation of the recommended mitigation measures for the Project such that the overall benefits from the Project will greatly outweigh the few adverse impacts.

All the negative impacts could be easily mitigated. Generally, the proposed solar PV energy facility will result in appreciable benefits to the people in the project area of influence and bring opportunities for development to the country.

Complaints Record Sheet

Complaints Record Sheet

COMPLAINTS RECORD SHEET	File Ref:	DATE:
	Page of
COMPLAINT RAISED BY:		
CAPACITY OF COMPLAINANT:		
COMPLAINT RECORDED BY:		
COMPLAINT:		
PROPOSED REMEDIAL ACTION:		
ECO: _____ Date: _____		
NOTES BY ECO:		
ECO: _____ Date: _____ Site Manager: _____ Date: _____		

Annexure B

Management of Soils: Guidelines

Topsoil

- Source of topsoil
 - Topsoil shall be stripped from all areas that are to be utilised during the construction period and where permanent structures and access is required. These areas will include temporary and permanent access roads, construction camps, and lay down areas. Topsoil shall be stripped after clearing of woody vegetation and before excavation or construction commences.
 - The topsoil is regarded as the top 300mm of the soil profile irrespective of the fertility appearance, structure, agricultural potential, fertility and composition of the soil.
- Topsoil stripping
 - Soil shall be stripped to a minimum depth of 150mm and maximum depth of 300mm or to the depth of bedrock where soil is shallower than 300mm. Herbaceous vegetation, overlying grass and other fine organic matter shall not be removed from the stripped soil.
 - No topsoil which has been stripped shall be buried or in any other way be rendered unsuitable for further use by mixing with spoil or by compaction using machinery.
 - Topsoil shall preferably be stripped when it is in a dry condition in order to prevent compaction.
- Topsoil stockpiling
 - The Consulting Engineer or Environmental Control Officer shall stockpile stripped topsoil in areas, which have been approved. Soil stockpiles may take the form of windrows.
 - To prevent erosion, material stockpiled for long periods (2 weeks) should be retained in a bermed area.
 - Topsoil, mulch and subsoil stockpiles must be placed in higher-lying areas of the site, and must not be positioned within stormwater channels or areas of ponding.
 - Topsoil stripped from different soil zones shall be stockpiled separately and clearly identified as such. Under no circumstances shall topsoil obtained from different soil zones be mixed.
 - Soil stockpiles shall not be higher than 2m or stored for a period longer than one year. The slopes of soil stockpiles shall not be steeper than 1 vertical to 2.5 horizontal.
 - No vehicles shall be allowed access onto the stockpiles after they have been placed. Topsoil stockpiles shall be clearly demarcated in order to prevent vehicle access and for later identification when required.
 - Soil stockpiles must not become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation in the soil.

- After topsoil removal has been completed, the Contractor shall apply soil conservation measures to the stockpiles where and as directed by the Consulting Engineer or Environmental Control Officer. This may include the use of erosion control fabric or grass seeding.
- Topsoil replacement
 - Topsoil shall be replaced to a minimum depth of 75mm over all areas where it has been stripped and over disused borrow pits, after construction in those areas has ceased. Topsoil placement shall follow as soon as construction in an area has ceased.
 - All areas onto which topsoil is to be spread shall be graded to the approximate original landform with maximum slopes of 1:25 and shall be ripped prior to topsoil placement. The entire area shall be ripped parallel to the contours to a minimum depth of 300mm.
 - Topsoil shall be placed in the same soil zone from which it had been stripped. However, if there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil may be brought from other soil zones at the approval of the Consulting Engineer or Environmental Control Officer.
 - Where topsoil that has been stripped by the Contractor is insufficient to provide the minimum specified depth, the Contractor shall obtain suitable substitute material from other sources at no cost to the employer. The suitability of the substitute material shall be determined by means of soil analyses, which are acceptable to the Consulting Engineer or Environmental Control Officer.
 - No vehicles shall be allowed access onto or through topsoil after it has been reinstated.
 - After topsoil reinstatement is complete, cleared and stockpiled vegetative matter shall be spread randomly by hand over the top soiled area. The vegetative material must be replaced on the areas from where it has been removed.

Annexure C

ESKOM REQUIREMENTS FOR WORK IN OR NEAR ESKOM SERVITUDES.

- 1) Eskom's rights and services must be acknowledged and respected at all times.
- 2) Eskom shall at all times retain unobstructed access to and egress from its servitudes.
- 3) Eskom's consent does not relieve the developer from obtaining the necessary statutory, land owner or municipal approvals.
- 4) The applicant will adhere to all relevant environmental legislation. Any cost incurred by Eskom as a result of non-compliance to any relevant environmental legislation will be charged to the developer.
- 5) Eskom's underground cables must be placed in sleeves encased in concrete across the width of the servitude, at the applicant's expense. This is only required in certain situations such as where frequent excavations might occur in the cable area. Materials to be used and relevant dimensions shall be determined by the internal assessor and by Project Engineering.
- 6) All underground cables in or crossing Eskom overhead sub-transmission and transmission servitudes shall be protected by concrete slabs placed 300mm above cables with danger tape markings and cable route/position indicated by standard concrete monuments.
- 7) No construction or excavation work shall be executed within 11 metres from any Eskom power line structure, and/or within 11 metres from any stay wire.
- 8) All work within Eskom's servitude areas shall comply with the relevant Eskom standards in force at the time.
- 9) If Eskom has to incur any expenditure in order to comply with statutory clearances or other regulations as a result of the developer's activities or because of the presence of his equipment or installation within the servitude restriction area, the developer shall pay such costs to Eskom on demand.
- 10) The use of explosives of any type within 500 metres of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the developer must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process. It is advisable to make application separately in this regard.

- 11) Changes in ground level may not infringe statutory ground to conductor clearances or statutory visibility clearances. After any changes in ground level, the surface shall be rehabilitated and stabilised so as to prevent erosion. The measures taken shall be to Eskom's satisfaction.
- 12) Eskom shall not be liable for the death of or injury to any person or for the loss of or damage to any property whether as a result of the encroachment or of the use of the servitude area by the developer, his/her agent, contractors, employees, successors in title, and assignees. The developer indemnifies Eskom against loss, claims or damages including claims pertaining to consequential damages by third parties and whether as a result of damage to or interruption of or interference with Eskom's services or apparatus or otherwise. Eskom will not be held responsible for damage to the developer's equipment.
- 13) No mechanical equipment, including mechanical excavators or high lifting machinery, shall be used in the vicinity of Eskom's apparatus and/or services, without prior written permission having been granted by Eskom. If such permission is granted the developer must give at least seven working days' notice prior to the commencement of work to Mr. Cyril Nuttall (Tel. 013 693 4144 Fax: 013 693 4180) at Middelburg Technical Service Centre, Eskom Distribution. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued.

Note: Where an electrical outage is required, at least fourteen work days are required to arrange it.

- 14) No work shall commence unless Eskom has received the applicant's written acceptance of the conditions specified in the letter of consent and/or permit. The applicant or his/her contractor on site must at all times be in possession of the letter of consent. Should the site agent or contractor on site not be able to produce the required approval on inspection all site activities will be stopped.
- 15) Eskom's rights and duties in the servitude shall be accepted as having prior right at all times and shall not be obstructed or interfered with.
- 16) Under no circumstances shall rubble, earth or other material be dumped within the servitude restriction area. The developer shall maintain the area concerned to Eskom's satisfaction. The developer shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom.
- 17) The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).
- 18) Equipment shall be regarded electrically live and therefore dangerous at all times.
- 19) In spite of the restrictions stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), as an additional safety precaution,

Eskom will not approve the erection of houses, or structures occupied or frequented by human beings, under the power lines or within the servitude restriction area.

- 20) Eskom may stipulate any additional requirements to eliminate any possible exposure to Customers or Public coming into contact or be exposed to any dangers of Eskom plant.
- 21) It is required of the developer to familiarise himself with all safety hazards related to Electrical plant.
- 22) Any third party servitudes encroaching on Eskom servitudes shall be registered against Eskom's title deed at the developer's own cost. If such a servitude is brought into being, its existence should be endorsed on the Eskom servitude deed concerned, while the third party's servitude deed must also include the rights of the affected Eskom servitude.
- 23) In the event of an application for the subdivision of land or rezoning it is essential that the conductor to ground clearance of an overhead line be confirmed. The conductor to ground clearance specified for land outside townships varies vastly from that inside townships. It could thus be necessary to increase the height of power lines to remain within the Regulations of the OHS Act.
- 24) Eskom (responsible professional engineer) requires:
 - Proposed design, longitudinal section included in letter of application,
 - As-built plans with co-ordinates, once constructed,
 - Ownership of the power line shall be clearly marked,
 - Where services run parallel to Eskom's, the applicant's power line will maintain a separation distance, centre line to centre line. The distance shall be determined by the internal assessor and must comply with access requirements and Occupation Health and Safety Act clearances and Eskom standards
- 25) If such permission is granted, the applicant must give at least fourteen work day's prior notice of the commencement of work to Mr. Cyril Nuttall (Tel. 013 693 4144 Fax: 013 693 4180) at Middelburg Technical Service Centre, Eskom Distribution. This allows time for arrangements to be made for supervision of and/or precautionary instructions to be issued in terms of the overhead power line construction.
- 26) Should the applicant or his contractor damage any of Eskom services during commencement of any work whatsoever, then Eskom's 24 hour Contact Centre Tel: 086 000 1414 must be dialed immediately to report the incident.

Any relocation of Eskom's services, due to the proposed prospecting, will be for the account of the Applicant. The Applicant will also be responsible for granting Eskom an alternative route for the power line. The Eskom Customer Contact Centre at 08600 37566 must be contacted in connection with any line deviation and costs.

John Geeringh (Pr Sci Nat)

Senior Environmental Advisor
Eskom GC: Land Development

And

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Appendix 9: Coordinates

**HELENA 3 OPS BUILDING & LAYDOWN AREA
COORDINATES (DD MM SS)**

DEVELOPMENT AREA	CENTRE POINT
OPS BUILDING	S30° 2' 20.228" E22° 17' 14.199"
LAYDOWN AREA	S30° 2' 33.241" E22° 17' 43.196"

**HELENA 3 PREFERRED SUBSTATION SITE
COORDINATES (DD MM SS)**

DEVELOPMENT AREA	NORTH-WEST CORNER	NORTH-EAST CORNER	CENTRE POINT	SOUTH-WEST CORNER	SOUTH-EAST CORNER
HELENA SOLAR 3 (ALT 2)	S30° 2' 12.826" E22° 17' 29.582"	S30° 2' 15.006" E22° 17' 35.633"	S30° 2' 16.435" E22° 17' 31.323"	S30° 2' 17.789" E22° 17' 26.946"	S30° 2' 20.069" E22° 17' 33.137"

HELENA SOLAR 3 PV

COORDINATES (DD MM SS)

SECTION	POINT	SOUTH	EAST
WEST	WEST_HS3_01 (NW)	S30° 1' 52.793"	E22° 16' 45.497"
WEST	WEST_HS3_02	S30° 1' 52.812"	E22° 16' 49.079"
WEST	WEST_HS3_03	S30° 1' 54.206"	E22° 16' 49.069"
WEST	WEST_HS3_04	S30° 1' 54.225"	E22° 16' 52.652"
WEST	WEST_HS3_05	S30° 1' 55.716"	E22° 16' 52.641"
WEST	WEST_HS3_06	S30° 1' 55.737"	E22° 16' 56.484"
WEST	WEST_HS3_07	S30° 1' 57.131"	E22° 16' 56.474"
WEST	WEST_HS3_08	S30° 1' 57.150"	E22° 17' 0.057"
WEST	WEST_HS3_09	S30° 1' 58.641"	E22° 17' 0.046"
WEST	WEST_HS3_010	S30° 1' 58.662"	E22° 17' 3.890"
WEST	WEST_HS3_011	S30° 2' 0.056"	E22° 17' 3.880"
WEST	WEST_HS3_012	S30° 2' 0.075"	E22° 17' 7.462"
WEST	WEST_HS3_013	S30° 2' 1.696"	E22° 17' 7.450"
WEST	WEST_HS3_014	S30° 2' 1.736"	E22° 17' 14.876"
WEST	WEST_HS3_015	S30° 2' 3.130"	E22° 17' 14.866"
WEST	WEST_HS3_016	S30° 2' 3.149"	E22° 17' 18.449"
WEST	WEST_HS3_017	S30° 2' 4.640"	E22° 17' 18.438"
WEST	WEST_HS3_018 (NE)	S30° 2' 4.660"	E22° 17' 22.020"
WEST	WEST_HS3_19	S30° 2' 7.447"	E22° 17' 22.001"
WEST	WEST_HS3_20	S30° 2' 7.427"	E22° 17' 18.418"
WEST	WEST_HS3_21	S30° 2' 10.442"	E22° 17' 18.397"
WEST	WEST_HS3_22	S30° 2' 10.423"	E22° 17' 14.814"
WEST	WEST_HS3_23	S30° 2' 13.307"	E22° 17' 14.793"
WEST	WEST_HS3_24	S30° 2' 13.286"	E22° 17' 10.950"
WEST	WEST_HS3_25	S30° 2' 19.185"	E22° 17' 10.907"
WEST	WEST_HS3_26	S30° 2' 19.166"	E22° 17' 7.325"
WEST	WEST_HS3_27	S30° 2' 25.065"	E22° 17' 7.283"
WEST	WEST_HS3_28	S30° 2' 25.045"	E22° 17' 3.700"
WEST	WEST_HS3_29	S30° 2' 30.944"	E22° 17' 3.658"
WEST	WEST_HS3_30	S30° 2' 30.883"	E22° 16' 52.387"
WEST	WEST_HS3_31	S30° 2' 33.897"	E22° 16' 52.365"
WEST	WEST_HS3_32	S30° 2' 33.877"	E22° 16' 48.783"
WEST	WEST_HS3_33 (SE)	S30° 2' 39.776"	E22° 16' 48.740"
WEST	WEST_HS3_34	S30° 2' 39.737"	E22° 16' 41.575"
WEST	WEST_HS3_35	S30° 2' 38.343"	E22° 16' 41.585"
WEST	WEST_HS3_36 (SW)	S30° 2' 38.324"	E22° 16' 38.002"
WEST	WEST_HS3_37	S30° 2' 25.132"	E22° 16' 38.098"
WEST	WEST_HS3_38	S30° 2' 25.152"	E22° 16' 41.680"
WEST	WEST_HS3_39	S30° 2' 7.455"	E22° 16' 41.809"
WEST	WEST_HS3_40	S30° 2' 7.475"	E22° 16' 45.391"
EAST	EAST_HS3_01 (NW)	S30° 2' 12.815"	E22° 17' 22.476"
EAST	EAST_HS3_02 (NE)	S30° 2' 12.834"	E22° 17' 26.058"
EAST	EAST_HS3_03	S30° 2' 19.997"	E22° 17' 26.007"
EAST	EAST_HS3_04	S30° 2' 20.016"	E22° 17' 29.590"

EAST	EAST_HS3_05 (SE)	S30° 2' 27.309"	E22° 17' 29.538"
EAST	EAST_HS3_06	S30° 2' 27.231"	E22° 17' 15.207"
EAST	EAST_HS3_07	S30° 2' 28.625"	E22° 17' 15.197"
EAST	EAST_HS3_08 (SW)	S30° 2' 28.605"	E22° 17' 11.615"
EAST	EAST_HS3_09	S30° 2' 24.425"	E22° 17' 11.645"
EAST	EAST_HS3_010	S30° 2' 24.444"	E22° 17' 15.227"
EAST	EAST_HS3_011	S30° 2' 19.939"	E22° 17' 15.260"
EAST	EAST_HS3_012	S30° 2' 19.958"	E22° 17' 18.842"
EAST	EAST_HS3_013	S30° 2' 15.680"	E22° 17' 18.873"
EAST	EAST_HS3_014	S30° 2' 15.699"	E22° 17' 22.455"
SOUTH	SOUTH_HS3_01 (NW)	S30° 2' 38.552"	E22° 17' 18.228"
SOUTH	SOUTH_HS3_02 (NE)	S30° 2' 38.669"	E22° 17' 39.985"
SOUTH	SOUTH_HS3_03	S30° 2' 47.355"	E22° 17' 39.924"
SOUTH	SOUTH_HS3_04	S30° 2' 47.336"	E22° 17' 36.341"
SOUTH	SOUTH_HS3_05	S30° 2' 56.119"	E22° 17' 36.279"
SOUTH	SOUTH_HS3_06	S30° 2' 56.100"	E22° 17' 32.696"
SOUTH	SOUTH_HS3_07	S30° 3' 5.013"	E22° 17' 32.632"
SOUTH	SOUTH_HS3_08	S30° 3' 4.973"	E22° 17' 25.205"
SOUTH	SOUTH_HS3_09 (SE)	S30° 3' 7.858"	E22° 17' 25.185"
SOUTH	SOUTH_HS3_10 (SW)	S30° 3' 7.701"	E22° 16' 56.259"
SOUTH	SOUTH_HS3_11	S30° 2' 56.130"	E22° 16' 56.343"
SOUTH	SOUTH_HS3_12	S30° 2' 56.150"	E22° 16' 59.925"
SOUTH	SOUTH_HS3_13	S30° 2' 45.746"	E22° 17' 0.000"
SOUTH	SOUTH_HS3_14	S30° 2' 45.765"	E22° 17' 3.583"
SOUTH	SOUTH_HS3_15	S30° 2' 41.357"	E22° 17' 3.615"
SOUTH	SOUTH_HS3_16	S30° 2' 41.377"	E22° 17' 7.198"
SOUTH	SOUTH_HS3_17	S30° 2' 39.886"	E22° 17' 7.208"
SOUTH	SOUTH_HS3_18	S30° 2' 39.945"	E22° 17' 18.218"

HELENA SOLAR POWER LINE CORRIDOR

APPROX CENTRE LINE COORDINATES AT 250M INTERVALS (DD MM SS)

POINT	SOUTH	EAST
1	S30° 1' 18.687"	E22° 17' 55.913"
2	S30° 1' 26.644"	E22° 17' 54.062"
3	S30° 1' 34.601"	E22° 17' 52.211"
4	S30° 1' 42.558"	E22° 17' 50.359"
5	S30° 1' 50.506"	E22° 17' 48.464"
6	S30° 1' 58.378"	E22° 17' 46.182"
7	S30° 2' 6.250"	E22° 17' 43.901"
8	S30° 2' 11.691"	E22° 17' 47.207"
9	S30° 2' 14.826"	E22° 17' 55.814"
10	S30° 2' 17.961"	E22° 18' 4.421"
11	S30° 2' 21.096"	E22° 18' 13.028"
12	S30° 2' 24.230"	E22° 18' 21.635"
13	S30° 2' 27.365"	E22° 18' 30.243"
14	S30° 2' 30.499"	E22° 18' 38.850"
15	S30° 2' 33.633"	E22° 18' 47.458"
16	S30° 2' 36.767"	E22° 18' 56.066"
17	S30° 2' 34.642"	E22° 19' 4.733"
18	S30° 2' 31.655"	E22° 19' 13.410"
19	S30° 2' 28.381"	E22° 19' 21.838"
20	S30° 2' 21.930"	E22° 19' 27.502"
21	S30° 2' 15.478"	E22° 19' 33.165"
22	S30° 2' 9.026"	E22° 19' 38.829"
23	S30° 2' 2.574"	E22° 19' 44.492"
24	S30° 1' 56.122"	E22° 19' 50.155"
25	S30° 1' 49.669"	E22° 19' 55.817"
26	S30° 1' 43.217"	E22° 20' 1.480"
27	S30° 1' 36.765"	E22° 20' 7.142"
28	S30° 1' 32.461"	E22° 20' 14.579"
29 (KRONOS SUBSTATION)	S30° 1' 29.947"	E22° 20' 22.526"

HELENA SOLAR POWER LINE CORRIDOR

APPROX CENTRE LINE COORDINATES AT BEND POINTS (DD MM SS)

POINT	SOUTH	EAST
1	S30° 1' 18.687"	E22° 17' 55.913"
2	S30° 1' 49.701"	E22° 17' 48.697"
3	S30° 2' 10.082"	E22° 17' 42.790"
4	S30° 2' 37.208"	E22° 18' 57.278"
5	S30° 2' 28.914"	E22° 19' 21.370"
6	S30° 1' 33.924"	E22° 20' 9.635"
7 (KRONOS SUBSTATION)	S30° 1' 29.947"	E22° 20' 22.526"

HELENA SOLAR POWER LINE CORRIDOR

ROUTE ALTERNATIVE	START POINT	MIDDLE POINT	END POINT (KRONOS SUBSTATION)
PREFERRED ASSESSMENT CORRIDOR	S30° 1' 18.687" E22° 17' 55.913"	S30° 2' 32.839" E22° 18' 45.280"	S30° 1' 29.947" E22° 20' 22.526"

LENGTH (KM)
6.830



Appendix 10: IFC Performance Standards

Overview of Performance Standards on Environmental and Social Sustainability

1. IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development, and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability, and IFC's Access to Information Policy. The Policy on Environmental and Social Sustainability describes IFC's commitments, roles, and responsibilities related to environmental and social sustainability. IFC's Access to Information Policy reflects IFC's commitment to transparency and good governance on its operations, and outlines the Corporation's institutional disclosure obligations regarding its investment and advisory services. The Performance Standards are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation in order to achieve its overall development objectives. The Performance Standards may also be applied by other financial institutions.

2. Together, the eight Performance Standards establish standards that the client¹ is to meet throughout the life of an investment by IFC:

Performance Standard 1:	Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 2:	Labor and Working Conditions
Performance Standard 3:	Resource Efficiency and Pollution Prevention
Performance Standard 4:	Community Health, Safety, and Security
Performance Standard 5:	Land Acquisition and Involuntary Resettlement
Performance Standard 6:	Biodiversity Conservation and Sustainable Management of Living Natural Resources
Performance Standard 7:	Indigenous Peoples
Performance Standard 8:	Cultural Heritage

3. Performance Standard 1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project. Performance Standards 2 through 8 establish objectives and requirements to avoid, minimize, and where residual impacts remain, to compensate/offset for risks and impacts to workers, Affected Communities, and the environment. While all relevant environmental and social risks and potential impacts should be considered as part of the assessment, Performance Standards 2 through 8 describe potential environmental and social risks and impacts that require particular attention. Where environmental or social risks and impacts

¹ The term "client" is used throughout the Performance Standards broadly to refer to the party responsible for implementing and operating the project that is being financed, or the recipient of the financing, depending on the project structure and type of financing. The term "project" is defined in Performance Standard 1.

are identified, the client is required to manage them through its Environmental and Social Management System (ESMS) consistent with Performance Standard 1.

4. Performance Standard 1 applies to all projects that have environmental and social risks and impacts. Depending on project circumstances, other Performance Standards may apply as well. The Performance Standards should be read together and cross-referenced as needed. The requirements section of each Performance Standard applies to all activities financed under the project, unless otherwise noted in the specific limitations described in each paragraph. Clients are encouraged to apply the ESMS developed under Performance Standard 1 to all their project activities, regardless of financing source. A number of cross-cutting topics such as climate change, gender, human rights, and water, are addressed across multiple Performance Standards.

5. In addition to meeting the requirements under the Performance Standards, clients must comply with applicable national law, including those laws implementing host country obligations under international law.

6. The World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) are technical reference documents with general and industry-specific examples of good international industry practice. IFC uses the EHS Guidelines as a technical source of information during project appraisal. The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. For IFC-financed projects, application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC, become project- or site-specific requirements. The General EHS Guideline contains information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors. It should be used together with the relevant industry sector guideline(s). The EHS Guidelines may be occasionally updated.

7. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternative performance level is protective of human health and the environment.

8. A set of eight Guidance Notes, corresponding to each Performance Standard, and an additional Interpretation Note on Financial Intermediaries offer guidance on the requirements contained in the Performance Standards, including reference materials, and on good sustainability practices to help clients improve project performance. These Guidance/Interpretation Notes may be occasionally updated.

Introduction

1. Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.¹ Drawing on the elements of the established business management process of “plan, do, check, and act,” the ESMS entails a methodological approach to managing environmental and social risks² and impacts³ in a structured way on an ongoing basis. A good ESMS appropriate to the nature and scale of the project promotes sound and sustainable environmental and social performance, and can lead to improved financial, social, and environmental outcomes.

2. At times, the assessment and management of certain environmental and social risks and impacts may be the responsibility of the government or other third parties over which the client does not have control or influence.⁴ Examples of where this may happen include: (i) when early planning decisions are made by the government or third parties which affect the project site selection and/or design; and/or (ii) when specific actions directly related to the project are carried out by the government or third parties such as providing land for a project which may have previously involved the resettlement of communities or individuals and/or leading to loss of biodiversity. While the client cannot control these government or third party actions, an effective ESMS should identify the different entities involved and the roles they play, the corresponding risks they present to the client, and opportunities to collaborate with these third parties in order to help achieve environmental and social outcomes that are consistent with the Performance Standards. In addition, this Performance Standard supports the use of an effective grievance mechanism that can facilitate early indication of, and prompt remediation for those who believe that they have been harmed by a client's actions.

3. Business should respect human rights, which means to avoid infringing on the human rights of others and address adverse human rights impacts business may cause or contribute to. Each of the Performance Standards has elements related to human rights dimensions that a project may face in the course of its operations. Due diligence against these Performance Standards will enable the client to address many relevant human rights issues in its project.

Objectives

- To identify and evaluate environmental and social risks and impacts of the project.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize,⁵ and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.

¹ Other stakeholders are those not directly affected by the project but that have an interest in it. These could include national and local authorities, neighboring projects, and/or nongovernmental organizations.

² Environmental and social risk is a combination of the probability of certain hazard occurrences and the severity of impacts resulting from such an occurrence.

³ Environmental and social impacts refer to any change, potential or actual, to (i) the physical, natural, or cultural environment, and (ii) impacts on surrounding community and workers, resulting from the business activity to be supported.

⁴ Contractors retained by, or acting on behalf of the client(s), are considered to be under direct control of the client and not considered third parties for the purposes of this Performance Standard.

⁵ Acceptable options to minimize will vary and include: abate, rectify, repair, and/or restore impacts, as appropriate. The risk and impact mitigation hierarchy is further discussed and specified in the context of Performance Standards 2 through 8, where relevant.

Performance Standard 1

Assessment and Management of Environmental and Social Risks and Impacts

January 1, 2012

- To promote improved environmental and social performance of clients through the effective use of management systems.
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Scope of Application

4. This Performance Standard applies to business activities with environmental and/or social risks and/or impacts. For the purposes of this Performance Standard, the term “project” refers to a defined set of business activities, including those where specific physical elements, aspects, and facilities likely to generate risks and impacts, have yet to be identified.⁶ Where applicable, this could include aspects from the early developmental stages through the entire life cycle (design, construction, commissioning, operation, decommissioning, closure or, where applicable, post-closure) of a physical asset.⁷ The requirements of this Performance Standard apply to all business activities unless otherwise noted in the specific limitations described in each of the paragraphs below.

Requirements

Environmental and Social Assessment and Management System

5. The client, in coordination with other responsible government agencies and third parties as appropriate,⁸ will conduct a process of environmental and social assessment, and establish and maintain an ESMS appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. The ESMS will incorporate the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review.

Policy

6. The client will establish an overarching policy defining the environmental and social objectives and principles that guide the project to achieve sound environmental and social performance.⁹ The policy provides a framework for the environmental and social assessment and management process, and specifies that the project (or business activities, as appropriate) will comply with the applicable laws and regulations of the jurisdictions in which it is being undertaken, including those laws implementing host country obligations under international law. The policy should be consistent with the principles of the Performance Standards. Under some circumstances, clients may also subscribe

⁶ For example, corporate entities which have portfolios of existing physical assets, and/or intend to develop or acquire new facilities, and investment funds or financial intermediaries with existing portfolios of assets and/or which intend to invest in new facilities.

⁷ Recognizing that this Performance Standard is used by a variety of financial institutions, investors, insurers, and owner/operators, each user should separately specify the business activities to which this Performance Standard should apply.

⁸ That is, those parties legally obligated and responsible for assessing and managing specific risks and impacts (e.g., government-led resettlement).

⁹ This requirement is a stand-alone, project-specific policy and is not intended to affect (or require alteration of) existing policies the client may have defined for non-related projects, business activities, or higher-level corporate activities.

January 1, 2012

to other internationally recognized standards, certification schemes, or codes of practice and these too should be included in the policy. The policy will indicate who, within the client's organization, will ensure conformance with the policy and be responsible for its execution (with reference to an appropriate responsible government agency or third party, as necessary). The client will communicate the policy to all levels of its organization.

Identification of Risks and Impacts

7. The client will establish and maintain a process for identifying the environmental and social risks and impacts of the project (see paragraph 18 for competency requirements). The type, scale, and location of the project guide the scope and level of effort devoted to the risks and impacts identification process. The scope of the risks and impacts identification process will be consistent with good international industry practice,¹⁰ and will determine the appropriate and relevant methods and assessment tools. The process may comprise a full-scale environmental and social impact assessment, a limited or focused environmental and social assessment, or straightforward application of environmental siting, pollution standards, design criteria, or construction standards.¹¹ When the project involves existing assets, environmental and/or social audits or risk/hazard assessments can be appropriate and sufficient to identify risks and impacts. If assets to be developed, acquired or financed have yet to be defined, the establishment of an environmental and social due diligence process will identify risks and impacts at a point in the future when the physical elements, assets, and facilities are reasonably understood. The risks and impacts identification process will be based on recent environmental and social baseline data at an appropriate level of detail. The process will consider all relevant environmental and social risks and impacts of the project, including the issues identified in Performance Standards 2 through 8, and those who are likely to be affected by such risks and impacts.¹² The risks and impacts identification process will consider the emissions of greenhouse gases, the relevant risks associated with a changing climate and the adaptation opportunities, and potential transboundary effects, such as pollution of air, or use or pollution of international waterways.

8. Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate:

- The area likely to be affected by: (i) the project¹³ and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;¹⁴ (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

¹⁰ Defined as the exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally.

¹¹ For greenfield developments or large expansions with specifically identified physical elements, aspects, and facilities that are likely to generate potential significant environmental or social impacts, the client will conduct a comprehensive Environmental and Social Impact Assessment, including an examination of alternatives, where appropriate.

¹² In limited high risk circumstances, it may be appropriate for the client to complement its environmental and social risks and impacts identification process with specific human rights due diligence as relevant to the particular business.

¹³ Examples include the project's sites, the immediate airshed and watershed, or transport corridors.

¹⁴ Examples include power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, construction camps, and contaminated land (e.g., soil, groundwater, surface water, and sediments).

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- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.¹⁵
- Cumulative impacts¹⁶ that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

9. In the event of risks and impacts in the project's area of influence resulting from a third party's actions, the client will address those risks and impacts in a manner commensurate with the client's control and influence over the third parties, and with due regard to conflict of interest.

10. Where the client can reasonably exercise control, the risks and impacts identification process will also consider those risks and impacts associated with primary supply chains, as defined in Performance Standard 2 (paragraphs 27–29) and Performance Standard 6 (paragraph 30).

11. Where the project involves specifically identified physical elements, aspects and facilities that are likely to generate environmental and social impacts, the identification of risks and impacts will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence.¹⁷ These include master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant. The risks and impacts identification will take account of the outcome of the engagement process with Affected Communities as appropriate.

12. Where the project involves specifically identified physical elements, aspects and facilities that are likely to generate impacts, and as part of the process of identifying risks and impacts, the client will identify individuals and groups that may be directly and differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status.¹⁸ Where individuals or groups are identified as disadvantaged or vulnerable, the client will propose and implement differentiated measures so that adverse impacts do not fall disproportionately on them and they are not disadvantaged in sharing development benefits and opportunities.

Management Programs

13. Consistent with the client's policy and the objectives and principles described therein, the client will establish management programs that, in sum, will describe mitigation and performance improvement measures and actions that address the identified environmental and social risks and impacts of the project.

¹⁵ Associated facilities may include railways, roads, captive power plants or transmission lines, pipelines, utilities, warehouses, and logistics terminals.

¹⁶ Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities. Examples of cumulative impacts include: incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.

¹⁷ The client can take these into account by focusing on the project's incremental contribution to selected impacts generally recognized as important on the basis of scientific concern or concerns from the Affected Communities within the area addressed by these larger scope regional studies or cumulative assessments.

¹⁸ This disadvantaged or vulnerable status may stem from an individual's or group's race, color, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status. The client should also consider factors such as gender, age, ethnicity, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

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14. Depending on the nature and scale of the project, these programs may consist of some documented combination of operational procedures, practices, plans, and related supporting documents (including legal agreements) that are managed in a systematic way.¹⁹ The programs may apply broadly across the client's organization, including contractors and primary suppliers over which the organization has control or influence, or to specific sites, facilities, or activities. The mitigation hierarchy to address identified risks and impacts will favor the avoidance of impacts over minimization, and, where residual impacts remain, compensation/offset, wherever technically²⁰ and financially feasible.²¹

15. Where the identified risks and impacts cannot be avoided, the client will identify mitigation and performance measures and establish corresponding actions to ensure the project will operate in compliance with applicable laws and regulations, and meet the requirements of Performance Standards 1 through 8. The level of detail and complexity of this collective management program and the priority of the identified measures and actions will be commensurate with the project's risks and impacts, and will take account of the outcome of the engagement process with Affected Communities as appropriate.

16. The management programs will establish environmental and social Action Plans,²² which will define desired outcomes and actions to address the issues raised in the risks and impacts identification process, as measurable events to the extent possible, with elements such as performance indicators, targets, or acceptance criteria that can be tracked over defined time periods, and with estimates of the resources and responsibilities for implementation. As appropriate, the management program will recognize and incorporate the role of relevant actions and events controlled by third parties to address identified risks and impacts. Recognizing the dynamic nature of the project, the management program will be responsive to changes in circumstances, unforeseen events, and the results of monitoring and review.

Organizational Capacity and Competency

17. The client, in collaboration with appropriate and relevant third parties, will establish, maintain, and strengthen as necessary an organizational structure that defines roles, responsibilities, and authority to implement the ESMS. Specific personnel, including management representative(s), with clear lines of responsibility and authority should be designated. Key environmental and social responsibilities should be well defined and communicated to the relevant personnel and to the rest of the client's organization. Sufficient management sponsorship and human and financial resources will be provided on an ongoing basis to achieve effective and continuous environmental and social performance.

¹⁹ Existing legal agreements between the client and third parties that address mitigation actions with regard to specific impacts constitute part of a program. Examples are government-managed resettlement responsibilities specified in an agreement.

²⁰ Technical feasibility is based on whether the proposed measures and actions can be implemented with commercially available skills, equipment, and materials, taking into consideration prevailing local factors such as climate, geography, demography, infrastructure, security, governance, capacity, and operational reliability.

²¹ Financial feasibility is based on commercial considerations, including relative magnitude of the incremental cost of adopting such measures and actions compared to the project's investment, operating, and maintenance costs, and on whether this incremental cost could make the project nonviable to the client.

²² Action plans may include an overall Environmental and Social Action Plan necessary for carrying out a suite of mitigation measures or thematic action plans, such as Resettlement Action Plans or Biodiversity Action Plans. Action plans may be plans designed to fill in the gaps of existing management programs to ensure consistency with the Performance Standards, or they may be stand alone plans that specify the project's mitigation strategy. The "Action plan" terminology is understood by some communities of practice to mean Management plans, or Development plans. In this case, examples are numerous and include various types of environmental and social management plans.

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18. Personnel within the client's organization with direct responsibility for the project's environmental and social performance will have the knowledge, skills, and experience necessary to perform their work, including current knowledge of the host country's regulatory requirements and the applicable requirements of Performance Standards 1 through 8. Personnel will also possess the knowledge, skills, and experience to implement the specific measures and actions required under the ESMS and the methods required to perform the actions in a competent and efficient manner.

19. The process of identification of risks and impacts will consist of an adequate, accurate, and objective evaluation and presentation, prepared by competent professionals. For projects posing potentially significant adverse impacts or where technically complex issues are involved, clients may be required to involve external experts to assist in the risks and impacts identification process.

Emergency Preparedness and Response

20. Where the project involves specifically identified physical elements, aspects and facilities that are likely to generate impacts, the ESMS will establish and maintain an emergency preparedness and response system so that the client, in collaboration with appropriate and relevant third parties, will be prepared to respond to accidental and emergency situations associated with the project in a manner appropriate to prevent and mitigate any harm to people and/or the environment. This preparation will include the identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted, response procedures, provision of equipment and resources, designation of responsibilities, communication, including that with potentially Affected Communities and periodic training to ensure effective response. The emergency preparedness and response activities will be periodically reviewed and revised, as necessary, to reflect changing conditions.

21. Where applicable, the client will also assist and collaborate with the potentially Affected Communities (see Performance Standard 4) and the local government agencies in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to ensure effective response. If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project. The client will document its emergency preparedness and response activities, resources, and responsibilities, and will provide appropriate information to potentially Affected Community and relevant government agencies.

Monitoring and Review

22. The client will establish procedures to monitor and measure the effectiveness of the management program, as well as compliance with any related legal and/or contractual obligations and regulatory requirements. Where the government or other third party has responsibility for managing specific risks and impacts and associated mitigation measures, the client will collaborate in establishing and monitoring such mitigation measures. Where appropriate, clients will consider involving representatives from Affected Communities to participate in monitoring activities.²³ The client's monitoring program should be overseen by the appropriate level in the organization. For projects with significant impacts, the client will retain external experts to verify its monitoring information. The extent of monitoring should be commensurate with the project's environmental and social risks and impacts and with compliance requirements.

23. In addition to recording information to track performance and establishing relevant operational controls, the client should use dynamic mechanisms, such as internal inspections and audits, where relevant, to verify compliance and progress toward the desired outcomes. Monitoring will normally

²³ For example, participatory water monitoring.

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include recording information to track performance and comparing this against the previously established benchmarks or requirements in the management program. Monitoring should be adjusted according to performance experience and actions requested by relevant regulatory authorities. The client will document monitoring results and identify and reflect the necessary corrective and preventive actions in the amended management program and plans. The client, in collaboration with appropriate and relevant third parties, will implement these corrective and preventive actions, and follow up on these actions in upcoming monitoring cycles to ensure their effectiveness.

24. Senior management in the client organization will receive periodic performance reviews of the effectiveness of the ESMS, based on systematic data collection and analysis. The scope and frequency of such reporting will depend upon the nature and scope of the activities identified and undertaken in accordance with the client's ESMS and other applicable project requirements. Based on results within these performance reviews, senior management will take the necessary and appropriate steps to ensure the intent of the client's policy is met, that procedures, practices, and plans are being implemented, and are seen to be effective.

Stakeholder Engagement

25. Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts.²⁴ Stakeholder engagement is an ongoing process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development.

Stakeholder Analysis and Engagement Planning

26. Clients should identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialog with all stakeholders (paragraph 34 below). Where projects involve specifically identified physical elements, aspects and/or facilities that are likely to generate adverse environmental and social impacts to Affected Communities the client will identify the Affected Communities and will meet the relevant requirements described below.

27. The client will develop and implement a Stakeholder Engagement Plan that is scaled to the project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities. Where applicable, the Stakeholder Engagement Plan will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable. When the stakeholder engagement process depends substantially on community representatives,²⁵ the client will make every reasonable effort to verify that such persons do in fact represent the views of Affected Communities and that they can be relied upon to faithfully communicate the results of consultations to their constituents.

28. In cases where the exact location of the project is not known, but it is reasonably expected to have significant impacts on local communities, the client will prepare a Stakeholder Engagement Framework, as part of its management program, outlining general principles and a strategy to identify Affected Communities and other relevant stakeholders and plan for an engagement process

²⁴ Requirements regarding engagement of workers and related grievance redress procedures are found in Performance Standard 2.

²⁵ For example, community and religious leaders, local government representatives, civil society representatives, politicians, school teachers, and/or others representing one or more affected stakeholder groups.

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compatible with this Performance Standard that will be implemented once the physical location of the project is known.

Disclosure of Information

29. Disclosure of relevant project information helps Affected Communities and other stakeholders understand the risks, impacts and opportunities of the project. The client will provide Affected Communities with access to relevant information²⁶ on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.

Consultation

30. When Affected Communities are subject to identified risks and adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them. The extent and degree of engagement required by the consultation process should be commensurate with the project's risks and adverse impacts and with the concerns raised by the Affected Communities. Effective consultation is a two-way process that should: (i) begin early in the process of identification of environmental and social risks and impacts and continue on an ongoing basis as risks and impacts arise; (ii) be based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information which is in a culturally appropriate local language(s) and format and is understandable to Affected Communities; (iii) focus inclusive²⁷ engagement on those directly affected as opposed to those not directly affected; (iv) be free of external manipulation, interference, coercion, or intimidation; (v) enable meaningful participation, where applicable; and (vi) be documented. The client will tailor its consultation process to the language preferences of the Affected Communities, their decision-making process, and the needs of disadvantaged or vulnerable groups. If clients have already engaged in such a process, they will provide adequate documented evidence of such engagement.

Informed Consultation and Participation

31. For projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation (ICP) process that will build upon the steps outlined above in Consultation and will result in the Affected Communities' informed participation. ICP involves a more in-depth exchange of views and information, and an organized and iterative consultation, leading to the client's incorporating into their decision-making process the views of the Affected Communities on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The consultation process should (i) capture both men's and women's views, if necessary through separate forums or engagements, and (ii) reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate. The client will document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the

²⁶ Depending on the scale of the project and significance of the risks and impacts, relevant document(s) could range from full Environmental and Social Assessments and Action Plans (i.e., Stakeholder Engagement Plan, Resettlement Action Plans, Biodiversity Action Plans, Hazardous Materials Management Plans, Emergency Preparedness and Response Plans, Community Health and Safety Plans, Ecosystem Restoration Plans, and Indigenous Peoples Development Plans, etc.) to easy-to-understand summaries of key issues and commitments. These documents could also include the client's environmental and social policy and any supplemental measures and actions defined as a result of independent due diligence conducted by financiers.

²⁷ Such as men, women, the elderly, youth, displaced persons, and vulnerable and disadvantaged persons or groups.

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Affected Communities, and will inform those affected about how their concerns have been considered.

Indigenous Peoples

32. For projects with adverse impacts to Indigenous Peoples, the client is required to engage them in a process of ICP and in certain circumstances the client is required to obtain their Free, Prior, and Informed Consent (FPIC). The requirements related to Indigenous Peoples and the definition of the special circumstances requiring FPIC are described in Performance Standard 7.

Private Sector Responsibilities Under Government-Led Stakeholder Engagement

33. Where stakeholder engagement is the responsibility of the host government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with the objectives of this Performance Standard. In addition, where government capacity is limited, the client will play an active role during the stakeholder engagement planning, implementation, and monitoring. If the process conducted by the government does not meet the relevant requirements of this Performance Standard, the client will conduct a complementary process and, where appropriate, identify supplemental actions.

External Communications and Grievance Mechanisms

External Communications

34. Clients will implement and maintain a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make publicly available periodic reports on their environmental and social sustainability.

Grievance Mechanism for Affected Communities

35. Where there are Affected Communities, the client will establish a grievance mechanism to receive and facilitate resolution of Affected Communities' concerns and grievances about the client's environmental and social performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project and have Affected Communities as its primary user. It should seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate and readily accessible, and at no cost and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies. The client will inform the Affected Communities about the mechanism in the course of the stakeholder engagement process.

Ongoing Reporting to Affected Communities

36. The client will provide periodic reports to the Affected Communities that describe progress with implementation of the project Action Plans on issues that involve ongoing risk to or impacts on Affected Communities and on issues that the consultation process or grievance mechanism have identified as a concern to those Communities. If the management program results in material changes in or additions to the mitigation measures or actions described in the Action Plans on issues of concern to the Affected Communities, the updated relevant mitigation measures or actions will be communicated to them. The frequency of these reports will be proportionate to the concerns of Affected Communities but not less than annually.

Introduction

1. Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental¹ rights of workers. For any business, the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. Failure to establish and foster a sound worker-management relationship can undermine worker commitment and retention, and can jeopardize a project. Conversely, through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, clients may create tangible benefits, such as enhancement of the efficiency and productivity of their operations.

2. The requirements set out in this Performance Standard have been in part guided by a number of international conventions and instruments, including those of the International Labour Organization (ILO) and the United Nations (UN).²

Objectives

- To promote the fair treatment, non-discrimination, and equal opportunity of workers.
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labor laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- To promote safe and healthy working conditions, and the health of workers.
- To avoid the use of forced labor.

Scope of Application

3. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1.

4. The scope of application of this Performance Standard depends on the type of employment relationship between the client and the worker. It applies to workers directly engaged by the client (direct workers), workers engaged through third parties to perform work related to core business

¹ As guided by the ILO Conventions listed in footnote 2.

² These conventions are:

ILO Convention 87 on Freedom of Association and Protection of the Right to Organize

ILO Convention 98 on the Right to Organize and Collective Bargaining

ILO Convention 29 on Forced Labor

ILO Convention 105 on the Abolition of Forced Labor

ILO Convention 138 on Minimum Age (of Employment)

ILO Convention 182 on the Worst Forms of Child Labor

ILO Convention 100 on Equal Remuneration

ILO Convention 111 on Discrimination (Employment and Occupation)

UN Convention on the Rights of the Child, Article 32.1

UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families

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processes³ of the project for a substantial duration (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).⁴

Direct Workers

5. With respect to direct workers, the client will apply the requirements of paragraphs 8–23 of this Performance Standard.

Contracted Workers

6. With respect to contracted workers, the client will apply the requirements of paragraphs 23–26 of this Performance Standard.

Supply Chain Workers

7. With respect to supply chain workers, the client will apply the requirements of paragraphs 27–29 of this Performance Standard.

Requirements

Working Conditions and Management of Worker Relationship

Human Resources Policies and Procedures

8. The client will adopt and implement human resources policies and procedures appropriate to its size and workforce that set out its approach to managing workers consistent with the requirements of this Performance Standard and national law.

9. The client will provide workers with documented information that is clear and understandable, regarding their rights under national labor and employment law and any applicable collective agreements, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.

Working Conditions and Terms of Employment

10. Where the client is a party to a collective bargaining agreement with a workers' organization, such agreement will be respected. Where such agreements do not exist, or do not address working conditions and terms of employment,⁵ the client will provide reasonable working conditions and terms of employment.⁶

11. The client will identify migrant workers and ensure that they are engaged on substantially equivalent terms and conditions to non-migrant workers carrying out similar work.

³ Core business processes constitute those production and/or service processes essential for a specific business activity without which the business activity could not continue.

⁴ Primary suppliers are those suppliers who, on an ongoing basis, provide goods or materials essential for the core business processes of the project.

⁵ Working conditions and terms of employment examples are wages and benefits; wage deductions; hours of work; overtime arrangements and overtime compensation; breaks; rest days; and leave for illness, maternity, vacation or holiday.

⁶ Reasonable working conditions and terms of employment could be assessed by reference to (i) conditions established for work of the same character in the trade or industry concerned in the area/region where the work is carried out; (ii) collective agreement or other recognized negotiation between other organizations of employers and workers' representatives in the trade or industry concerned; (iii) arbitration award; or (iv) conditions established by national law.

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12. Where accommodation services⁷ are provided to workers covered by the scope of this Performance Standard, the client will put in place and implement policies on the quality and management of the accommodation and provision of basic services.⁸ The accommodation services will be provided in a manner consistent with the principles of non-discrimination and equal opportunity. Workers' accommodation arrangements should not restrict workers' freedom of movement or of association.

Workers' Organizations

13. In countries where national law recognizes workers' rights to form and to join workers' organizations of their choosing without interference and to bargain collectively, the client will comply with national law. Where national law substantially restricts workers' organizations, the client will not restrict workers from developing alternative mechanisms to express their grievances and protect their rights regarding working conditions and terms of employment. The client should not seek to influence or control these mechanisms

14. In either case described in paragraph 13 of this Performance Standard, and where national law is silent, the client will not discourage workers from electing worker representatives, forming or joining workers' organizations of their choosing, or from bargaining collectively, and will not discriminate or retaliate against workers who participate, or seek to participate, in such organizations and collective bargaining. The client will engage with such workers' representatives and workers' organizations, and provide them with information needed for meaningful negotiation in a timely manner. Workers' organizations are expected to fairly represent the workers in the workforce.

Non-Discrimination and Equal Opportunity

15. The client will not make employment decisions on the basis of personal characteristics⁹ unrelated to inherent job requirements. The client will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to any aspects of the employment relationship, such as recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. The client will take measures to prevent and address harassment, intimidation, and/or exploitation, especially in regard to women. The principles of non-discrimination apply to migrant workers.

16. In countries where national law provides for non-discrimination in employment, the client will comply with national law. When national laws are silent on non-discrimination in employment, the client will meet this Performance Standard. In circumstances where national law is inconsistent with this Performance Standard, the client is encouraged to carry out its operations consistent with the intent of paragraph 15 above without contravening applicable laws.

17. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job will not be deemed as discrimination, provided they are consistent with national law.

⁷ Those services might be provided either directly by the client or by third parties.

⁸ Basic services requirements refer to minimum space, supply of water, adequate sewage and garbage disposal system, appropriate protection against heat, cold, damp, noise, fire and disease-carrying animals, adequate sanitary and washing facilities, ventilation, cooking and storage facilities and natural and artificial lighting, and in some cases basic medical services.

⁹ Such as gender, race, nationality, ethnic, social and indigenous origin, religion or belief, disability, age, or sexual orientation.

Retrenchment

18. Prior to implementing any collective dismissals,¹⁰ the client will carry out an analysis of alternatives to retrenchment.¹¹ If the analysis does not identify viable alternatives to retrenchment, a retrenchment plan will be developed and implemented to reduce the adverse impacts of retrenchment on workers. The retrenchment plan will be based on the principle of non-discrimination and will reflect the client's consultation with workers, their organizations, and, where appropriate, the government, and comply with collective bargaining agreements if they exist. The client will comply with all legal and contractual requirements related to notification of public authorities, and provision of information to, and consultation with workers and their organizations.

19. The client should ensure that all workers receive notice of dismissal and severance payments mandated by law and collective agreements in a timely manner. All outstanding back pay and social security benefits and pension contributions and benefits will be paid (i) on or before termination of the working relationship to the workers, (ii) where appropriate, for the benefit of the workers, or (iii) payment will be made in accordance with a timeline agreed through a collective agreement. Where payments are made for the benefit of workers, workers will be provided with evidence of such payments.

Grievance Mechanism

20. The client will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. The client will inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed. The mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

Protecting the Work Force

Child Labor

21. The client will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. The client will identify the presence of all persons under the age of 18. Where national laws have provisions for the employment of minors, the client will follow those laws applicable to the client. Children under the age of 18 will not be employed in hazardous work.¹² All work of persons under the age of 18 will be subject to an appropriate risk assessment and regular monitoring of health, working conditions, and hours of work.

¹⁰ Collective dismissals cover all multiple dismissals that are a result of an economic, technical, or organizational reason; or other reasons that are not related to performance or other personal reasons.

¹¹ Examples of alternatives may include negotiated working-time reduction programs, employee capacity-building programs; long-term maintenance works during low production periods, etc.

¹² Examples of hazardous work activities include work (i) with exposure to physical, psychological, or sexual abuse; (ii) underground, underwater, working at heights, or in confined spaces; (iii) with dangerous machinery, equipment, or tools, or involving handling of heavy loads; (iv) in unhealthy environments exposing the worker to hazardous substances, agents, processes, temperatures, noise, or vibration damaging to health; or (v) under difficult conditions such as long hours, late night, or confinement by employer.

Forced Labor

22. The client will not employ forced labor, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labor, such as indentured labor, bonded labor, or similar labor-contracting arrangements. The client will not employ trafficked persons.¹³

Occupational Health and Safety

23. The client will provide a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women. The client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, as far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice,¹⁴ as reflected in various internationally recognized sources including the World Bank Group Environmental, Health and Safety Guidelines, the client will address areas that include the (i) identification of potential hazards to workers, particularly those that may be life-threatening; (ii) provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) training of workers; (iv) documentation and reporting of occupational accidents, diseases, and incidents; and (v) emergency prevention, preparedness, and response arrangements. For additional information related to emergency preparedness and response refer to Performance Standard 1.

Workers Engaged by Third Parties

24. With respect to contracted workers the client will take commercially reasonable efforts to ascertain that the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate ESMS that will allow them to operate in a manner consistent with the requirements of this Performance Standard, except for paragraphs 18–19, and 27–29.

25. The client will establish policies and procedures for managing and monitoring the performance of such third party employers in relation to the requirements of this Performance Standard. In addition, the client will use commercially reasonable efforts to incorporate these requirements in contractual agreements with such third party employers.

26. The client will ensure that contracted workers, covered in paragraphs 24–25 of this Performance Standard, have access to a grievance mechanism. In cases where the third party is not able to provide a grievance mechanism the client will extend its own grievance mechanism to serve workers engaged by the third party.

¹³ Trafficking in persons is defined as the recruitment, transportation, transfer, harboring, or receipt of persons, by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Women and children are particularly vulnerable to trafficking practices.

¹⁴ Defined as the exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances, globally or regionally.

Supply Chain

27. Where there is a high risk of child labor or forced labor¹⁵ in the primary supply chain, the client will identify those risks consistent with paragraphs 21 and 22 above. If child labor or forced labor cases are identified, the client will take appropriate steps to remedy them. The client will monitor its primary supply chain on an ongoing basis in order to identify any significant changes in its supply chain and if new risks or incidents of child and/or forced labor are identified, the client will take appropriate steps to remedy them.

28. Additionally, where there is a high risk of significant safety issues related to supply chain workers, the client will introduce procedures and mitigation measures to ensure that primary suppliers within the supply chain are taking steps to prevent or to correct life-threatening situations.

29. The ability of the client to fully address these risks will depend upon the client's level of management control or influence over its primary suppliers. Where remedy is not possible, the client will shift the project's primary supply chain over time to suppliers that can demonstrate that they are complying with this Performance Standard.

¹⁵ The potential risk of child labor and forced labor will be determined during the risks and impacts identification process as required in Performance Standard 1.

Introduction

1. Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels.¹ There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention² and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world. These are often implemented through continuous improvement methodologies similar to those used to enhance quality or productivity, which are generally well known to most industrial, agricultural, and service sector companies.

2. This Performance Standard outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. In addition, this Performance Standard promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources.

Objectives

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- To promote more sustainable use of resources, including energy and water.
- To reduce project-related GHG emissions.

Scope of Application

3. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System, the elements of which are outlined in Performance Standard 1.

Requirements

4. During the project life-cycle, the client will consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention principles and techniques that are best suited to avoid, or where avoidance is not possible, minimize adverse impacts on human health and the environment.³ The principles and techniques applied during the project life-cycle will be

¹ For the purposes of this Performance Standard, the term "pollution" is used to refer to both hazardous and non-hazardous chemical pollutants in the solid, liquid, or gaseous phases, and includes other components such as pests, pathogens, thermal discharge to water, GHG emissions, nuisance odors, noise, vibration, radiation, electromagnetic energy, and the creation of potential visual impacts including light.

² For the purpose of this Performance Standard, the term "pollution prevention" does not mean absolute elimination of emissions, but the avoidance at source whenever possible, and, if not possible, then subsequent minimization of pollution to the extent that the Performance Standard objectives are satisfied.

³ Technical feasibility is based on whether the proposed measures and actions can be implemented with commercially available skills, equipment, and materials, taking into consideration prevailing local factors such as climate, geography, infrastructure, security, governance, capacity and operational reliability. Financial feasibility is

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tailored to the hazards and risks associated with the nature of the project and consistent with good international industry practice (GIIP),⁴ as reflected in various internationally recognized sources, including the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

5. The client will refer to the EHS Guidelines or other internationally recognized sources, as appropriate, when evaluating and selecting resource efficiency and pollution prevention and control techniques for the project. The EHS Guidelines contain the performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from the levels and measures presented in the EHS Guidelines, clients will be required to achieve whichever is more stringent. If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific project circumstances, the client will provide full and detailed justification for any proposed alternatives through the environmental and social risks and impacts identification and assessment process. This justification must demonstrate that the choice for any alternate performance levels is consistent with the objectives of this Performance Standard.

Resource Efficiency

6. The client will implement technically and financially feasible and cost effective⁵ measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core business activities. Such measures will integrate the principles of cleaner production into product design and production processes with the objective of conserving raw materials, energy, and water. Where benchmarking data are available, the client will make a comparison to establish the relative level of efficiency.

Greenhouse Gases

7. In addition to the resource efficiency measures described above, the client will consider alternatives and implement technically and financially feasible and cost-effective options to reduce project-related GHG emissions during the design and operation of the project. These options may include, but are not limited to, alternative project locations, adoption of renewable or low carbon energy sources, sustainable agricultural, forestry and livestock management practices, the reduction of fugitive emissions and the reduction of gas flaring.

8. For projects that are expected to or currently produce more than 25,000 tonnes of CO₂-equivalent annually,⁶ the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary,⁷ as well as indirect emissions associated with the off-site

based on commercial considerations, including relative magnitude of the incremental cost of adopting such measures and actions compared to the project's investment, operating, and maintenance costs.

⁴ GIIP is defined as the exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally. The outcome of such exercise should be that the project employs the most appropriate technologies in the project-specific circumstances.

⁵ Cost-effectiveness is determined according to the capital and operational cost and financial benefits of the measure considered over the life of the measure. For the purpose of this Performance Standard, a resource efficiency or GHG emissions reduction measure is considered cost-effective if it is expected to provide a risk-rated return on investment at least comparable to the project itself.

⁶ The quantification of emissions should consider all significant sources of greenhouse gas emissions, including non-energy related sources such as methane and nitrous oxide, among others.

⁷ Project-induced changes in soil carbon content or above ground biomass, and project-induced decay of organic matter may contribute to direct emissions sources and shall be included in this emissions quantification where such emissions are expected to be significant.

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production of energy⁸ used by the project. Quantification of GHG emissions will be conducted by the client annually in accordance with internationally recognized methodologies and good practice.⁹

Water Consumption

9. When the project is a potentially significant consumer of water, in addition to applying the resource efficiency requirements of this Performance Standard, the client shall adopt measures that avoid or reduce water usage so that the project's water consumption does not have significant adverse impacts on others. These measures include, but are not limited to, the use of additional technically feasible water conservation measures within the client's operations, the use of alternative water supplies, water consumption offsets to reduce total demand for water resources to within the available supply, and evaluation of alternative project locations.

Pollution Prevention

10. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release. This applies to the release of pollutants to air, water, and land due to routine, non-routine, and accidental circumstances with the potential for local, regional, and transboundary impacts.¹⁰ Where historical pollution such as land or ground water contamination exists, the client will seek to determine whether it is responsible for mitigation measures. If it is determined that the client is legally responsible, then these liabilities will be resolved in accordance with national law, or where this is silent, with GIIP.¹¹

11. To address potential adverse project impacts on existing ambient conditions,¹² the client will consider relevant factors, including, for example (i) existing ambient conditions; (ii) the finite assimilative capacity¹³ of the environment; (iii) existing and future land use; (iv) the project's proximity to areas of importance to biodiversity; and (v) the potential for cumulative impacts with uncertain and/or irreversible consequences. In addition to applying resource efficiency and pollution control measures as required in this Performance Standard, when the project has the potential to constitute a significant source of emissions in an already degraded area, the client will consider additional strategies and adopt measures that avoid or reduce negative effects. These strategies include, but are not limited to, evaluation of project location alternatives and emissions offsets.

Wastes

12. The client will avoid the generation of hazardous and non-hazardous waste materials. Where waste generation cannot be avoided, the client will reduce the generation of waste, and recover and reuse waste in a manner that is safe for human health and the environment. Where waste cannot be recovered or reused, the client will treat, destroy, or dispose of it in an environmentally sound manner that includes the appropriate control of emissions and residues resulting from the handling and processing of the waste material. If the generated waste is considered hazardous,¹⁴ the client will

⁸ Refers to the off-site generation by others of electricity, and heating and cooling energy used in the project.

⁹ Estimation methodologies are provided by the Intergovernmental Panel on Climate Change, various international organizations, and relevant host country agencies.

¹⁰ Transboundary pollutants include those covered under the Convention on Long-Range Transboundary Air Pollution.

¹¹ This may require coordination with national and local government, communities, and the contributors to the contamination, and that any assessment follows a risk-based approach consistent with GIIP as reflected in the EHS Guidelines.

¹² Such as air, surface and groundwater, and soils.

¹³ The capacity of the environment for absorbing an incremental load of pollutants while remaining below a threshold of unacceptable risk to human health and the environment.

¹⁴ As defined by international conventions or local legislation.

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adopt GIIP alternatives for its environmentally sound disposal while adhering to the limitations applicable to its transboundary movement.¹⁵ When hazardous waste disposal is conducted by third parties, the client will use contractors that are reputable and legitimate enterprises licensed by the relevant government regulatory agencies and obtain chain of custody documentation to the final destination. The client should ascertain whether licensed disposal sites are being operated to acceptable standards and where they are, the client will use these sites. Where this is not the case, clients should reduce waste sent to such sites and consider alternative disposal options, including the possibility of developing their own recovery or disposal facilities at the project site.

Hazardous Materials Management

13. Hazardous materials are sometimes used as raw material or produced as product by the project. The client will avoid or, when avoidance is not possible, minimize and control the release of hazardous materials. In this context, the production, transportation, handling, storage, and use of hazardous materials for project activities should be assessed. The client will consider less hazardous substitutes where hazardous materials are intended to be used in manufacturing processes or other operations. The client will avoid the manufacture, trade, and use of chemicals and hazardous materials subject to international bans or phase-outs due to their high toxicity to living organisms, environmental persistence, potential for bioaccumulation, or potential for depletion of the ozone layer.¹⁶

Pesticide Use and Management

14. The client will, where appropriate, formulate and implement an integrated pest management (IPM) and/or integrated vector management (IVM) approach targeting economically significant pest infestations and disease vectors of public health significance. The client's IPM and IVM program will integrate coordinated use of pest and environmental information along with available pest control methods, including cultural practices, biological, genetic, and, as a last resort, chemical means to prevent economically significant pest damage and/or disease transmission to humans and animals.

15. When pest management activities include the use of chemical pesticides, the client will select chemical pesticides that are low in human toxicity, that are known to be effective against the target species, and that have minimal effects on non-target species and the environment. When the client selects chemical pesticides, the selection will be based upon requirements that the pesticides be packaged in safe containers, be clearly labeled for safe and proper use, and that the pesticides have been manufactured by an entity currently licensed by relevant regulatory agencies.

16. The client will design its pesticide application regime to (i) avoid damage to natural enemies of the target pest, and where avoidance is not possible, minimize, and (ii) avoid the risks associated with the development of resistance in pests and vectors, and where avoidance is not possible minimize. In addition, pesticides will be handled, stored, applied, and disposed of in accordance with the Food and Agriculture Organization's International Code of Conduct on the Distribution and Use of Pesticides or other GIIP.

17. The client will not purchase, store, use, manufacture, or trade in products that fall in WHO Recommended Classification of Pesticides by Hazard Class Ia (extremely hazardous); or Ib (highly

¹⁵ Transboundary movement of hazardous materials should be consistent with national, regional and international law, including the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter.

¹⁶ Consistent with the objectives of the Stockholm Convention on Persistent Organic Pollutants and the Montreal Protocol on Substances that Deplete the Ozone Layer. Similar considerations will apply to certain World Health Organization (WHO) classes of pesticides.



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hazardous). The client will not purchase, store, use, manufacture or trade in Class II (moderately hazardous) pesticides, unless the project has appropriate controls on manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities to handle, store, apply, and dispose of these products properly.

Performance Standard 4

Community Health, Safety, and Security

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Introduction

1. Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.
2. In conflict and post-conflict areas, the level of risks and impacts described in this Performance Standard may be greater. The risks that a project could exacerbate an already sensitive local situation and stress scarce local resources should not be overlooked as it may lead to further conflict.

Objectives

- To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

Scope of Application

3. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System, the elements of which are outlined in Performance Standard 1.
4. This Performance Standard addresses potential risks and impacts to the Affected Communities from project activities. Occupational health and safety requirements for workers are included in Performance Standard 2, and environmental standards to avoid or minimize impacts on human health and the environment due to pollution are included in Performance Standard 3.

Requirements

Community Health and Safety

5. The client will evaluate the risks and impacts to the health and safety of the Affected Communities during the project life-cycle and will establish preventive and control measures consistent with good international industry practice (GIIP),¹ such as in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) or other internationally recognized sources. The client will identify risks and impacts and propose mitigation measures that are commensurate with their nature and magnitude. These measures will favor the avoidance of risks and impacts over minimization.

¹ Defined as the exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally.

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Infrastructure and Equipment Design and Safety

6. The client will design, construct, operate, and decommission the structural elements or components of the project in accordance with GIIP, taking into consideration safety risks to third parties or Affected Communities. When new buildings and structures will be accessed by members of the public, the client will consider incremental risks of the public's potential exposure to operational accidents and/or natural hazards and be consistent with the principles of universal access. Structural elements will be designed and constructed by competent professionals, and certified or approved by competent authorities or professionals. When structural elements or components, such as dams, tailings dams, or ash ponds are situated in high-risk locations, and their failure or malfunction may threaten the safety of communities, the client will engage one or more external experts with relevant and recognized experience in similar projects, separate from those responsible for the design and construction, to conduct a review as early as possible in project development and throughout the stages of project design, construction, operation, and decommissioning. For projects that operate moving equipment on public roads and other forms of infrastructure, the client will seek to avoid the occurrence of incidents and injuries to members of the public associated with the operation of such equipment.

Hazardous Materials Management and Safety

7. The client will avoid or minimize the potential for community exposure to hazardous materials and substances that may be released by the project. Where there is a potential for the public (including workers and their families) to be exposed to hazards, particularly those that may be life-threatening, the client will exercise special care to avoid or minimize their exposure by modifying, substituting, or eliminating the condition or material causing the potential hazards. Where hazardous materials are part of existing project infrastructure or components, the client will exercise special care when conducting decommissioning activities in order to avoid exposure to the community. The client will exercise commercially reasonable efforts to control the safety of deliveries of hazardous materials, and of transportation and disposal of hazardous wastes, and will implement measures to avoid or control community exposure to pesticides, in accordance with the requirements of Performance Standard 3.

Ecosystem Services

8. The project's direct impacts on priority ecosystem services may result in adverse health and safety risks and impacts to Affected Communities. With respect to this Performance Standard, ecosystem services are limited to provisioning and regulating services as defined in paragraph 2 of Performance Standard 6. For example, land use changes or the loss of natural buffer areas such as wetlands, mangroves, and upland forests that mitigate the effects of natural hazards such as flooding, landslides, and fire, may result in increased vulnerability and community safety-related risks and impacts. The diminution or degradation of natural resources, such as adverse impacts on the quality, quantity, and availability of freshwater,² may result in health-related risks and impacts. Where appropriate and feasible, the client will identify those risks and potential impacts on priority ecosystem services that may be exacerbated by climate change. Adverse impacts should be avoided, and if these impacts are unavoidable, the client will implement mitigation measures in accordance with paragraphs 24 and 25 of Performance Standard 6. With respect to the use of and loss of access to provisioning services, clients will implement mitigation measures in accordance with paragraphs 25–29 of Performance Standard 5.

² Freshwater is an example of provisioning ecosystem services.

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Community Exposure to Disease

9. The client will avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases, and communicable diseases that could result from project activities, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups. Where specific diseases are endemic in communities in the project area of influence, the client is encouraged to explore opportunities during the project life-cycle to improve environmental conditions that could help minimize their incidence.

10. The client will avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labor.

Emergency Preparedness and Response

11. In addition to the emergency preparedness and response requirements described in Performance Standard 1, the client will also assist and collaborate with the Affected Communities, local government agencies, and other relevant parties, in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project. The client will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information to Affected Communities, relevant government agencies, or other relevant parties.

Security Personnel

12. When the client retains direct or contracted workers to provide security to safeguard its personnel and property, it will assess risks posed by its security arrangements to those within and outside the project site. In making such arrangements, the client will be guided by the principles of proportionality and good international practice³ in relation to hiring, rules of conduct, training, equipping, and monitoring of such workers, and by applicable law. The client will make reasonable inquiries to ensure that those providing security are not implicated in past abuses; will train them adequately in the use of force (and where applicable, firearms), and appropriate conduct toward workers and Affected Communities; and require them to act within the applicable law. The client will not sanction any use of force except when used for preventive and defensive purposes in proportion to the nature and extent of the threat. The client will provide a grievance mechanism for Affected Communities to express concerns about the security arrangements and acts of security personnel.

13. The client will assess and document risks arising from the project's use of government security personnel deployed to provide security services. The client will seek to ensure that security personnel will act in a manner consistent with paragraph 12 above, and encourage the relevant public authorities to disclose the security arrangements for the client's facilities to the public, subject to overriding security concerns.

14. The client will consider and, where appropriate, investigate all allegations of unlawful or abusive acts of security personnel, take action (or urge appropriate parties to take action) to prevent recurrence, and report unlawful and abusive acts to public authorities.

³ Including practice consistent with the United Nation's (UN) Code of Conduct for Law Enforcement Officials, and UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials.

Introduction

1. Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood¹) as a result of project-related land acquisition² and/or restrictions on land use. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement. This occurs in cases of (i) lawful expropriation or temporary or permanent restrictions on land use and (ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.

2. Unless properly managed, involuntary resettlement may result in long-term hardship and impoverishment for the Affected Communities and persons, as well as environmental damage and adverse socio-economic impacts in areas to which they have been displaced. For these reasons, involuntary resettlement should be avoided. However, where involuntary resettlement is unavoidable, it should be minimized and appropriate measures to mitigate adverse impacts on displaced persons and host communities³ should be carefully planned and implemented. The government often plays a central role in the land acquisition and resettlement process, including the determination of compensation, and is therefore an important third party in many situations. Experience demonstrates that the direct involvement of the client in resettlement activities can result in more cost-effective, efficient, and timely implementation of those activities, as well as in the introduction of innovative approaches to improving the livelihoods of those affected by resettlement.

3. To help avoid expropriation and eliminate the need to use governmental authority to enforce relocation, clients are encouraged to use negotiated settlements meeting the requirements of this Performance Standard, even if they have the legal means to acquire land without the seller's consent.

Objectives

- To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.
- To avoid forced eviction.
- To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost⁴ and (ii) ensuring

¹ The term "livelihood" refers to the full range of means that individuals, families, and communities utilize to make a living, such as wage-based income, agriculture, fishing, foraging, other natural resource-based livelihoods, petty trade, and bartering.

² Land acquisition includes both outright purchases of property and acquisition of access rights, such as easements or rights of way.

³ A host community is any community receiving displaced persons.

⁴ Replacement cost is defined as the market value of the assets plus transaction costs. In applying this method of valuation, depreciation of structures and assets should not be taken into account. Market value is defined as the value required to allow Affected Communities and persons to replace lost assets with assets of similar value. The valuation method for determining replacement cost should be documented and included in applicable Resettlement and/or Livelihood Restoration plans (see paragraphs 18 and 25).

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that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.

- To improve, or restore, the livelihoods and standards of living of displaced persons.
- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure⁵ at resettlement sites.

Scope of Application

4. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System, the elements of which are outlined in Performance Standard 1.

5. This Performance Standard applies to physical and/or economic displacement resulting from the following types of land-related transactions:

- Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of the host country;
- Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement would have resulted in expropriation or other compulsory procedures;⁶
- Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights;⁷
- Certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights;⁸ or
- Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas.⁹

6. This Performance Standard does not apply to resettlement resulting from voluntary land transactions (i.e., market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures sanctioned by the legal system of the host country if negotiations fail). It also does not apply to impacts on livelihoods where the project is not changing the land use of the affected groups or communities.¹⁰

⁵ Security of tenure means that resettled individuals or communities are resettled to a site that they can legally occupy and where they are protected from the risk of eviction.

⁶ This also applies to customary or traditional rights recognized or recognizable under the laws of the host country. The negotiations may be carried out by the government or by the company (in some circumstances, as an agent of the government).

⁷ In such situations, affected persons frequently do not have formal ownership. This may include freshwater and marine environments. This Performance Standard may also apply when project-related biodiversity areas or legally designated buffer zones are established but not acquired by the client.

⁸ While some people do not have rights over the land they occupy, this Performance Standard requires that non-land assets be retained, replaced, or compensated for; relocation take place with security of tenure; and lost livelihoods be restored.

⁹ Natural resource assets referred to in this Performance Standard are equivalent to ecosystem provisioning services as described in Performance Standard 6.

¹⁰ More generalized impacts on communities or groups of people are covered in Performance Standard 1. For example, disruption of access to mineral deposits by artisanal miners is covered by Performance Standard 1.

7. Where project impacts on land, assets, or access to assets become significantly adverse at any stage of the project, the client should consider applying requirements of this Performance Standard, even where no land acquisition or land use restriction is involved.

Requirements

General

Project Design

8. The client will consider feasible alternative project designs to avoid or minimize physical and/or economic displacement, while balancing environmental, social, and financial costs and benefits, paying particular attention to impacts on the poor and vulnerable.

Compensation and Benefits for Displaced Persons

9. When displacement cannot be avoided, the client will offer displaced communities and persons compensation for loss of assets at full replacement cost and other assistance¹¹ to help them improve or restore their standards of living or livelihoods, as provided in this Performance Standard. Compensation standards will be transparent and applied consistently to all communities and persons affected by the displacement. Where livelihoods of displaced persons are land-based,¹² or where land is collectively owned, the client will, where feasible,¹³ offer the displaced land-based compensation. The client will take possession of acquired land and related assets only after compensation has been made available¹⁴ and, where applicable, resettlement sites and moving allowances have been provided to the displaced persons in addition to compensation.¹⁵ The client will also provide opportunities to displaced communities and persons to derive appropriate development benefits from the project.

Community Engagement

10. The client will engage with Affected Communities, including host communities, through the process of stakeholder engagement described in Performance Standard 1. Decision-making processes related to resettlement and livelihood restoration should include options and alternatives, where applicable. Disclosure of relevant information and participation of Affected Communities and persons will continue during the planning, implementation, monitoring, and evaluation of compensation payments, livelihood restoration activities, and resettlement to achieve outcomes that are consistent with the objectives of this Performance Standard.¹⁶ Additional provisions apply to consultations with Indigenous Peoples, in accordance with Performance Standard 7.

¹¹ As described in paragraphs 19 and 26.

¹² The term "land-based" includes livelihood activities such as subsistence cropping and grazing of livestock as well as the harvesting of natural resources.

¹³ Refer to paragraph 26 of this Performance Standard for further requirements.

¹⁴ In certain cases it may not be feasible to pay compensation to all those affected before taking possession of the land, for example when the ownership of the land in question is in dispute. Such circumstances shall be identified and agreed on a case-by-case basis, and compensation funds shall be made available for example through deposit into an escrow account before displacement takes place.

¹⁵ Unless government-managed resettlement is involved and where the client has no direct influence over the timing of compensation payments. Such cases should be handled in accordance with paragraphs 27–29 of this Performance Standard. Staggered compensation payments may be made where one-off cash payments would demonstrably undermine social and/or resettlement objectives, or where there are ongoing impacts to livelihood activities.

¹⁶ The consultation process should ensure that women's perspectives are obtained and their interests factored into all aspects of resettlement planning and implementation. Addressing livelihood impacts may require intra-household analysis in cases where women's and men's livelihoods are affected differently. Women's and men's preferences in terms of compensation mechanisms, such as compensation in kind rather than in cash, should be explored.

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Grievance Mechanism

11. The client will establish a grievance mechanism consistent with Performance Standard 1 as early as possible in the project development phase. This will allow the client to receive and address specific concerns about compensation and relocation raised by displaced persons or members of host communities in a timely fashion, including a recourse mechanism designed to resolve disputes in an impartial manner.

Resettlement and Livelihood Restoration Planning and Implementation

12. Where involuntary resettlement is unavoidable, either as a result of a negotiated settlement or expropriation, a census will be carried out to collect appropriate socio-economic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance,¹⁷ and discourage ineligible persons, such as opportunistic settlers, from claiming benefits. In the absence of host government procedures, the client will establish a cut-off date for eligibility. Information regarding the cut-off date will be well documented and disseminated throughout the project area.

13. In cases where affected persons reject compensation offers that meet the requirements of this Performance Standard and, as a result, expropriation or other legal procedures are initiated, the client will explore opportunities to collaborate with the responsible government agency, and, if permitted by the agency, play an active role in resettlement planning, implementation, and monitoring (see paragraphs 30–32).

14. The client will establish procedures to monitor and evaluate the implementation of a Resettlement Action Plan or Livelihood Restoration Plan (see paragraphs 19 and 25) and take corrective action as necessary. The extent of monitoring activities will be commensurate with the project's risks and impacts. For projects with significant involuntary resettlement risks, the client will retain competent resettlement professionals to provide advice on compliance with this Performance Standard and to verify the client's monitoring information. Affected persons will be consulted during the monitoring process.

15. Implementation of a Resettlement Action Plan or Livelihood Restoration Plan will be considered completed when the adverse impacts of resettlement have been addressed in a manner that is consistent with the relevant plan as well as the objectives of this Performance Standard. It may be necessary for the client to commission an external completion audit of the Resettlement Action Plan or Livelihood Restoration Plan to assess whether the provisions have been met, depending on the scale and/or complexity of physical and economic displacement associated with a project. The completion audit should be undertaken once all mitigation measures have been substantially completed and once displaced persons are deemed to have been provided adequate opportunity and assistance to sustainably restore their livelihoods. The completion audit will be undertaken by competent resettlement professionals once the agreed monitoring period is concluded. The completion audit will include, at a minimum, a review of the totality of mitigation measures implemented by the Client, a comparison of implementation outcomes against agreed objectives, and a conclusion as to whether the monitoring process can be ended.¹⁸

¹⁷ Documentation of ownership or occupancy and compensation arrangements should be issued in the names of both spouses or heads of households, and other resettlement assistance, such as skills training, access to credit, and job opportunities, should be equally available to women and adapted to their needs. Where national law and tenure systems do not recognize the rights of women to hold or contract in property, measures should be considered to provide women as much protection as possible with the objective to achieve equity with men.

¹⁸ The completion audit of the Resettlement Action Plan and/or Livelihood Restoration Plan, will be undertaken by external resettlement experts once the agreed monitoring period is concluded, and will involve a more in-depth assessment than regular resettlement monitoring activities, including at a minimum a review of all mitigation

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16. Where the exact nature or magnitude of the land acquisition or restrictions on land use related to a project with potential to cause physical and/or economic displacement is unknown due to the stage of project development, the client will develop a Resettlement and/or Livelihood Restoration Framework outlining general principles compatible with this Performance Standard. Once the individual project components are defined and the necessary information becomes available, such a framework will be expanded into a specific Resettlement Action Plan or Livelihood Restoration Plan and procedures in accordance with paragraphs 19 and 25 below.

Displacement

17. Displaced persons may be classified as persons (i) who have formal legal rights to the land or assets they occupy or use; (ii) who do not have formal legal rights to land or assets, but have a claim to land that is recognized or recognizable under national law;¹⁹ or (iii) who have no recognizable legal right or claim to the land or assets they occupy or use. The census will establish the status of the displaced persons.

18. Project-related land acquisition and/or restrictions on land use may result in the physical displacement of people as well as their economic displacement. Consequently, requirements of this Performance Standard in respect of physical displacement and economic displacement may apply simultaneously.²⁰

Physical Displacement

19. In the case of physical displacement, the client will develop a Resettlement Action Plan that covers, at a minimum, the applicable requirements of this Performance Standard regardless of the number of people affected. This will include compensation at full replacement cost for land and other assets lost. The Plan will be designed to mitigate the negative impacts of displacement; identify development opportunities; develop a resettlement budget and schedule; and establish the entitlements of all categories of affected persons (including host communities). Particular attention will be paid to the needs of the poor and the vulnerable. The client will document all transactions to acquire land rights, as well as compensation measures and relocation activities.

20. If people living in the project area are required to move to another location, the client will (i) offer displaced persons choices among feasible resettlement options, including adequate replacement housing or cash compensation where appropriate; and (ii) provide relocation assistance suited to the needs of each group of displaced persons. New resettlement sites built for displaced persons must offer improved living conditions. The displaced persons' preferences with respect to relocating in preexisting communities and groups will be taken into consideration. Existing social and cultural institutions of the displaced persons and any host communities will be respected.

21. In the case of physically displaced persons under paragraph 17 (i) or (ii), the client will offer the choice of replacement property of equal or higher value, security of tenure, equivalent or better characteristics, and advantages of location or cash compensation where appropriate. Compensation

measures with respect to the physical and/or economic displacement implemented by the Client, a comparison of implementation outcomes against agreed objectives, a conclusion as to whether the monitoring process can be ended and, where necessary, a Corrective Action Plan listing outstanding actions necessary to met the objectives.

¹⁹ Such claims could be derived from adverse possession or from customary or traditional tenure arrangements.

²⁰ Where a project results in both physical and economic displacement, the requirements of paragraphs 25 and 26 (Economic Displacement) should be incorporated into the Resettlement Action Plan or Framework (i.e., there is no need to have a separate Resettlement Action Plan and Livelihood Restoration Plan).

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in kind should be considered in lieu of cash. Cash compensation levels should be sufficient to replace the lost land and other assets at full replacement cost in local markets.²¹

22. In the case of physically displaced persons under paragraph 17 (iii), the client will offer them a choice of options for adequate housing with security of tenure so that they can resettle legally without having to face the risk of forced eviction. Where these displaced persons own and occupy structures, the client will compensate them for the loss of assets other than land, such as dwellings and other improvements to the land, at full replacement cost, provided that these persons have been occupying the project area prior to the cut-off date for eligibility. Based on consultation with such displaced persons, the client will provide relocation assistance sufficient for them to restore their standard of living at an adequate alternative site.²²

23. The client is not required to compensate or assist those who encroach on the project area after the cut-off date for eligibility, provided the cut-off date has been clearly established and made public.

24. Forced evictions²³ will not be carried out except in accordance with law and the requirements of this Performance Standard.

Economic Displacement

25. In the case of projects involving economic displacement only, the client will develop a Livelihood Restoration Plan to compensate affected persons and/or communities and offer other assistance that meet the objectives of this Performance Standard. The Livelihood Restoration Plan will establish the entitlements of affected persons and/or communities and will ensure that these are provided in a transparent, consistent, and equitable manner. The mitigation of economic displacement will be considered complete when affected persons or communities have received compensation and other assistance according to the requirements of the Livelihood Restoration Plan and this Performance Standard, and are deemed to have been provided with adequate opportunity to reestablish their livelihoods.

26. If land acquisition or restrictions on land use result in economic displacement defined as loss of assets and/or means of livelihood, regardless of whether or not the affected people are physically displaced, the client will meet the requirements in paragraphs 27–29 below, as applicable.

27. Economically displaced persons who face loss of assets or access to assets will be compensated for such loss at full replacement cost.

- In cases where land acquisition or restrictions on land use affect commercial structures, affected business owners will be compensated for the cost of reestablishing commercial activities elsewhere, for lost net income during the

²¹ Payment of cash compensation for lost assets may be appropriate where (i) livelihoods are not land-based; (ii) livelihoods are land-based but the land taken for the project is a small fraction of the affected asset and the residual land is economically viable; or (iii) active markets for land, housing, and labor exist, displaced persons use such markets, and there is sufficient supply of land and housing.

²² Relocation of informal settlers in urban areas may involve trade-offs. For example, the relocated families may gain security of tenure, but they may lose advantages of location. Changes in location that may affect livelihood opportunities should be addressed in accordance with the principles of this Performance Standard (see in particular paragraph 25).

²³ The permanent or temporary removal against the will of individuals, families, and/or communities from the homes and/or lands which they occupy without the provision of, and access to, appropriate forms of legal and other protection.

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period of transition, and for the costs of the transfer and reinstallation of the plant, machinery, or other equipment.

- In cases affecting persons with legal rights or claims to land which are recognized or recognizable under national law (see paragraph 17 (i) and (ii)), replacement property (e.g., agricultural or commercial sites) of equal or greater value will be provided, or, where appropriate, cash compensation at full replacement cost.
- Economically displaced persons who are without legally recognizable claims to land (see paragraph 17 (iii)) will be compensated for lost assets other than land (such as crops, irrigation infrastructure and other improvements made to the land), at full replacement cost. The client is not required to compensate or assist opportunistic settlers who encroach on the project area after the cut-off date for eligibility.

28. In addition to compensation for lost assets, if any, as required under paragraph 27, economically displaced persons whose livelihoods or income levels are adversely affected will also be provided opportunities to improve, or at least restore, their means of income-earning capacity, production levels, and standards of living:

- For persons whose livelihoods are land-based, replacement land that has a combination of productive potential, locational advantages, and other factors at least equivalent to that being lost should be offered as a matter of priority.
- For persons whose livelihoods are natural resource-based and where project-related restrictions on access envisaged in paragraph 5 apply, implementation of measures will be made to either allow continued access to affected resources or provide access to alternative resources with equivalent livelihood-earning potential and accessibility. Where appropriate, benefits and compensation associated with natural resource usage may be collective in nature rather than directly oriented towards individuals or households.
- If circumstances prevent the client from providing land or similar resources as described above, alternative income earning opportunities may be provided, such as credit facilities, training, cash, or employment opportunities. Cash compensation alone, however, is frequently insufficient to restore livelihoods.

29. Transitional support should be provided as necessary to all economically displaced persons, based on a reasonable estimate of the time required to restore their income-earning capacity, production levels, and standards of living.

Private Sector Responsibilities Under Government-Managed Resettlement

30. Where land acquisition and resettlement are the responsibility of the government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with this Performance Standard. In addition, where government capacity is limited, the client will play an active role during resettlement planning, implementation, and monitoring, as described below.

31. In the case of acquisition of land rights or access to land through compulsory means or negotiated settlements involving physical displacement, the client will identify and describe²⁴ government resettlement measures. If these measures do not meet the relevant requirements of this Performance Standard, the client will prepare a Supplemental Resettlement Plan that, together with

²⁴ Government documents, where available, may be used to identify such measures.

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the documents prepared by the responsible government agency, will address the relevant requirements of this Performance Standard (the General Requirements and requirements for Physical Displacement and Economic Displacement above). The client will need to include in its Supplemental Resettlement Plan, at a minimum (i) identification of affected people and impacts; (ii) a description of regulated activities, including the entitlements of displaced persons provided under applicable national laws and regulations; (iii) the supplemental measures to achieve the requirements of this Performance Standard as described in paragraphs 19–29 in a way that is permitted by the responsible agency and implementation time schedule; and (iv) the financial and implementation responsibilities of the client in the execution of its Supplemental Resettlement Plan.

32. In the case of projects involving economic displacement only, the client will identify and describe the measures that the responsible government agency plans to use to compensate Affected Communities and persons. If these measures do not meet the relevant requirements of this Performance Standard, the client will develop an Environmental and Social Action Plan to complement government action. This may include additional compensation for lost assets, and additional efforts to restore lost livelihoods where applicable.

Introduction

1. Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.”

2. Ecosystem services are the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services.¹

3. Ecosystem services valued by humans are often underpinned by biodiversity. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services. This Performance Standard addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project’s lifecycle.

Objectives

- To protect and conserve biodiversity.
- To maintain the benefits from ecosystem services.
- To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Scope of Application

4. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client’s Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1.

5. Based on the risks and impacts identification process, the requirements of this Performance Standard are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).

¹ Examples are as follows: (i) provisioning services may include food, freshwater, timber, fibers, medicinal plants; (ii) regulating services may include surface water purification, carbon storage and sequestration, climate regulation, protection from natural hazards; (iii) cultural services may include natural areas that are sacred sites and areas of importance for recreation and aesthetic enjoyment; and (iv) supporting services may include soil formation, nutrient cycling, primary production.

Requirements

General

6. The risks and impacts identification process as set out in Performance Standard 1 should consider direct and indirect project-related impacts on biodiversity and ecosystem services and identify any significant residual impacts. This process will consider relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution. It will also take into account the differing values attached to biodiversity and ecosystem services by Affected Communities and, where appropriate, other stakeholders. Where paragraphs 13–19 are applicable, the client should consider project-related impacts across the potentially affected landscape or seascape.

7. As a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle.

8. Where paragraphs 13–15 are applicable, the client will retain competent professionals to assist in conducting the risks and impacts identification process. Where paragraphs 16–19 are applicable, the client should retain external experts with appropriate regional experience to assist in the development of a mitigation hierarchy that complies with this Performance Standard and to verify the implementation of those measures.

Protection and Conservation of Biodiversity

9. Habitat is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment. For the purposes of implementation of this Performance Standard, habitats are divided into modified, natural, and critical. Critical habitats are a subset of modified or natural habitats.

10. For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, which may be considered only after appropriate avoidance, minimization, and restoration measures have been applied.² A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes³ that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity; however, a net gain is required in critical habitats. The design of a biodiversity offset must adhere to the “like-for-like or better” principle⁴ and must be carried out in

² Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimization and restoration measures have been taken.

³ Measurable conservation outcomes for biodiversity must be demonstrated in situ (on-the-ground) and on an appropriate geographic scale (e.g., local, landscape-level, national, regional).

⁴ The principle of “like-for-like or better” indicates that biodiversity offsets must be designed to conserve the same biodiversity values that are being impacted by the project (an “in-kind” offset). In certain situations, however, areas of biodiversity to be impacted by the project may be neither a national nor a local priority, and there may be other areas of biodiversity with like values that are a higher priority for conservation and sustainable use and under imminent threat or need of protection or effective management. In these situations, it may be appropriate to consider an “out-of-kind” offset that involves “trading up” (i.e., where the offset targets biodiversity of higher

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alignment with best available information and current practices. When a client is considering the development of an offset as part of the mitigation strategy, external experts with knowledge in offset design and implementation must be involved.

Modified Habitat

11. Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.⁵ Modified habitats may include areas managed for agriculture, forest plantations, reclaimed⁶ coastal zones, and reclaimed wetlands.

12. This Performance Standard applies to those areas of modified habitat that include significant biodiversity value, as determined by the risks and impacts identification process required in Performance Standard 1. The client should minimize impacts on such biodiversity and implement mitigation measures as appropriate.

Natural Habitat

13. Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

14. The client will not significantly convert or degrade⁷ natural habitats, unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on modified habitat;
- Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation;⁸ and
- Any conversion or degradation is mitigated according to the mitigation hierarchy.

15. In areas of natural habitat, mitigation measures will be designed to achieve no net loss⁹ of biodiversity where feasible. Appropriate actions include:

- Avoiding impacts on biodiversity through the identification and protection of set-asides;¹⁰

priority than that affected by the project) that will, for critical habitats, meet the requirements of paragraph 17 of this Performance Standard.

⁵ This excludes habitat that has been converted in anticipation of the project.

⁶ Reclamation as used in this context is the process of creating new land from sea or other aquatic areas for productive use.

⁷ Significant conversion or degradation is (i) the elimination or severe diminution of the integrity of a habitat caused by a major and/or long-term change in land or water use; or (ii) a modification that substantially minimizes the habitat's ability to maintain viable populations of its native species.

⁸ Conducted as part of the stakeholder engagement and consultation process, as described in Performance Standard 1.

⁹ No net loss is defined as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional).

¹⁰ Set-asides are land areas within the project site, or areas over which the client has management control, that are excluded from development and are targeted for the implementation of conservation enhancement measures. Set-asides will likely contain significant biodiversity values and/or provide ecosystem services of significance at the local, national and/or regional level. Set-asides should be defined using internationally recognized approaches or methodologies (e.g., High Conservation Value, systematic conservation planning).

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- Implementing measures to minimize habitat fragmentation, such as biological corridors;
- Restoring habitats during operations and/or after operations; and
- Implementing biodiversity offsets.

Critical Habitat

16. Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered¹¹ species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

17. In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
- The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;¹²
- The project does not lead to a net reduction in the global and/or national/regional population¹³ of any Critically Endangered or Endangered species over a reasonable period of time;¹⁴ and
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

18. In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a Biodiversity Action Plan and will be designed to achieve net gains¹⁵ of those biodiversity values for which the critical habitat was designated.

¹¹ As listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. The determination of critical habitat based on other listings is as follows: (i) If the species is listed nationally / regionally as critically endangered or endangered, in countries that have adhered to IUCN guidance, the critical habitat determination will be made on a project by project basis in consultation with competent professionals; and (ii) in instances where nationally or regionally listed species' categorizations do not correspond well to those of the IUCN (e.g., some countries more generally list species as "protected" or "restricted"), an assessment will be conducted to determine the rationale and purpose of the listing. In this case, the critical habitat determination will be based on such an assessment.

¹² Biodiversity values and their supporting ecological processes will be determined on an ecologically relevant scale.

¹³ Net reduction is a singular or cumulative loss of individuals that impacts on the species' ability to persist at the global and/or regional/national scales for many generations or over a long period of time. The scale (i.e., global and/or regional/national) of the potential net reduction is determined based on the species' listing on either the (global) IUCN Red List and/or on regional/national lists. For species listed on both the (global) IUCN Red List and the national/regional lists, the net reduction will be based on the national/regional population.

¹⁴ The timeframe in which clients must demonstrate "no net reduction" of Critically Endangered and Endangered species will be determined on a case-by-case basis in consultation with external experts.

¹⁵ Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements of paragraph 17 of this Performance Standard without a biodiversity offset, the client should achieve net gains through the implementation of programs that could be implemented in situ (on-the-ground) to enhance habitat, and protect and conserve biodiversity.

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19. In instances where biodiversity offsets are proposed as part of the mitigation strategy, the client must demonstrate through an assessment that the project's significant residual impacts on biodiversity will be adequately mitigated to meet the requirements of paragraph 17.

Legally Protected and Internationally Recognized Areas

20. In circumstances where a proposed project is located within a legally protected area¹⁶ or an internationally recognized area,¹⁷ the client will meet the requirements of paragraphs 13 through 19 of this Performance Standard, as applicable. In addition, the client will:

- Demonstrate that the proposed development in such areas is legally permitted;
- Act in a manner consistent with any government recognized management plans for such areas;
- Consult protected area sponsors and managers, Affected Communities, Indigenous Peoples and other stakeholders on the proposed project, as appropriate; and
- Implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.¹⁸

Invasive Alien Species

21. Intentional or accidental introduction of alien, or non-native, species of flora and fauna into areas where they are not normally found can be a significant threat to biodiversity, since some alien species can become invasive, spreading rapidly and out-competing native species.

22. The client will not intentionally introduce any new alien species (not currently established in the country or region of the project) unless this is carried out in accordance with the existing regulatory framework for such introduction. Notwithstanding the above, the client will not deliberately introduce any alien species with a high risk of invasive behavior regardless of whether such introductions are permitted under the existing regulatory framework. All introductions of alien species will be subject to a risk assessment (as part of the client's environmental and social risks and impacts identification process) to determine the potential for invasive behavior. The client will implement measures to avoid the potential for accidental or unintended introductions including the transportation of substrates and vectors (such as soil, ballast, and plant materials) that may harbor alien species.

23. Where alien species are already established in the country or region of the proposed project, the client will exercise diligence in not spreading them into areas in which they have not already been established. As practicable, the client should take measures to eradicate such species from the natural habitats over which they have management control.

Management of Ecosystem Services

24. Where a project is likely to adversely impact ecosystem services, as determined by the risks and impacts identification process, the client will conduct a systematic review to identify priority

¹⁶ This Performance Standard recognizes legally protected areas that meet the IUCN definition: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." For the purposes of this Performance Standard, this includes areas proposed by governments for such designation.

¹⁷ Exclusively defined as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention).

¹⁸ Implementing additional programs may not be necessary for projects that do not create a new footprint.

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ecosystem services. Priority ecosystem services are two-fold: (i) those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to Affected Communities; and/or (ii) those services on which the project is directly dependent for its operations (e.g., water). When Affected Communities are likely to be impacted, they should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in Performance Standard 1.

25. With respect to impacts on priority ecosystem services of relevance to Affected Communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided. If these impacts are unavoidable, the client will minimize them and implement mitigation measures that aim to maintain the value and functionality of priority services. With respect to impacts on priority ecosystem services on which the project depends, clients should minimize impacts on ecosystem services and implement measures that increase resource efficiency of their operations, as described in Performance Standard 3. Additional provisions for ecosystem services are included in Performance Standards 4, 5, 7, and 8.¹⁹

Sustainable Management of Living Natural Resources

26. Clients who are engaged in the primary production of living natural resources, including natural and plantation forestry, agriculture, animal husbandry, aquaculture, and fisheries, will be subject to the requirements of paragraphs 26 through 30, in addition to the rest of this Performance Standard. Where feasible, the client will locate land-based agribusiness and forestry projects on unforested land or land already converted. Clients who are engaged in such industries will manage living natural resources in a sustainable manner, through the application of industry-specific good management practices and available technologies. Where such primary production practices are codified in globally, regionally, or nationally recognized standards, the client will implement sustainable management practices to one or more relevant and credible standards as demonstrated by independent verification or certification.

27. Credible globally, regionally, or nationally recognized standards for sustainable management of living natural resources are those which (i) are objective and achievable; (ii) are founded on a multi-stakeholder consultative process; (iii) encourage step-wise and continual improvements; and (iv) provide for independent verification or certification through appropriate accredited bodies for such standards.²⁰

28. Where relevant and credible standard(s) exist, but the client has not yet obtained independent verification or certification to such standard(s), the client will conduct a pre-assessment of its conformity to the applicable standard(s) and take actions to achieve such verification or certification over an appropriate period of time.

29. In the absence of a relevant and credible global, regional, or national standard for the particular living natural resource in the country concerned, the client will:

¹⁹ Ecosystem service references are located in Performance Standard 4, paragraph 8; Performance Standard 5, paragraphs 5 and 25–29; Performance Standard 7, paragraphs 13–17 and 20; and Performance Standard 8, paragraph 11.

²⁰ A credible certification system would be one which is independent, cost-effective, based on objective and measurable performance standards and developed through consultation with relevant stakeholders, such as local people and communities, Indigenous Peoples, and civil society organizations representing consumer, producer and conservation interests. Such a system has fair, transparent and independent decision-making procedures that avoid conflicts of interest.

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- Commit to applying good international industry operating principles, management practices, and technologies; and
- Actively engage and support the development of a national standard, where relevant, including studies that contribute to the definition and demonstration of sustainable practices.

Supply Chain

30. Where a client is purchasing primary production (especially but not exclusively food and fiber commodities) that is known to be produced in regions where there is a risk of significant conversion of natural and/or critical habitats, systems and verification practices will be adopted as part of the client's ESMS to evaluate its primary suppliers.²¹ The systems and verification practices will (i) identify where the supply is coming from and the habitat type of this area; (ii) provide for an ongoing review of the client's primary supply chains; (iii) limit procurement to those suppliers that can demonstrate that they are not contributing to significant conversion of natural and/or critical habitats (this may be demonstrated by delivery of certified product, or progress towards verification or certification under a credible scheme in certain commodities and/or locations); and (iv) where possible, require actions to shift the client's primary supply chain over time to suppliers that can demonstrate that they are not significantly adversely impacting these areas. The ability of the client to fully address these risks will depend upon the client's level of management control or influence over its primary suppliers.

²¹ Primary suppliers are those suppliers who, on an ongoing basis, provide the majority of living natural resources, goods, and materials essential for the core business processes of the project.

Introduction

1. Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities. This vulnerability may include loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and diseases.

2. Private sector projects can create opportunities for Indigenous Peoples to participate in, and benefit from project-related activities that may help them fulfill their aspiration for economic and social development. Furthermore, Indigenous Peoples may play a role in sustainable development by promoting and managing activities and enterprises as partners in development. Government often plays a central role in the management of Indigenous Peoples' issues, and clients should collaborate with the responsible authorities in managing the risks and impacts of their activities.¹

Objectives

- To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
- To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts.
- To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.
- To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.
- To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present.
- To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.

Scope of Application

3. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System, the elements of which are outlined in Performance Standard 1.

¹ In addition to meeting the requirements under this Performance Standard, clients must comply with applicable national law, including those laws implementing host country obligations under international law.

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4. There is no universally accepted definition of “Indigenous Peoples.” Indigenous Peoples may be referred to in different countries by such terms as “Indigenous ethnic minorities,” “aboriginals,” “hill tribes,” “minority nationalities,” “scheduled tribes,” “first nations,” or “tribal groups.”
5. In this Performance Standard, the term “Indigenous Peoples” is used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:
 - Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
 - Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
 - Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or
 - A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.
6. This Performance Standard applies to communities or groups of Indigenous Peoples who maintain a collective attachment, i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. It may also apply to communities or groups that have lost collective attachment to distinct habitats or ancestral territories in the project area, occurring within the concerned group members’ lifetime, because of forced severance, conflict, government resettlement programs, dispossession of their lands, natural disasters, or incorporation of such territories into an urban area.
7. The client may be required to seek inputs from competent professionals to ascertain whether a particular group is considered as Indigenous Peoples for the purpose of this Performance Standard.

Requirements

General

Avoidance of Adverse Impacts

8. The client will identify, through an environmental and social risks and impacts assessment process, all communities of Indigenous Peoples within the project area of influence who may be affected by the project, as well as the nature and degree of the expected direct and indirect economic, social, cultural (including cultural heritage²), and environmental impacts on them.
9. Adverse impacts on Affected Communities of Indigenous Peoples should be avoided where possible. Where alternatives have been explored and adverse impacts are unavoidable, the client will minimize, restore, and/or compensate for these impacts in a culturally appropriate manner commensurate with the nature and scale of such impacts and the vulnerability of the Affected Communities of Indigenous Peoples. The client’s proposed actions will be developed with the ICP of the Affected Communities of Indigenous Peoples and contained in a time-bound plan, such as an Indigenous Peoples Plan, or a broader community development plan with separate components for Indigenous Peoples.³

² Additional requirements on protection of cultural heritage are set out in Performance Standard 8.

³ The determination of the appropriate plan may require the input of competent professionals. A community development plan may be appropriate in circumstances where Indigenous Peoples are a part of larger Affected Communities.

Participation and Consent

10. The client will undertake an engagement process with the Affected Communities of Indigenous Peoples as required in Performance Standard 1. This engagement process includes stakeholder analysis and engagement planning, disclosure of information, consultation, and participation, in a culturally appropriate manner. In addition, this process will:

- Involve Indigenous Peoples' representative bodies and organizations (e.g., councils of elders or village councils), as well as members of the Affected Communities of Indigenous Peoples; and
- Provide sufficient time for Indigenous Peoples' decision-making processes.⁴

11. Affected Communities of Indigenous Peoples may be particularly vulnerable to the loss of, alienation from or exploitation of their land and access to natural and cultural resources.⁵ In recognition of this vulnerability, in addition to the General Requirements of this Performance Standard, the client will obtain the FPIC of the Affected Communities of Indigenous Peoples in the circumstances described in paragraphs 13–17 of this Performance Standard. FPIC applies to project design, implementation, and expected outcomes related to impacts affecting the communities of Indigenous Peoples. When any of these circumstances apply, the client will engage external experts to assist in the identification of the project risks and impacts.

12. There is no universally accepted definition of FPIC. For the purposes of Performance Standards 1, 7 and 8, "FPIC" has the meaning described in this paragraph. FPIC builds on and expands the process of ICP described in Performance Standard 1 and will be established through good faith negotiation between the client and the Affected Communities of Indigenous Peoples. The client will document: (i) the mutually accepted process between the client and Affected Communities of Indigenous Peoples, and (ii) evidence of agreement between the parties as the outcome of the negotiations. FPIC does not necessarily require unanimity and may be achieved even when individuals or groups within the community explicitly disagree.

Circumstances Requiring Free, Prior, and Informed Consent

Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use

13. Indigenous Peoples are often closely tied to their lands and related natural resources.⁶ Frequently, these lands are traditionally owned or under customary use.⁷ While Indigenous Peoples may not possess legal title to these lands as defined by national law, their use of these lands, including seasonal or cyclical use, for their livelihoods, or cultural, ceremonial, and spiritual purposes that define their identity and community, can often be substantiated and documented.

⁴ Internal decision making processes are generally but not always collective in nature. There may be internal dissent, and decisions may be challenged by some in the community. The consultation process should be sensitive to such dynamics and allow sufficient time for internal decision making processes to reach conclusions that are considered legitimate by the majority of the concerned participants.

⁵ Natural resources and natural areas with cultural value referred to in this Performance Standard are equivalent to ecosystem provisioning and cultural services as described in Performance Standard 6.

⁶ Examples include marine and aquatic resources timber, and non-timber forest products, medicinal plants, hunting and gathering grounds, and grazing and cropping areas. Natural resource assets, as referred to in this Performance Standard, are equivalent to provisioning ecosystem services as described in Performance Standard 6.

⁷ The acquisition and/or leasing of lands with legal title is addressed in Performance Standard 5: Land Acquisition and Involuntary Resettlement.

14. If the client proposes to locate a project on, or commercially develop natural resources on lands traditionally owned by, or under the customary use of, Indigenous Peoples, and adverse impacts⁸ can be expected, the client will take the following steps:

- Document efforts to avoid and otherwise minimize the area of land proposed for the project;
- Document efforts to avoid and otherwise minimize impacts on natural resources and natural areas of importance⁹ to Indigenous People;
- Identify and review all property interests and traditional resource uses prior to purchasing or leasing land;
- Assess and document the Affected Communities of Indigenous Peoples' resource use without prejudicing any Indigenous Peoples' land claim.¹⁰ The assessment of land and natural resource use should be gender inclusive and specifically consider women's role in the management and use of these resources;
- Ensure that Affected Communities of Indigenous Peoples are informed of their land rights under national law, including any national law recognizing customary use rights; and
- Offer Affected Communities of Indigenous Peoples compensation and due process in the case of commercial development of their land and natural resources, together with culturally appropriate sustainable development opportunities, including:
 - Providing land-based compensation or compensation-in-kind in lieu of cash compensation where feasible.¹¹
 - Ensuring continued access to natural resources, identifying the equivalent replacement resources, or, as a last option, providing compensation and identifying alternative livelihoods if project development results in the loss of access to and the loss of natural resources independent of project land acquisition.
 - Ensuring fair and equitable sharing of benefits associated with project usage of the resources where the client intends to utilize natural resources that are central to the identity and livelihood of Affected Communities of Indigenous People and their usage thereof exacerbates livelihood risk.
 - Providing Affected Communities of Indigenous Peoples with access, usage, and transit on land it is developing subject to overriding health, safety, and security considerations.

Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use

15. The client will consider feasible alternative project designs to avoid the relocation of Indigenous Peoples from communally held¹² lands and natural resources subject to traditional ownership or

⁸ Such adverse impacts may include impacts from loss of access to assets or resources or restrictions on land use resulting from project activities.

⁹ "Natural resources and natural areas of importance" as referred to in this Performance Standard are equivalent to priority ecosystem services as defined in Performance Standard 6. They refer to those services over which the client has direct management control or significant influence, and those services most likely to be sources of risk in terms of impacts on Affected Communities of Indigenous Peoples.

¹⁰ While this Performance Standard requires substantiation and documentation of the use of such land, clients should also be aware that the land may already be under alternative use, as designated by the host government.

¹¹ If circumstances prevent the client from offering suitable replacement land, the client must provide verification that such is the case. Under such circumstances, the client will provide non land-based income-earning opportunities over and above cash compensation to the Affected Communities of Indigenous Peoples.

under customary use. If such relocation is unavoidable the client will not proceed with the project unless FPIC has been obtained as described above. Any relocation of Indigenous Peoples will be consistent with the requirements of Performance Standard 5. Where feasible, the relocated Indigenous Peoples should be able to return to their traditional or customary lands, should the cause of their relocation cease to exist.

Critical Cultural Heritage

16. Where a project may significantly impact on critical cultural heritage¹³ that is essential to the identity and/or cultural, ceremonial, or spiritual aspects of Indigenous Peoples lives, priority will be given to the avoidance of such impacts. Where significant project impacts on critical cultural heritage are unavoidable, the client will obtain the FPIC of the Affected Communities of Indigenous Peoples.

17. Where a project proposes to use the cultural heritage including knowledge, innovations, or practices of Indigenous Peoples for commercial purposes, the client will inform the Affected Communities of Indigenous Peoples of (i) their rights under national law; (ii) the scope and nature of the proposed commercial development; (iii) the potential consequences of such development; and (iv) obtain their FPIC. The client will also ensure fair and equitable sharing of benefits from commercialization of such knowledge, innovation, or practice, consistent with the customs and traditions of the Indigenous Peoples.

Mitigation and Development Benefits

18. The client and the Affected Communities of Indigenous Peoples will identify mitigation measures in alignment with the mitigation hierarchy described in Performance Standard 1 as well as opportunities for culturally appropriate and sustainable development benefits. The client will ensure the timely and equitable delivery of agreed measures to the Affected Communities of Indigenous Peoples.

19. The determination, delivery, and distribution of compensation and other benefit sharing measures to the Affected Communities of Indigenous Peoples will take account of the laws, institutions, and customs of these communities as well as their level of interaction with mainstream society. Eligibility for compensation can either be individually or collectively-based, or be a combination of both.¹⁴ Where compensation occurs on a collective basis, mechanisms that promote the effective delivery and distribution of compensation to all eligible members of the group will be defined and implemented.

20. Various factors including, but not limited to, the nature of the project, the project context and the vulnerability of the Affected Communities of Indigenous Peoples will determine how these communities should benefit from the project. Identified opportunities should aim to address the goals

¹² Typically, Indigenous Peoples claim rights and access to, and use of land and resources through traditional or customary systems, many of which entail communal property rights. These traditional claims to land and resources may not be recognized under national laws. Where members of the Affected Communities of Indigenous Peoples individually hold legal title, or where the relevant national law recognizes customary rights for individuals, the requirements of Performance Standard 5 will apply, rather than the requirements under paragraph 17 of this Performance Standard.

¹³ Includes natural areas with cultural and/or spiritual value such as sacred groves, sacred bodies of water and waterways, sacred trees, and sacred rocks. Natural areas with cultural value are equivalent to priority ecosystem cultural services as defined in Performance Standard 6.

¹⁴ Where control of resources, assets and decision making are predominantly collective in nature, efforts will be made to ensure that, where possible, benefits and compensation are collective, and take account of intergenerational differences and needs.

and preferences of the Indigenous Peoples including improving their standard of living and livelihoods in a culturally appropriate manner, and to foster the long-term sustainability of the natural resources on which they depend.

Private Sector Responsibilities Where Government is Responsible for Managing Indigenous Peoples Issues

21. Where the government has a defined role in the management of Indigenous Peoples issues in relation to the project, the client will collaborate with the responsible government agency, to the extent feasible and permitted by the agency, to achieve outcomes that are consistent with the objectives of this Performance Standard. In addition, where government capacity is limited, the client will play an active role during planning, implementation, and monitoring of activities to the extent permitted by the agency.

22. The client will prepare a plan that, together with the documents prepared by the responsible government agency, will address the relevant requirements of this Performance Standard. The client may need to include (i) the plan, implementation, and documentation of the process of ICP and engagement and FPIC where relevant; (ii) a description of the government-provided entitlements of affected Indigenous Peoples; (iii) the measures proposed to bridge any gaps between such entitlements, and the requirements of this Performance Standard; and (iv) the financial and implementation responsibilities of the government agency and/or the client.

Introduction

1. Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

Objectives

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

Scope of Application

2. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1. During the project life-cycle, the client will consider potential project impacts to cultural heritage and will apply the provisions of this Performance Standard.

3. For the purposes of this Performance Standard, cultural heritage refers to (i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

4. Requirements with respect to tangible forms of cultural heritage are contained in paragraphs 6–16. For requirements with respect to specific instances of intangible forms of cultural heritage described in paragraph 3 (iii) see paragraph 16.

5. The requirements of this Performance Standard apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed. The requirements of this Performance Standard do not apply to cultural heritage of Indigenous Peoples; Performance Standard 7 describes those requirements.

Requirements

Protection of Cultural Heritage in Project Design and Execution

6. In addition to complying with applicable law on the protection of cultural heritage, including national law implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural and Natural Heritage, the client will identify and protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented.

Performance Standard 8 Cultural Heritage

January 1, 2012

7. Where the risk and identification process determines that there is a chance of impacts to cultural heritage, the client will retain competent professionals to assist in the identification and protection of cultural heritage. The removal of nonreplicable cultural heritage is subject to the additional requirements of paragraph 10 below. In the case of critical cultural heritage, the requirements of paragraphs 13–15 will apply.

Chance Find Procedures

8. The client is responsible for siting and designing a project to avoid significant adverse impacts to cultural heritage. The environmental and social risks and impacts identification process should determine whether the proposed location of a project is in areas where cultural heritage is expected to be found, either during construction or operations. In such cases, as part of the client's ESMS, the client will develop provisions for managing chance finds¹ through a chance find procedure² which will be applied in the event that cultural heritage is subsequently discovered. The client will not disturb any chance find further until an assessment by competent professionals is made and actions consistent with the requirements of this Performance Standard are identified.

Consultation

9. Where a project may affect cultural heritage, the client will consult with Affected Communities within the host country who use, or have used within living memory, the cultural heritage for long-standing cultural purposes. The client will consult with the Affected Communities to identify cultural heritage of importance, and to incorporate into the client's decision-making process the views of the Affected Communities on such cultural heritage. Consultation will also involve the relevant national or local regulatory agencies that are entrusted with the protection of cultural heritage.

Community Access

10. Where the client's project site contains cultural heritage or prevents access to previously accessible cultural heritage sites being used by, or that have been used by, Affected Communities within living memory for long-standing cultural purposes, the client will, based on consultations under paragraph 9, allow continued access to the cultural site or will provide an alternative access route, subject to overriding health, safety, and security considerations.

Removal of Replicable Cultural Heritage

11. Where the client has encountered tangible cultural heritage that is replicable³ and not critical, the client will apply mitigation measures that favor avoidance. Where avoidance is not feasible, the client will apply a mitigation hierarchy as follows:

- Minimize adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes⁴ needed to support it;
- Where restoration in situ is not possible, restore the functionality of the cultural heritage, in a different location, including the ecosystem processes needed to support it;

¹ Tangible cultural heritage encountered unexpectedly during project construction or operation.

² A chance find procedure is a project-specific procedure that outlines the actions to be taken if previously unknown cultural heritage is encountered.

³ Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.

⁴ Consistent with requirements in Performance Standard 6 related to ecosystem services and conservation of biodiversity.

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- The permanent removal of historical and archeological artifacts and structures is carried out according to the principles of paragraphs 6 and 7 above; and
- Only where minimization of adverse impacts and restoration to ensure maintenance of the value and functionality of the cultural heritage are demonstrably not feasible, and where the Affected Communities are using the tangible cultural heritage for long-standing cultural purposes, compensate for loss of that tangible cultural heritage.

Removal of Non-Replicable Cultural Heritage

12. Most cultural heritage is best protected by preservation in its place, since removal is likely to result in irreparable damage or destruction of the cultural heritage. The client will not remove any nonreplicable cultural heritage,⁵ unless all of the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and
- Any removal of cultural heritage is conducted using the best available technique.

Critical Cultural Heritage

13. Critical cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation.

14. The client should not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances when impacts on critical cultural heritage are unavoidable, the client will use a process of Informed Consultation and Participation (ICP) of the Affected Communities as described in Performance Standard 1 and which uses a good faith negotiation process that results in a documented outcome. The client will retain external experts to assist in the assessment and protection of critical cultural heritage.

15. Legally protected cultural heritage areas⁶ are important for the protection and conservation of cultural heritage, and additional measures are needed for any projects that would be permitted under the applicable national law in these areas. In circumstances where a proposed project is located within a legally protected area or a legally defined buffer zone, the client, in addition to the requirements for critical cultural heritage cited in paragraph 14 above, will meet the following requirements:

- Comply with defined national or local cultural heritage regulations or the protected area management plans;
- Consult the protected area sponsors and managers, local communities and other key stakeholders on the proposed project; and
- Implement additional programs, as appropriate, to promote and enhance the conservation aims of the protected area.

⁵ Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site.

⁶ Examples include world heritage sites and nationally protected areas.

Project's Use of Cultural Heritage

16. Where a project proposes to use the cultural heritage, including knowledge, innovations, or practices of local communities for commercial purposes,⁷ the client will inform these communities of (i) their rights under national law; (ii) the scope and nature of the proposed commercial development; and (iii) the potential consequences of such development. The client will not proceed with such commercialization unless it (i) enters into a process of ICP as described in Performance Standard 1 and which uses a good faith negotiation process that results in a documented outcome and (ii) provides for fair and equitable sharing of benefits from commercialization of such knowledge, innovation, or practice, consistent with their customs and traditions.

⁷ Examples include, but are not limited to, commercialization of traditional medicinal knowledge or other sacred or traditional technique for processing plants, fibers, or metals.



Appendix 11: Risk Evaluation to SKA Antenna Installations



THE SCIENCE OF MEASUREMENT

Technical Report:

Topographical Analysis of Proposed Helena Solar PV Plant

Work done for: BioTherm Energy



A. J. Otto and P. S. van der Merwe




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Executive Summary

MESA Solutions was asked by BioTherm Energy to do a topographical analysis of the terrain profile between the Helena solar farm and the SKA closest and core-site telescopes.

- An equivalent emission level that is 10 dB below the SKA threshold limit was defined. This level can be verified through measurements.
- The maximum allowed emission level is related to the well-known CISPR 11/22 Class B standard.
- The total path loss is a function of topography and frequency, as well as characteristics such as the transmitter and receiver heights.
- SPLAT! propagation results show that at lower frequencies emissions below CISPR are required in the case of the closest telescope. This is mainly due to the absence of any terrain loss over this short distance.
- Towards the core site the allowable measured levels increase slightly due to additional terrain loss.
- The possibility exists that the overall lower levels would have to be achieved to limit interference to the closest telescopes.

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Nomenclature

AGA	Astronomy Geographic Advantage
DEM	Digital Elevation Model
FSPL	Free Space Path Loss
ITM	Irregular Terrain Model
ITWOM	Irregular Terrain With Obstruction Model
KAT	Karoo Array Telescope
PV	Photo-Voltaic
SKA	Square Kilometre Array
SKA-SA	Square Kilometre Array South Africa
TL	Terrain Loss
TPL	Total Path Loss

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1 Introduction

MESA Solutions was asked by BioTherm Energy to do a topographical analysis of the terrain profile between the Helena Solar photo-voltaic (PV) plant and the Square Kilometre Array (SKA) closest and core-site telescopes. The PV plant is situated in the vicinity of the Karoo Central Astronomy Advantage Areas. These areas are protected against unwanted electromagnetic interference (EMI) under the Astronomy Geographic Advantage (AGA) Act [1] for the purpose of radio astronomy and related scientific endeavors which includes the SKA. From the terrain evaluation we are able to determine what influences, if any, natural topographical features will have on the total expected propagation attenuation based on the location of the site. This determines the maximum allowable emission levels which the facility may generate in order to still comply with SKA threshold limits as specified in [2]. The Helena PV plant's proximity to the closest and core-site SKA telescopes are shown in Figs. 1 and 2, respectively. Also included in each figure is a basic elevation profile over the specified distance. Characteristics such as separation distance, transmitter height, and azimuth angle are given in Table 1.

It is important to note that the findings from this assessment is for the client's own edification, and will be taken into account by the SKA during its own propagation analysis. It is therefore not meant to supersede any investigation done by the SKA or relevant RFI working groups.



Figure 1: Google Earth location and elevation profile of Helena Solar toward closest SKA telescope.



Figure 2: Google Earth location and elevation profile of Helena Solar toward SKA core site.

Helena Solar	SKA Core Site	Closest Telescope
Distance	112.47 km	13.17 km
Azimuth	231.71 °	145.42 °
PV Tx Height	5 m	5 m
SKA Rx Height	15 m	15 m

Table 1: Specifications of Helena Solar relative to the SKA core and closest telescopes.

2 Topographical Analysis using SPLAT!

The default propagation analysis software used by MESA Solutions is called SPLAT!, which is a **S**ignal **P**ropagation, **L**oss **A**nd **T**errain analysis tool based on the *Longley-Rice Irregular Terrain Model (ITM)*, as well as the *Irregular Terrain With Obstructions Model (ITWOM 3.0)*. The software takes into account actual terrain elevation data to ultimately predict the total path loss (TPL) between a transmitter and a receiver. As part of the analysis, certain assumptions are made regarding the source characteristics. For this investigation the various parameters defining the SPLAT! propagation model are listed in Table 2. The digital elevation model (DEM) makes use of 3-arc-second (90 m) elevation resolution data.

For this investigation, the frequency range of interest are defined from 100 MHz to 3 GHz. While the upper frequency limit of the standard in [2] are specified to at least 10 GHz, the span is limited to what is practically measurable and representative of the majority of expected interference. In the analysis the allowable SKA radiation limit in [2], including an additional 10 dB safety margin, are used as the reference level. This defines the maximum allowable level of interference than can be tolerated at the telescope.

This maximum level, which is given as a power spectral density (PSD) in dBm/Hz , is compensated for by the TPL as predicted by SPLAT!, to provide an equivalent PSD associated with the closest and core-site telescopes. This PSD for each case is then converted to an equivalent electric field (E-field) as measured at either 10 m (frequency < 1 GHz) or 3 m (frequency > 1 GHz) away from the plant. The 3 and 10 m separation distances is in accordance with measurement specifications defined in the latest international special committee on radio interference's (CISPR) 11/22 Class B standard. This standard is used for reference purposes as it is internationally known and used for industry qualification. This calculation is done for a number of representative frequencies within the band of interest and defines an E-field upper limit which the plant is allowed to radiate without exceeding emission limits at the two telescope locations. Ultimately, conformance of the plant can then be determined by comparing representative measured results to the calculated levels provided.

SPLAT! Analysis Parameters	
	Helena Solar
Frequency [MHz]	100 - 3000
Earth Dielectric Constant (Relative Permittivity [F/m])	4.000
Earth Conductivity [S/m]	0.001
Atmospheric Bending Constant	301
Radio Climate	4 (Desert)
Polarisation (Vertical=1; Horizontal=0)	1
Fraction of Time	0.05
Fraction of Situations	0.05

Table 2: SPLAT! parameters for predicted 100 MHz to 3 GHz emissions from Helena Solar to SKA core and closest telescope.

3 Total Path Loss

Shown in Table 3 below are the values for the free space path loss (FSPL), terrain loss (TL), and total path loss (TPL) at each of the frequencies chosen for the investigation. From the table it is clear that there is minimal contribution from the TL towards the closest SKA telescope. This is mainly due to the absence of major natural obstructions between the PV plant and the SKA core site as evidence from Fig. 1. The 0 dB TL at 100 MHz is a purely mathematical limitation of the software indicating a negligible contribution at that frequency over that particular terrain.

Frequency	SKA Core Site			Closest Telescope		
	SPLAT! FSPL	SPLAT! TL	SPLAT! TPL	SPLAT! FSPL	SPLAT! TL	SPLAT! TPL
100 MHz	113.50 dB	0.00 dB	113.50 dB	94.86 dB	0.00 dB	94.86 dB
300 MHz	123.04 dB	1.08 dB	124.12 dB	104.40 dB	0.00 dB	104.40 dB
500 MHz	127.48 dB	5.23 dB	132.71 dB	108.84 dB	0.00 dB	108.84 dB
700 MHz	130.40 dB	8.10 dB	138.51 dB	111.76 dB	0.00 dB	111.76 dB
1000 MHz	133.50 dB	11.11 dB	144.61 dB	114.86 dB	0.00 dB	114.86 dB
1500 MHz	137.02 dB	14.51 dB	151.54 dB	118.38 dB	0.00 dB	118.38 dB
2000 MHz	139.52 dB	16.92 dB	156.45 dB	120.88 dB	0.00 dB	120.88 dB
2500 MHz	141.45 dB	18.79 dB	160.24 dB	122.82 dB	0.00 dB	122.82 dB
3000 MHz	143.03 dB	20.32 dB	163.35 dB	124.40 dB	0.00 dB	124.40 dB

Table 3: SPLAT! Free Space Path Loss (FSPL), Terrain Loss (TL) and Total Path Loss (TPL) for vertical polarisation Helena Solar emissions.

4 Attenuation Coverage Maps

The coverage maps in this section gives an indication of the variation in TPL as a function of frequency. This has only been done for vertical polarisation with similar results assumed for horizontal polarisation.

4.1 Closest SKA Telescope

Shown in Figs. 3 to 10 are the attenuation maps in the direction of the closest SKA telescope.

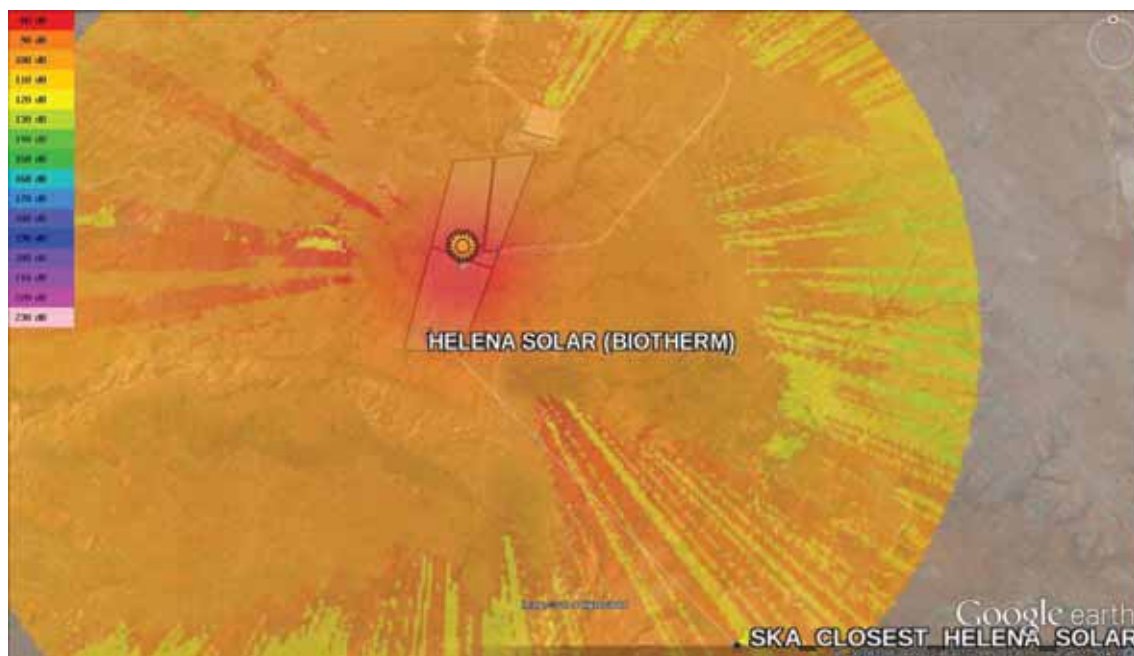


Figure 3: Attenuation map for f=100MHz from Helena Solar to the closest SKA telescope.

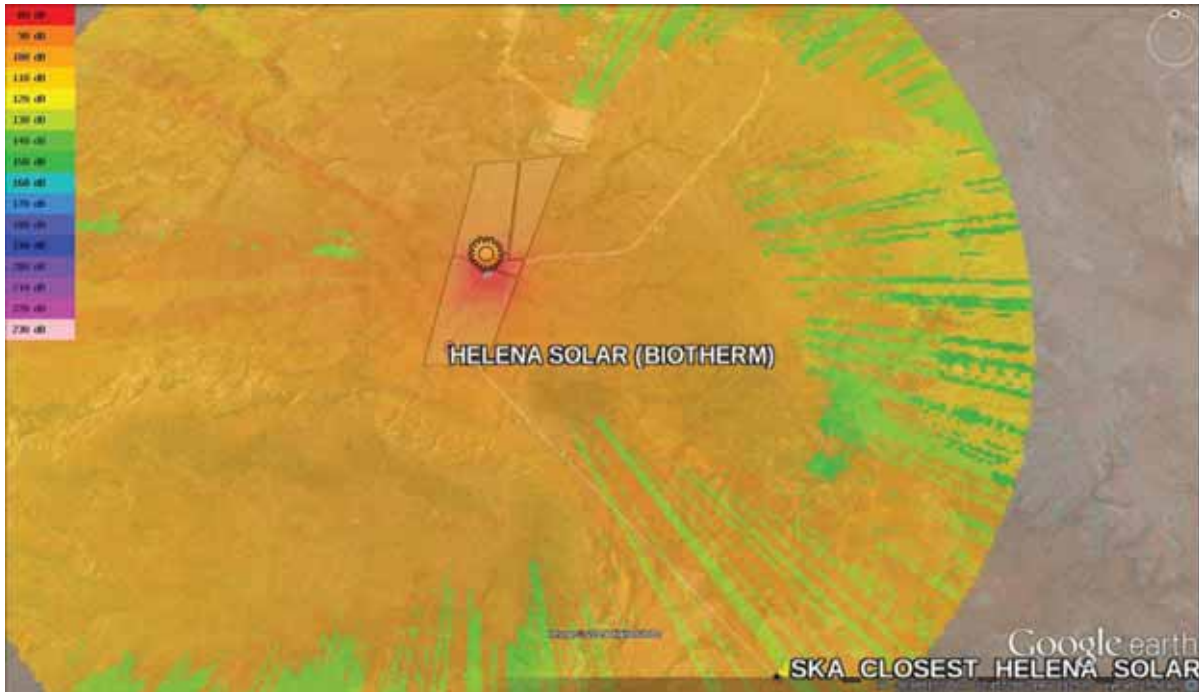


Figure 4: Attenuation map for $f=300\text{MHz}$ from Helena Solar to the closest SKA telescope.

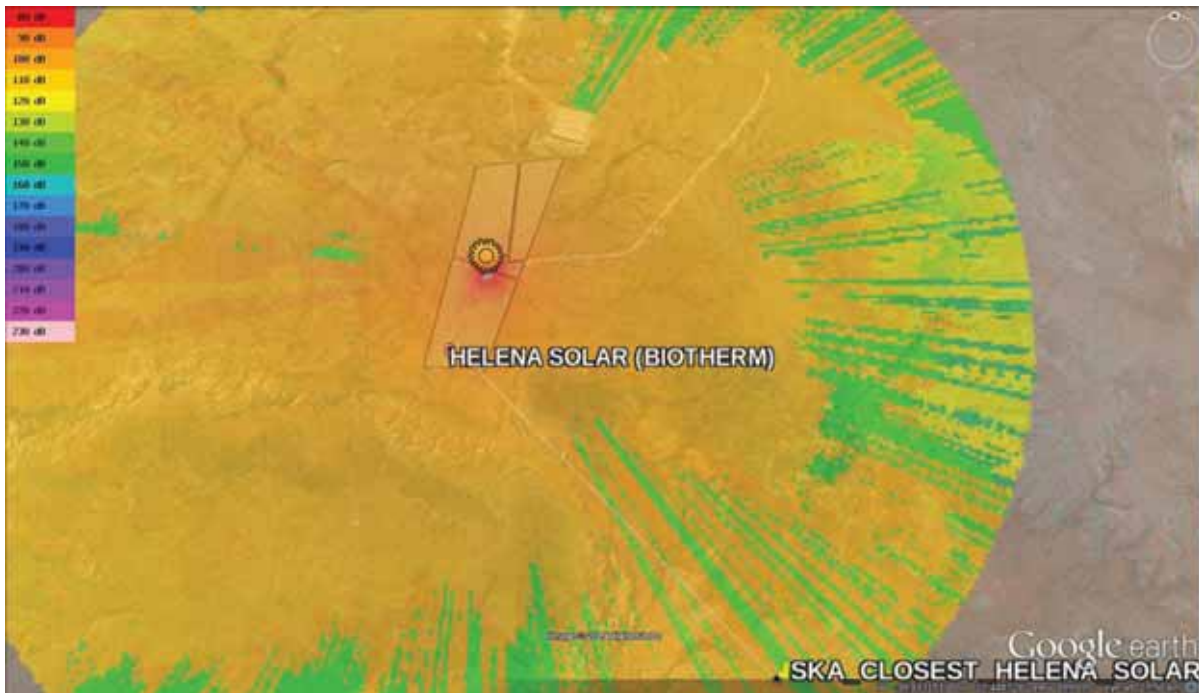


Figure 5: Attenuation map for $f=500\text{MHz}$ from Helena Solar to the closest SKA telescope.

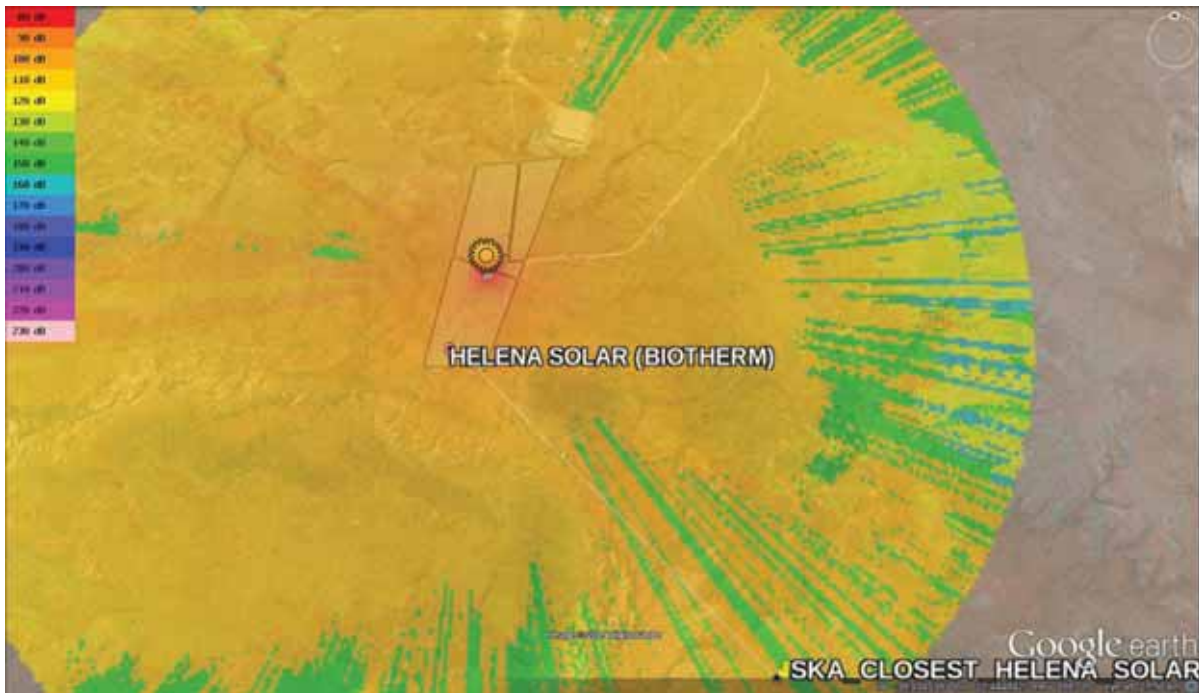


Figure 6: Attenuation map for $f=700\text{MHz}$ from Helena Solar to the closest SKA telescope.

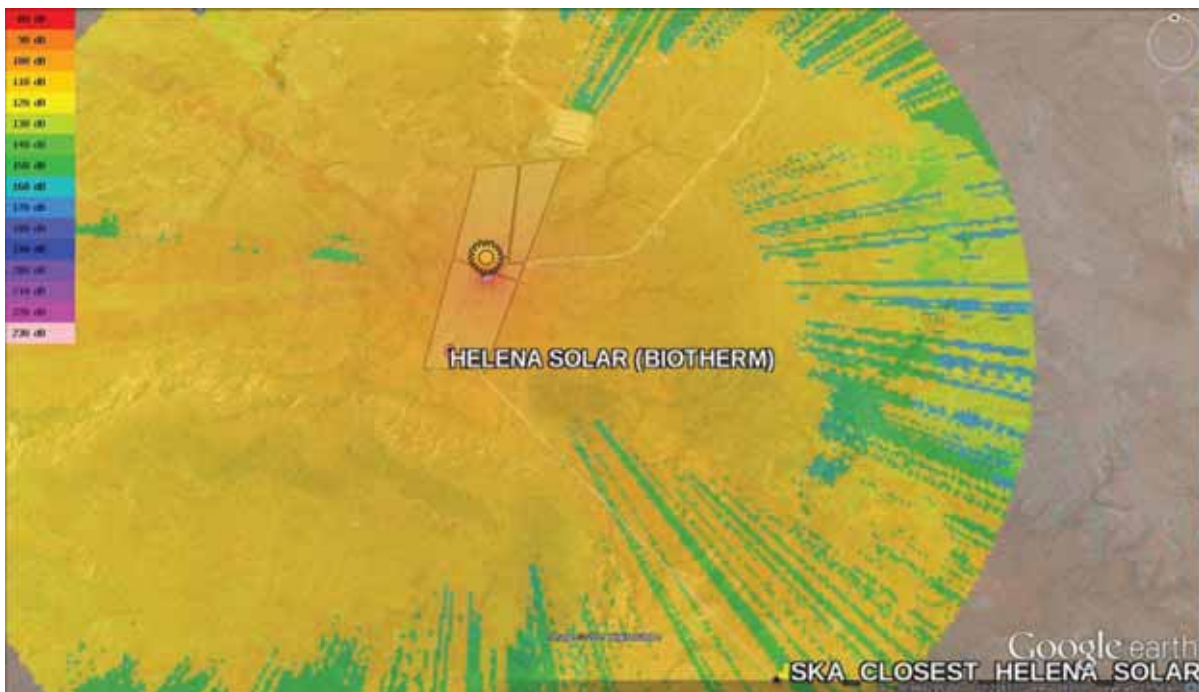


Figure 7: Attenuation map for $f=1000\text{MHz}$ from Helena Solar to the closest SKA telescope.

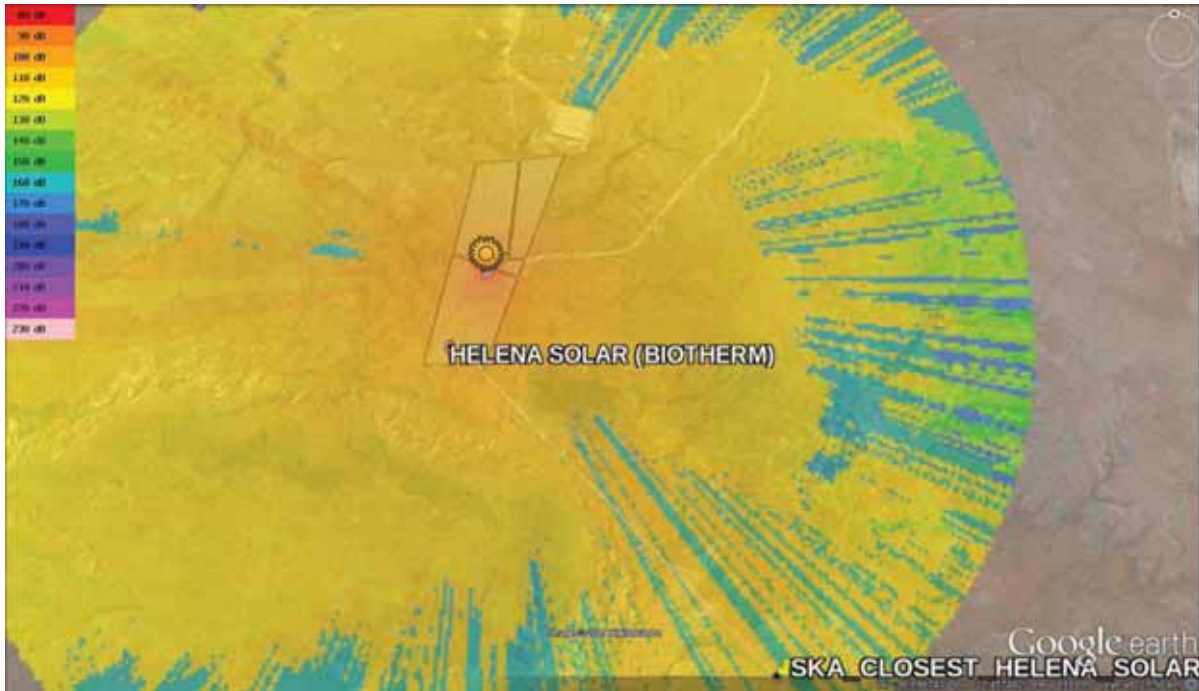


Figure 8: Attenuation map for $f=1500\text{MHz}$ from Helena Solar to the closest SKA telescope.

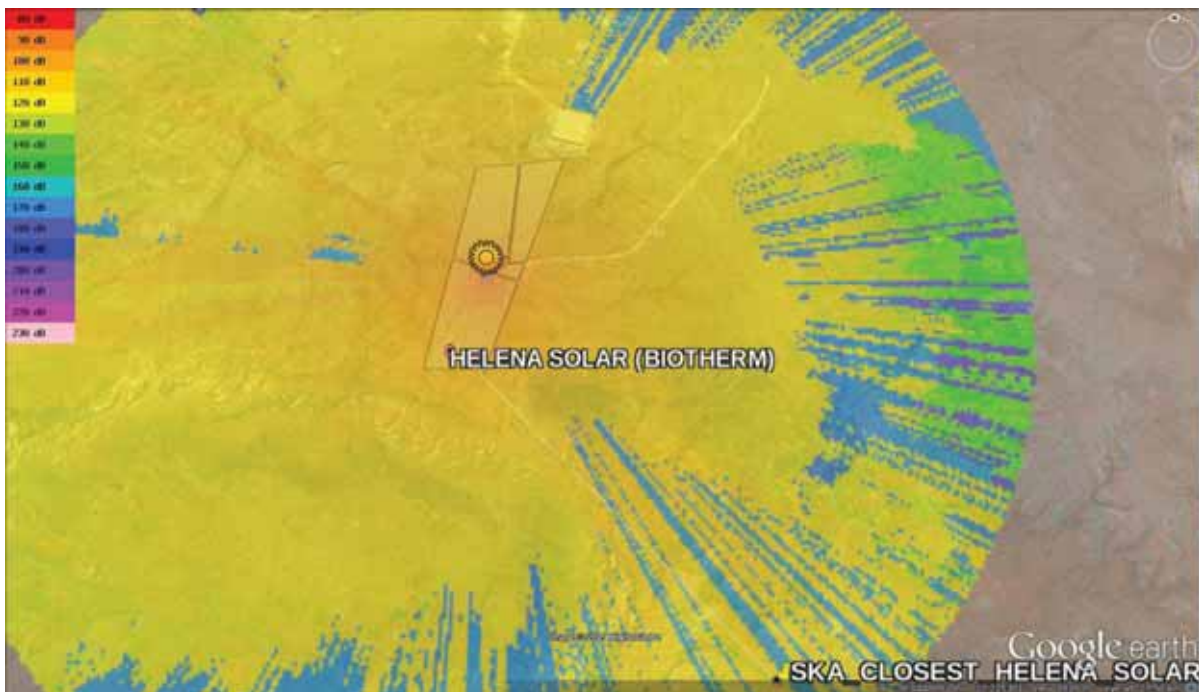


Figure 9: Attenuation map for $f=2500\text{MHz}$ from Helena Solar to the closest SKA telescope.

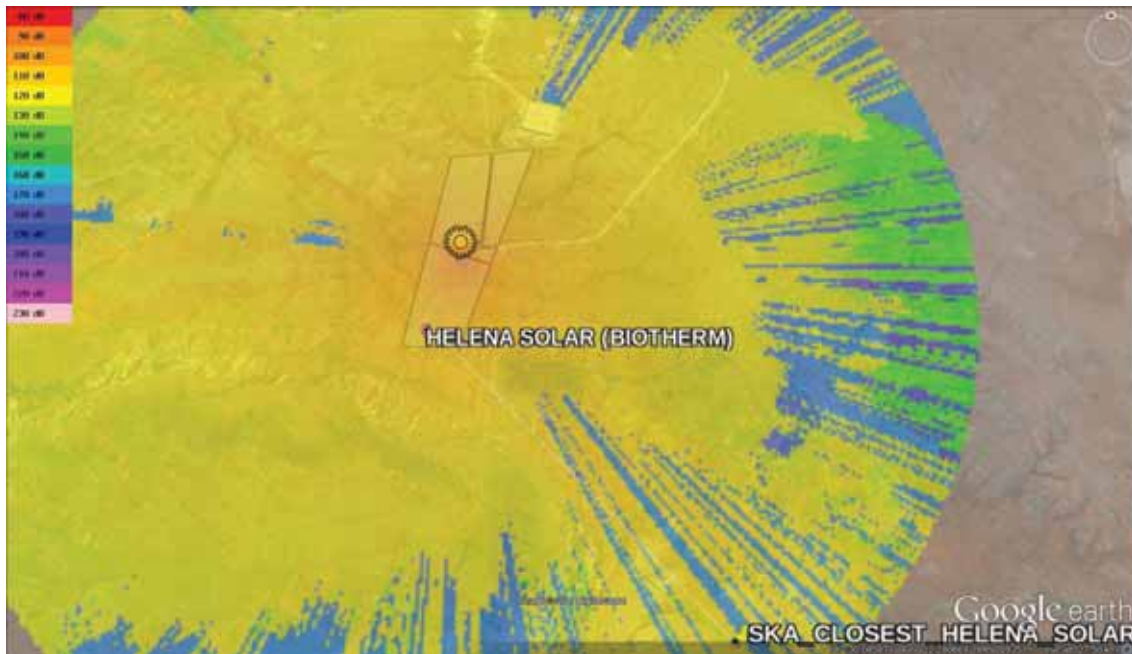


Figure 10: Attenuation map for $f=3000\text{MHz}$ from Helena Solar to the closest SKA telescope.

4.2 SKA Core Site

In Figs. 11 to 18 are the attenuation maps in the direction of the core site.

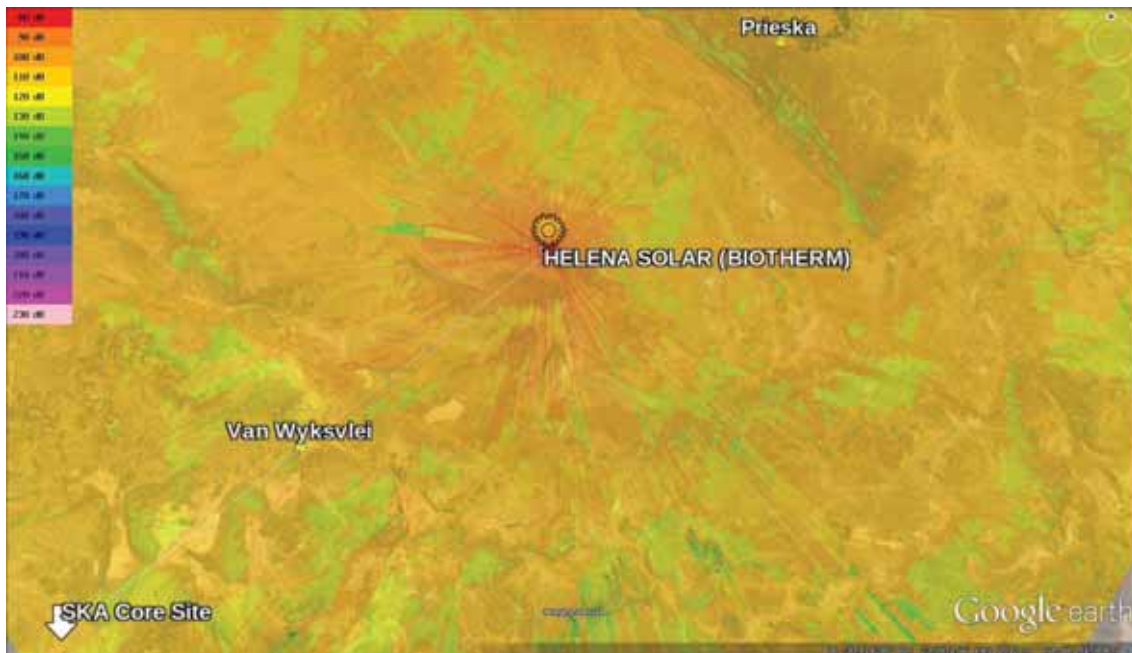


Figure 11: Attenuation map for $f=100\text{MHz}$ from Helena Solar to the SKA core.

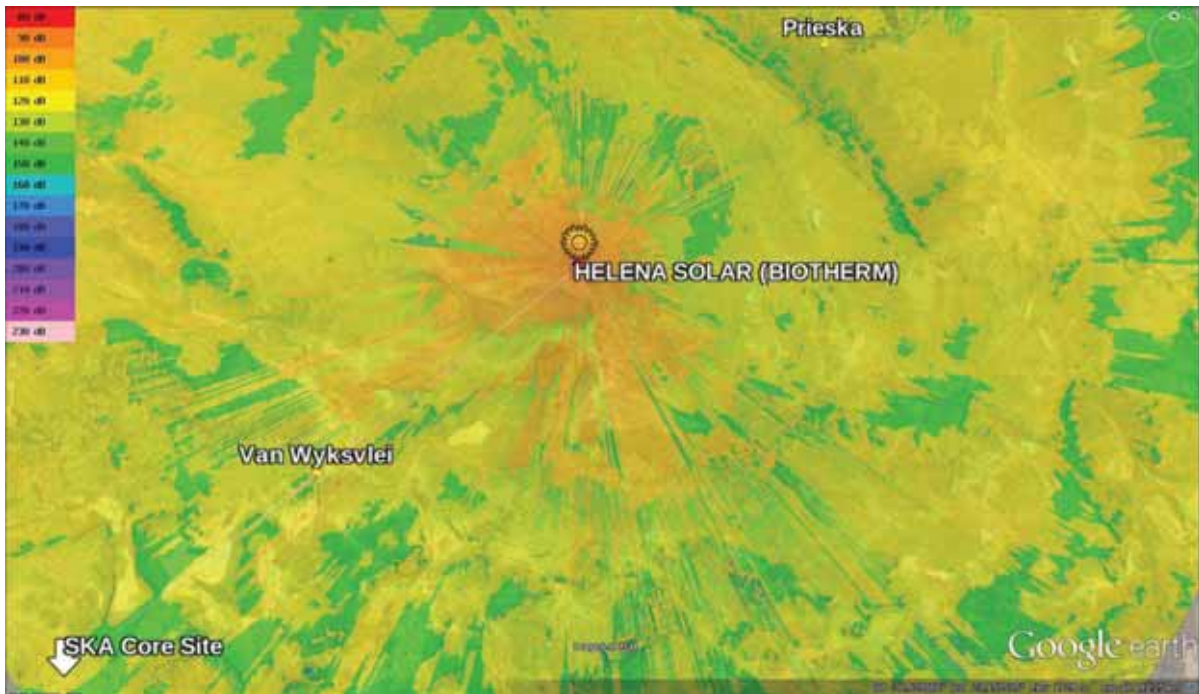


Figure 12: Attenuation map for $f=300\text{MHz}$ from Helena Solar to the SKA core.

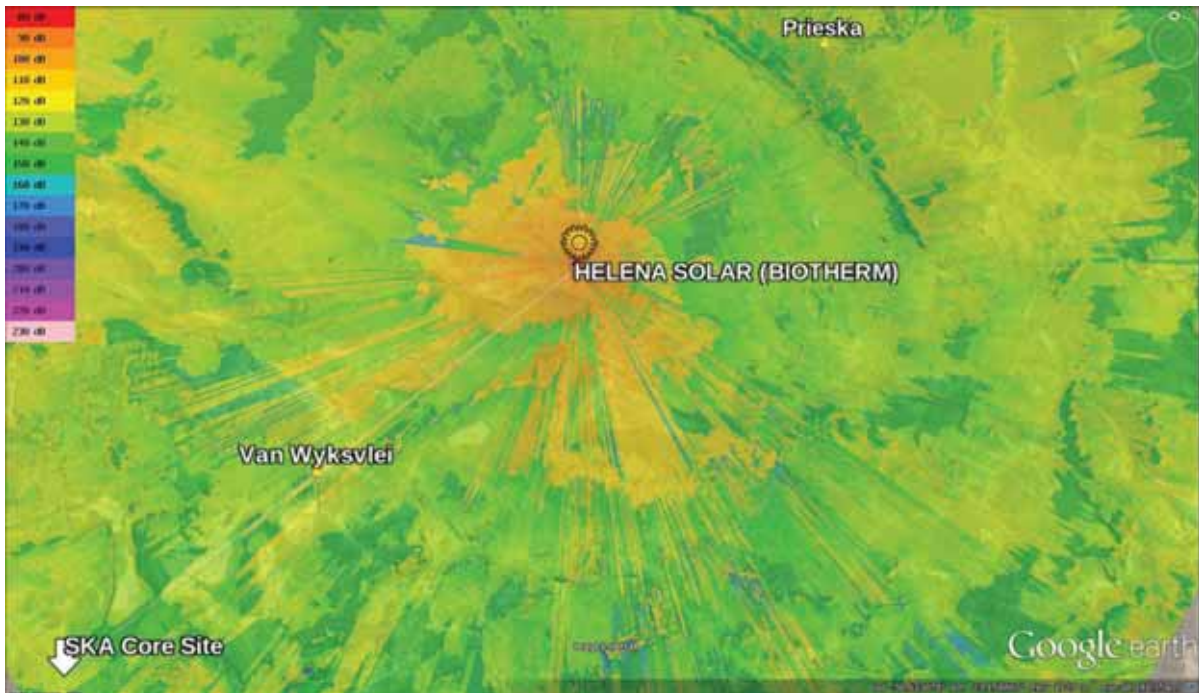


Figure 13: Attenuation map for $f=500\text{MHz}$ from Helena Solar to the SKA core.

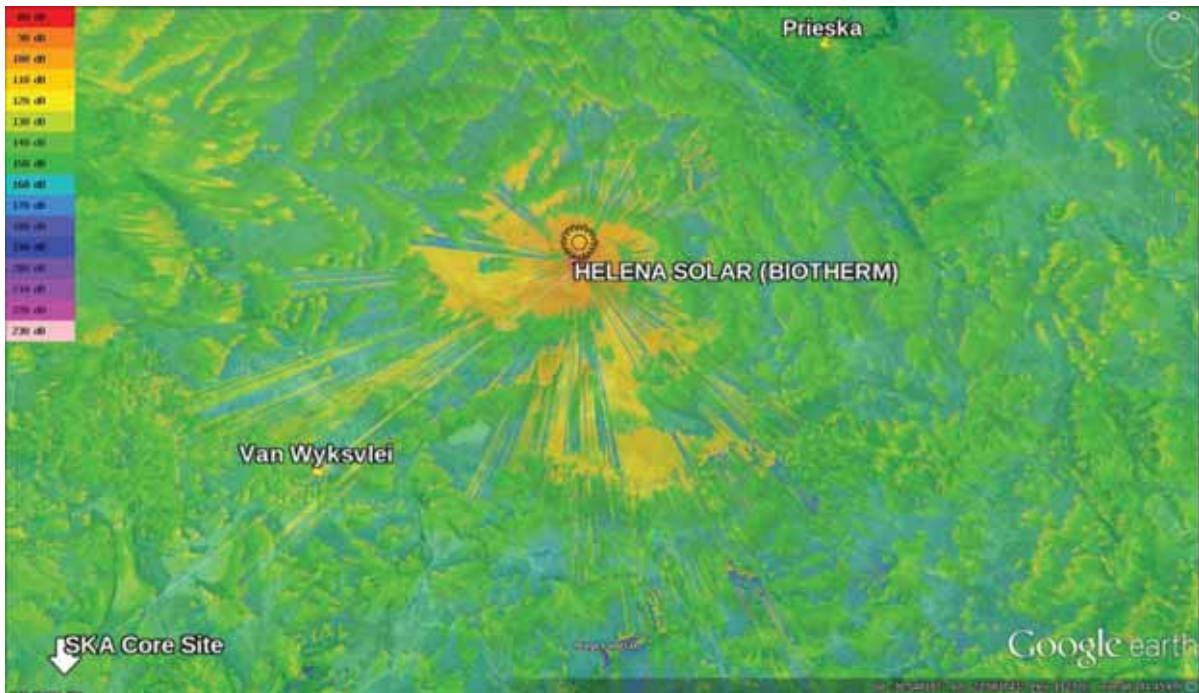


Figure 14: Attenuation map for $f=700\text{MHz}$ from Helena Solar to the SKA core.

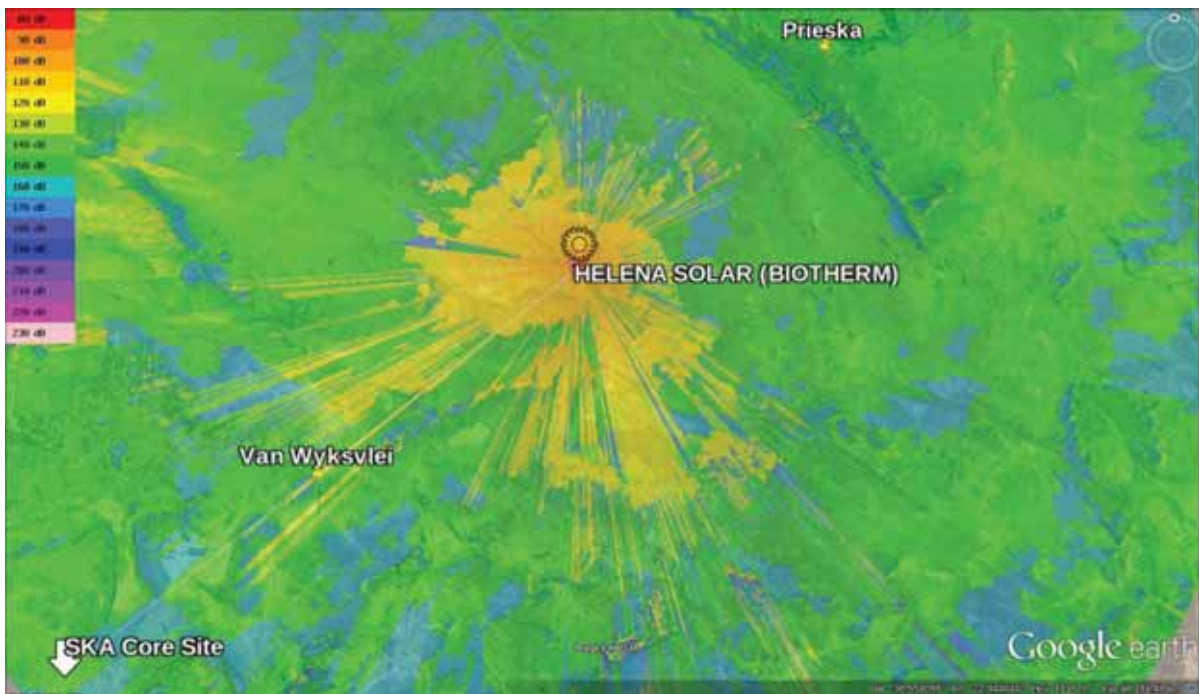


Figure 15: Attenuation map for $f=1000\text{MHz}$ from Helena Solar to the SKA core.

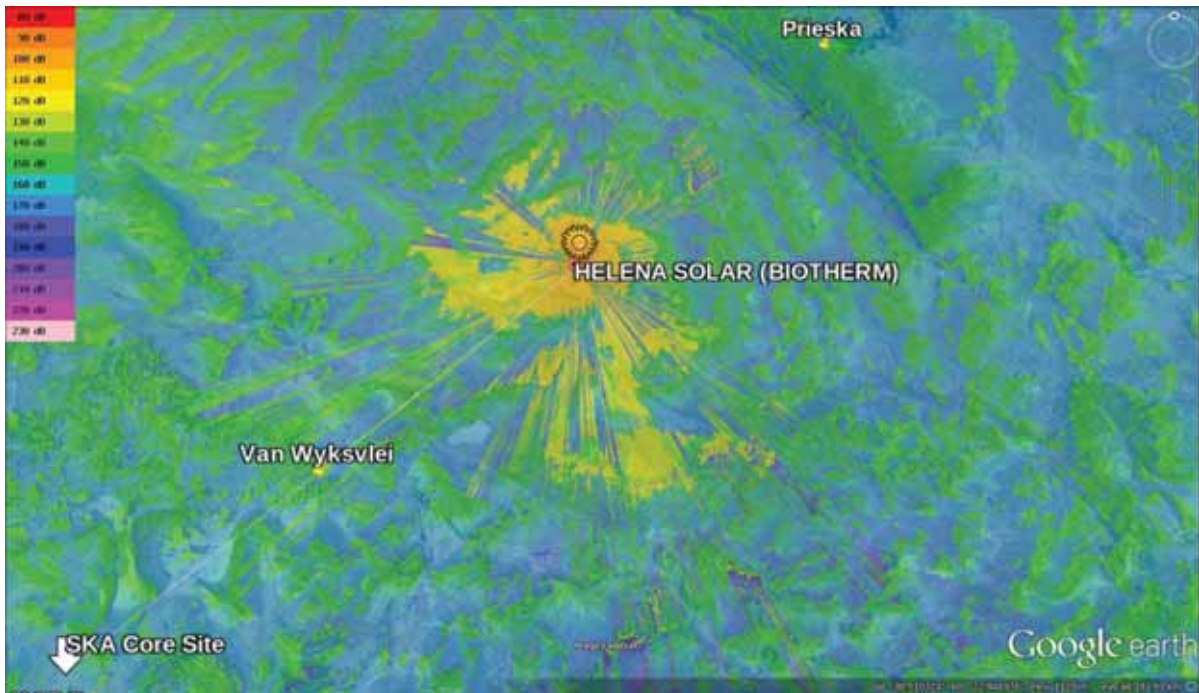


Figure 16: Attenuation map for $f=1500\text{MHz}$ from Helena Solar to the SKA core.

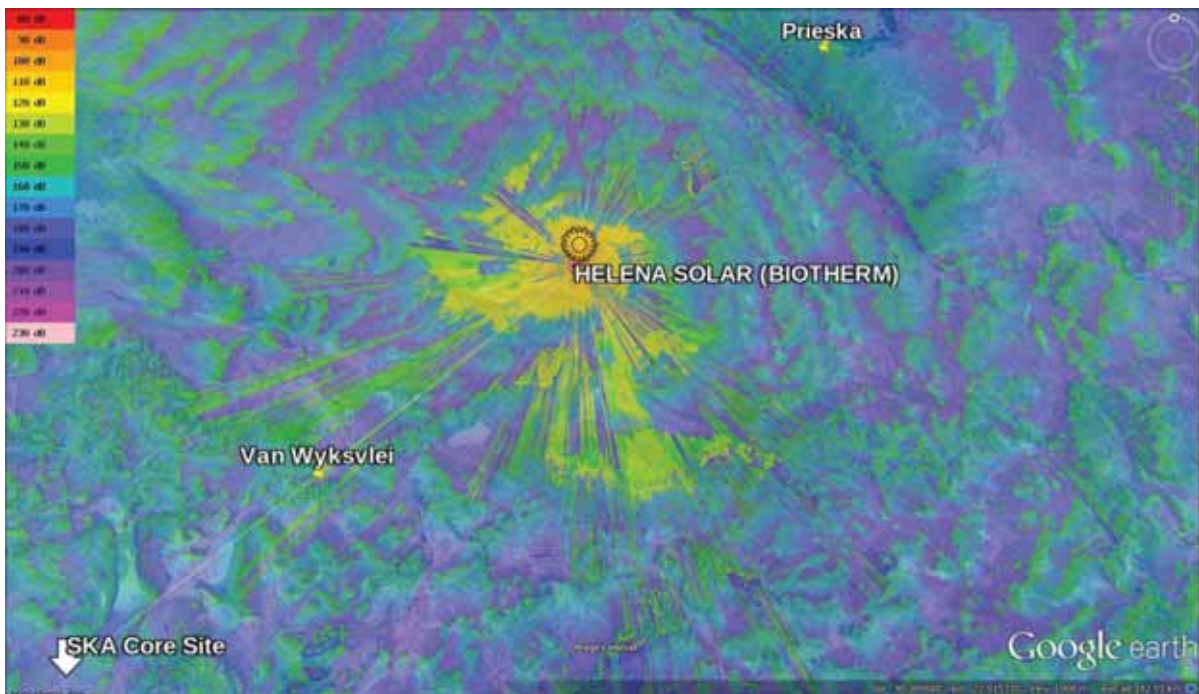


Figure 17: Attenuation map for $f=2500\text{MHz}$ from Helena Solar to the SKA core.

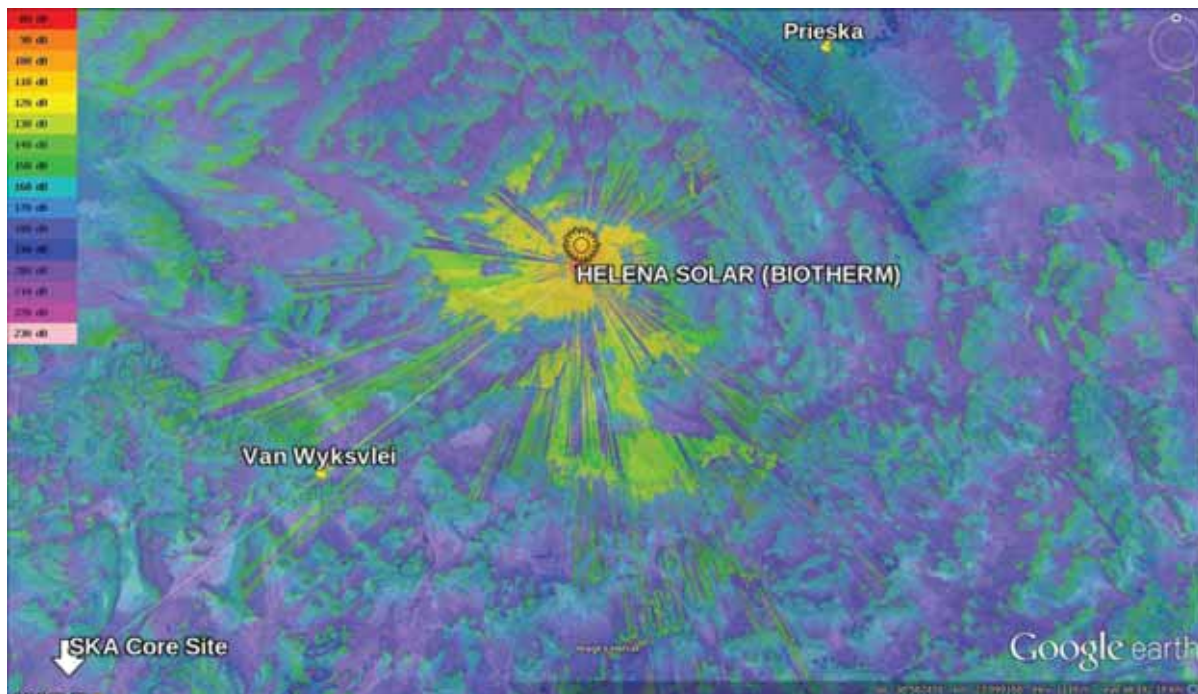


Figure 18: Attenuation map for $f=3000\text{MHz}$ from Helena Solar to the SKA core.

5 Fresnel Zones and Elevation Profiles

The Fresnel zones and elevation profiles, including the earth curvature, are shown in Figs. 19 to 26 for the closest SKA telescope and Figs. 27 to 34 for the core site. A more detailed terrain profile shows features not visible in a normal Google Map profile. This profile is then compensated for the earth curvature, clearly visible for the longer distance toward the core site. Important to note is the scale used in these figures. The elevation change is in meters but the separation distance varies in kilometers. The earth curvature representation is therefore somewhat enhanced.

5.1 Closest SKA Telescope

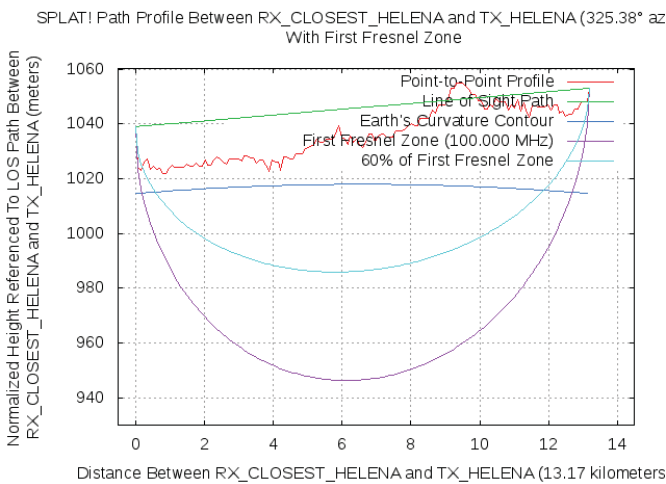


Figure 19: Elevation profile and first Fresnel zones for $f=100\text{MHz}$ from Helena Solar to closest SKA telescope.

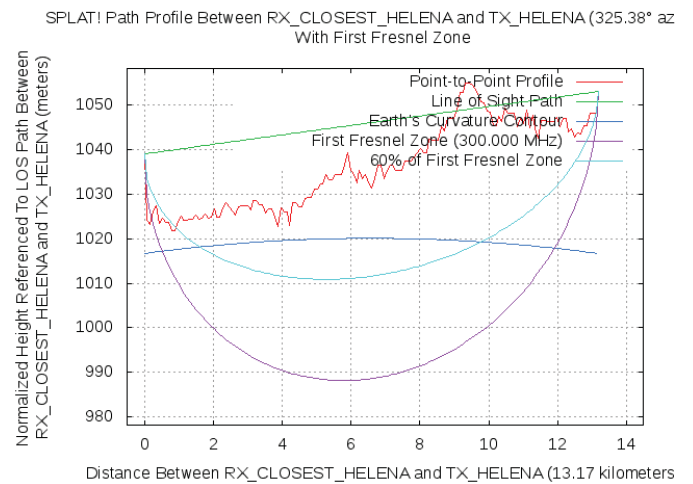


Figure 20: Elevation profile and first Fresnel zones for $f=300\text{MHz}$ from Helena Solar to closest SKA telescope.

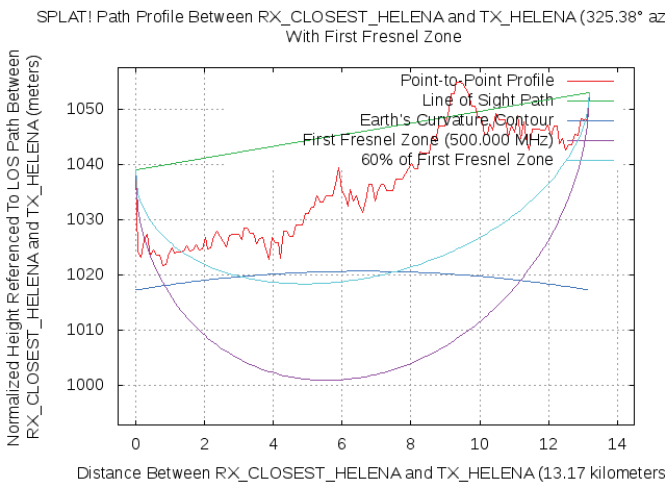


Figure 21: Elevation profile and first Fresnel zones for $f=500\text{MHz}$ from Helena Solar to closest SKA telescope.

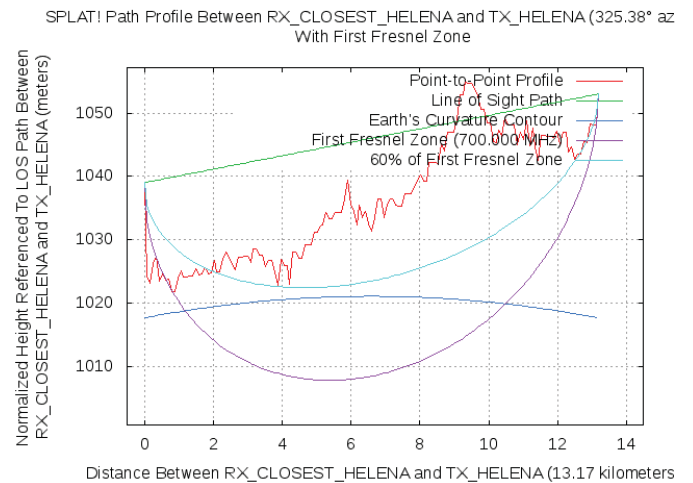


Figure 22: Elevation profile and first Fresnel zones for $f=700\text{MHz}$ from Helena Solar to closest SKA telescope.

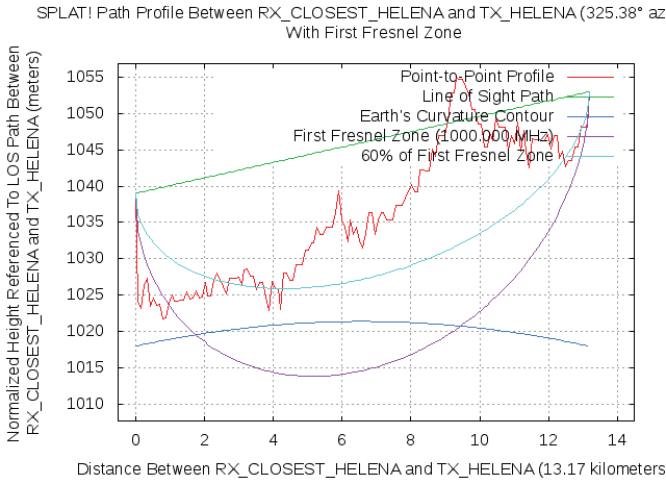


Figure 23: Elevation profile and first Fresnel zones for $f=1000\text{MHz}$ from Helena Solar to closest SKA telescope.

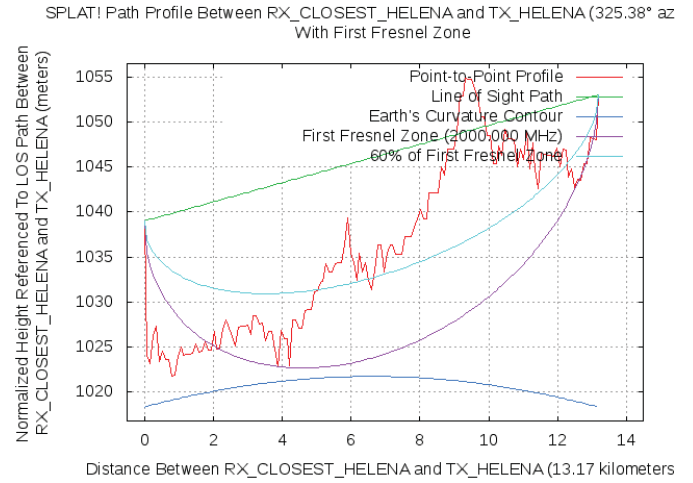


Figure 24: Elevation profile and first Fresnel zones for $f=2000\text{MHz}$ from Helena Solar to closest SKA telescope.

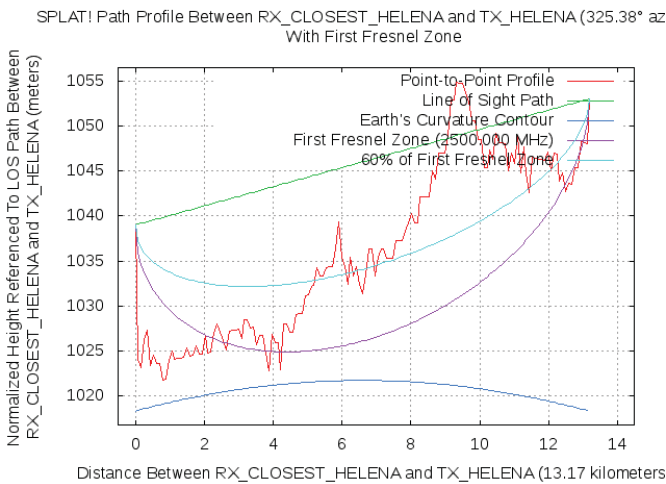


Figure 25: Elevation profile and first Fresnel zones for $f=2500\text{MHz}$ from Helena Solar to closest SKA telescope.

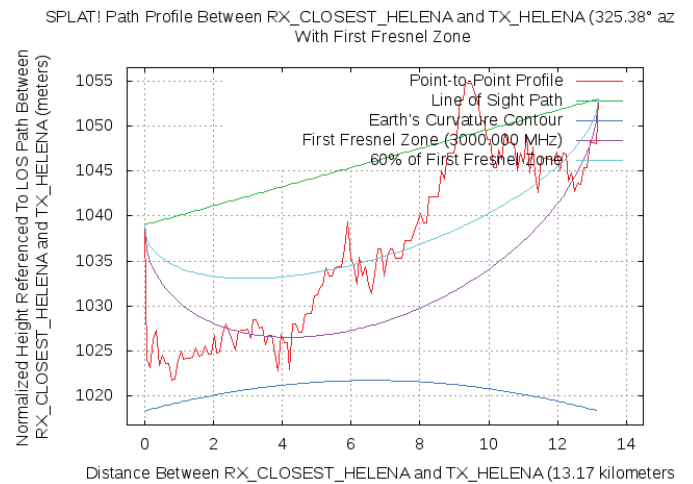


Figure 26: Elevation profile and first Fresnel zones for $f=3000\text{MHz}$ from Helena Solar to closest SKA telescope.

5.2 SKA Core Site

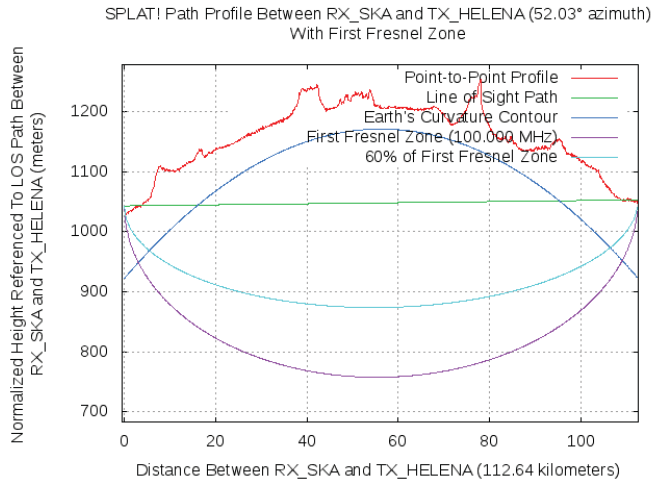


Figure 27: Elevation profile and first Fresnel zones for $f=100\text{MHz}$ from Helena Solar to SKA core.

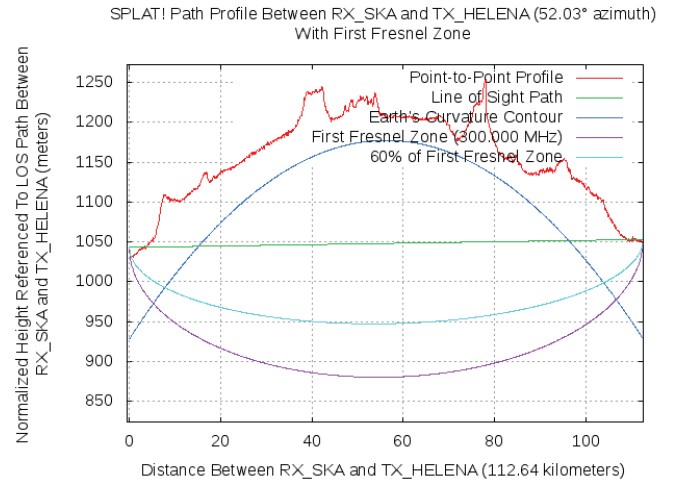


Figure 28: Elevation profile and first Fresnel zones for $f=300\text{MHz}$ from Helena Solar to SKA core.

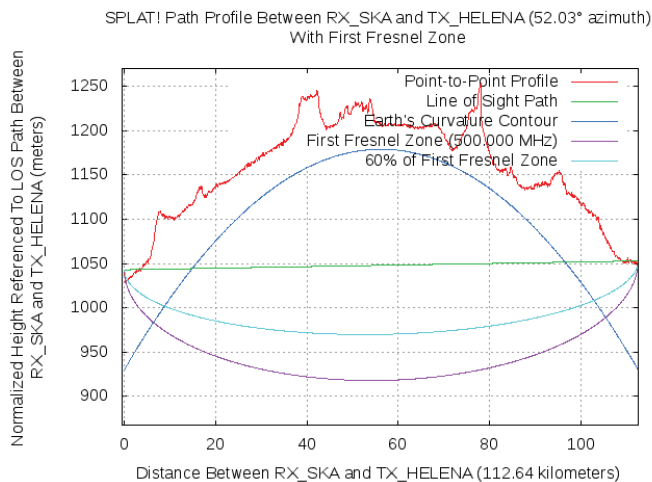


Figure 29: Elevation profile and first Fresnel zones for $f=500\text{MHz}$ from Helena Solar to SKA core.

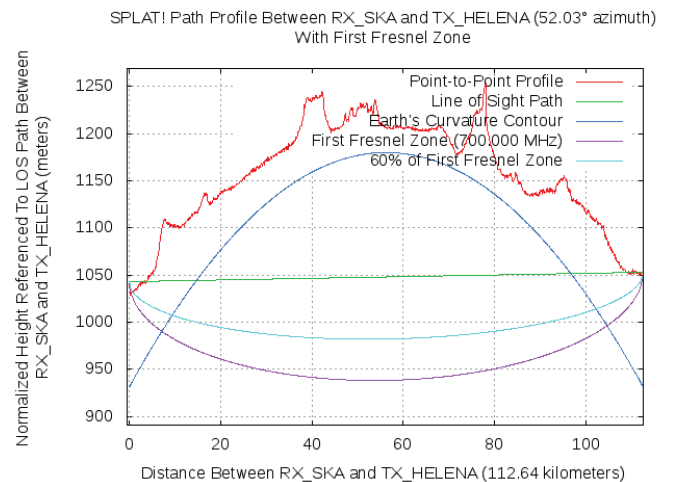


Figure 30: Elevation profile and first Fresnel zones for $f=700\text{MHz}$ from Helena Solar to SKA core.

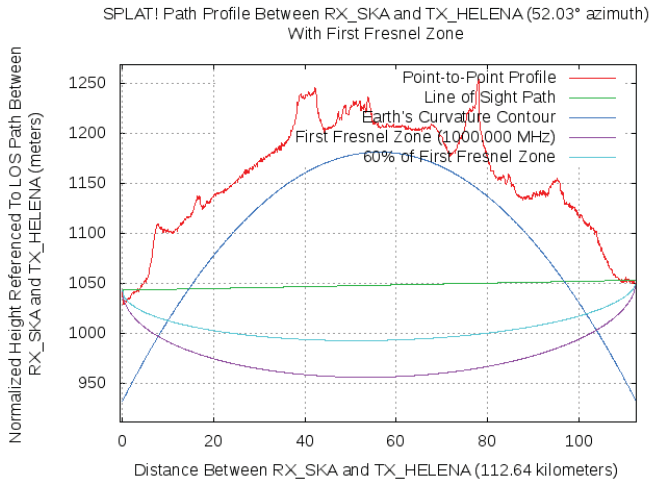


Figure 31: Elevation profile and first Fresnel zones for f=1000MHz from Helena Solar to SKA core.

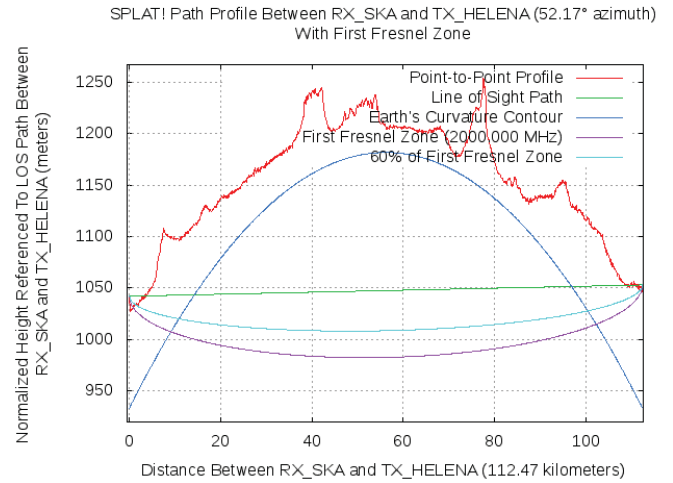


Figure 32: Elevation profile and first Fresnel zones for f=2000MHz from Helena Solar to SKA core.

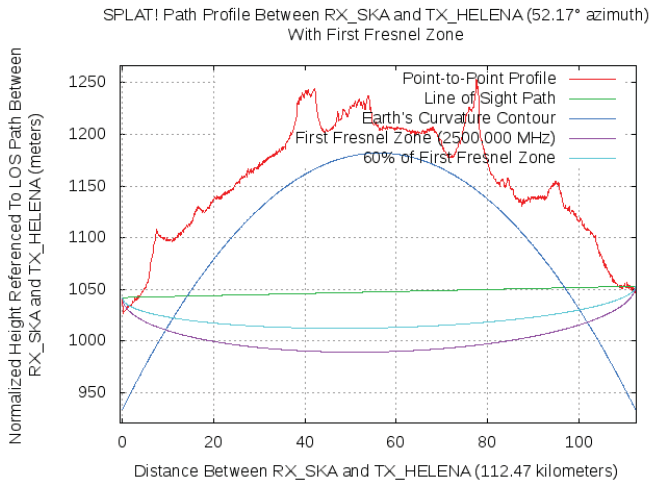


Figure 33: Elevation profile and first Fresnel zones for f=2500MHz from Helena Solar to SKA core.

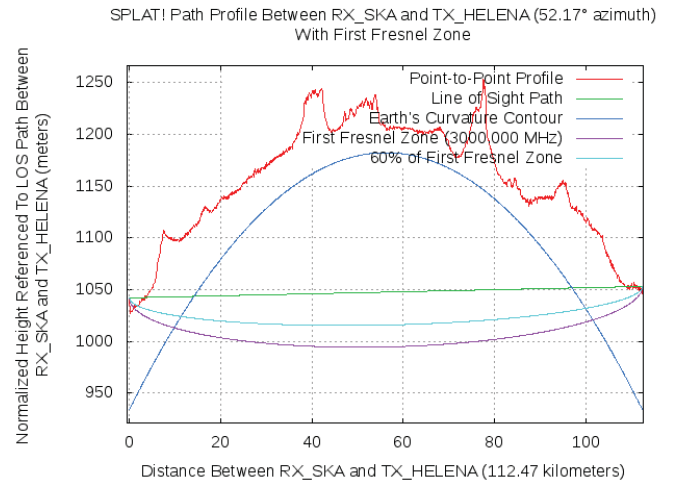


Figure 34: Elevation profile and first Fresnel zones for f=3000MHz from Helena Solar to SKA core.

6 SKA Threshold Limits

The results shown in this section are the comparison of the acceptable levels as measured at 3 and 10 m distances from the plant, which will produce emission levels that are 10 dB below the SKA threshold limits as defined in [2]. This takes into account the TPL calculated by SPLAT!.

6.1 Closest SKA Telescope

The results in Fig. 35 are a comparison in terms of power spectral density, and in 36 in terms of E-field for the closest SKA telescope.

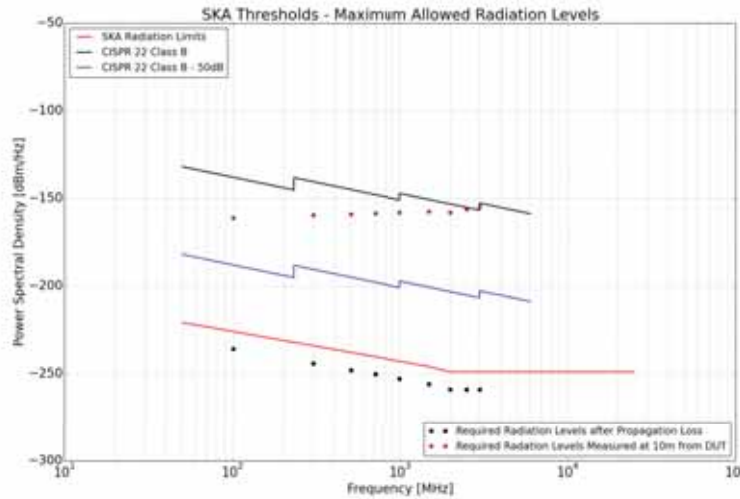


Figure 35: Helena Solar maximum allowed PSD [dBm/Hz] radiation limit compared to CISPR 22 Class B to ensure SKA threshold - 10 dB at the closest SKA telescope.

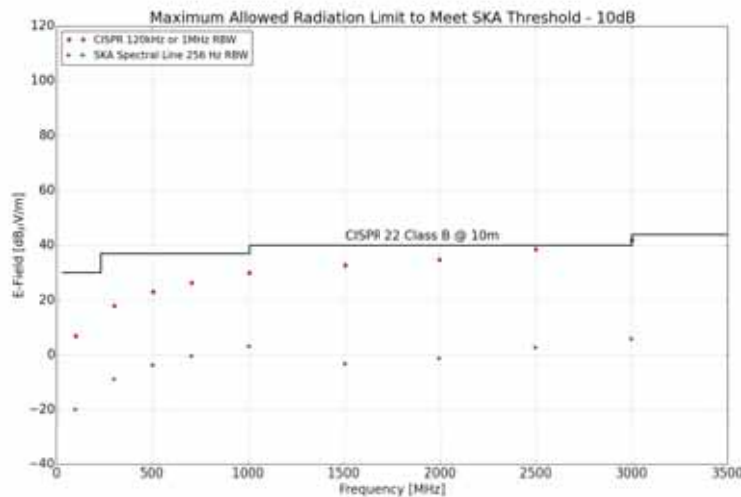


Figure 36: Helena Solar maximum allowed E-Field [dBμV/m] to be measured according to CISPR 22 Class B at 10 m from DUT using RBW = 120 kHz for f < 1 GHz; and at 3 m from DUT using RBW = 1 MHz for f > 1 GHz to ensure SKA threshold - 10 dB at the closest SKA telescope.

6.2 SKA Core Site

The results in Fig. 37 are a comparison in terms of power spectral density, and in Fig. 38 in terms of E-field for the core-site telescope.

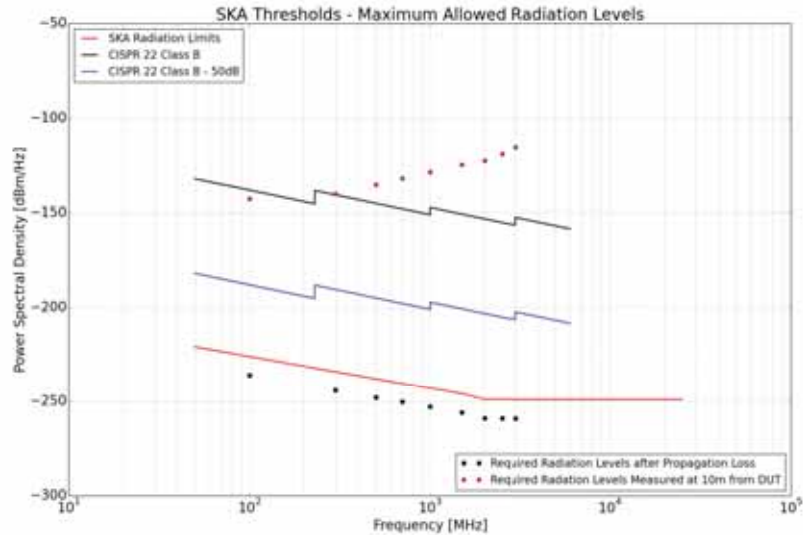


Figure 37: Helena Solar maximum allowed PSD [dBm/Hz] radiation limit compared to CISPR 22 Class B to ensure SKA threshold - 10 dB at the SKA core site.

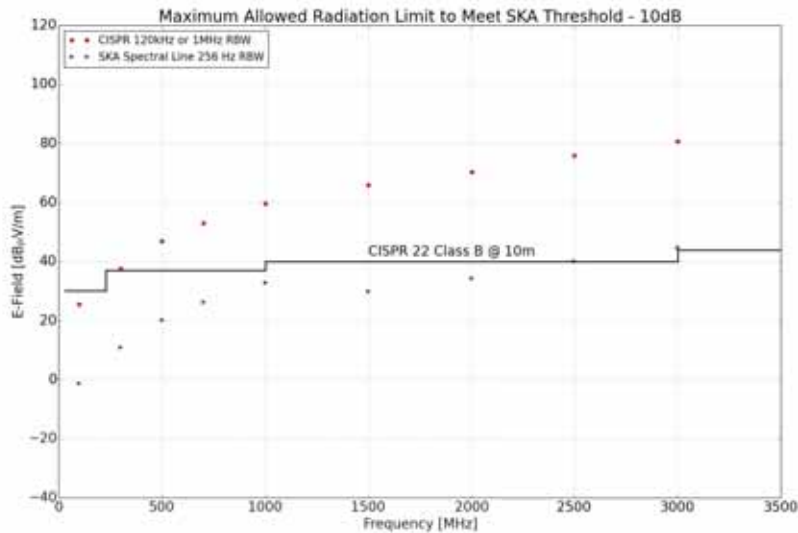


Figure 38: Helena Solar maximum allowed E-Field [dBμV/m] to be measured according to CISPR 22 Class B at 10 m from DUT using RBW = 120 kHz for $f < 1$ GHz; and at 3 m from DUT using RBW = 1 MHz for $f > 1$ GHz to ensure SKA threshold - 10 dB at the SKA core site.

The proximity of the PV plant to the closest telescope means that there is only FSPL and essentially no TL as evident from Table 3. Additional TL in the propagation towards the core site, leads to the slightly higher allowable levels compared to CISPR as shown in Fig. 38. However, overall compliance would likely be determined by the lowest allowable emissions to help reduce the effect of interference on the outlying telescopes as much as possible.

7 Conclusion

MESA Solutions was asked by BioTherm Energy to do a topographical analysis of the terrain profile between the Helena solar farm and the SKA closest and core-site telescopes. The purpose of the investigation is to define a level that can be verified through measurements which will result in an equivalent emission level that is 10 dB below the SKA threshold limit. This measurement level is influenced by the TPL between both telescope locations. However, the TPL is a function of topography and frequency as well as characteristics such as the transmitter and receiver heights. The measurement level is related to the well-known CISPR 11/22 Class B standard that is defined at a measurement distance of 10 m for frequencies below 1 GHz and at 3 m for frequencies above 1 GHz.

From the results in Section 6 it is clear that at lower frequencies, emissions below CISPR are required especially in the case of the closest telescope. This is mainly due to the absence of any TL over this short distance. Towards telescopes in the core site, the allowable measured levels increase slightly due to the additional TL. The possibility exists that the overall lower levels would have to be achieved to limit interference to the closest telescopes as much as possible.

MESA Solutions

Drs A. J. Otto and P. S. van der Merwe
March 2015

References

- [1] *Astronomy Geographic Advantage Act, 2007*, No. 21 of 2007, Government Gazette, Vol. 516, No. 31157, Cape Town, Republic of South Africa, 17 June 2008.
- [2] P. Dewdney and G. Han Tan, *SKA EMI/EMC Standards and Procedures*, Technical Report SKA-TEL-SKO-0000202, Revision 1, Square Kilometre Array (SKA) Organisation, Jodrell Bank Observatory, UK, 10 January 2015.