ORLIGHT SA (PTY) LTD

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

PROPOSED DEVELOPMENT OF THE LOERIESFONTEIN SOLAR PHOTOVOLTAIC POWER PLANT IN THE NORTHERN CAPE PROVINCE

SUBMITTED AS PART OF THE FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPLICANT:

ORLIGHT SA (PTY) LTD

JULY 2012

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DIGBY WELLS ENVIRONMENTAL

This document has been prepared by **Digby Wells Environmental**.

Report title: Orlight SA (Pty) Ltd – Draft Environmental Management Programme for the proposed development of the Loeriesfontein Solar Photovoltaic Power Plant in the Northern Cape Province

Project number: BSG1384

NAME	RESPONSIBILITY	SIGNATURE	DATE
Marike de Klerk	Project administrator and report compiler		26 April 2012
Mia Ackermann	Project manager and report compiler		02 July 2012
Grant Beringer	Project sponsor and report review		10 May 2012

A. INSTRUCTIONS ON ACCEPTANCE OF THE FINAL SCOPING REPORT

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
8	The EMP must include the following:	N/A
8.1	All recommendations and mitigation measures recorded in the EIA Report.	Refer to Chapter 6 – Environmental Management Programme
8.2	The final site layout plan.	Refer to Plan 1c
8.3	Measures as dictated by the final site lay-out plan and micro-siting.	Refer to Section 6.1.1 – Design considerations
8.4	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Plan 2c
8.5	A map combining the final layout plan superimposed on the environmental sensitivity map.	Refer to Plan 1c
8.6	An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Refer to Table 6-6: Construction phase implementation plan – Alien invasive control Refer to Table 6-19: Operational phase implementation plan – Alien invasive control
8.7	A plant rescue and protection plan which allows for the maximum transplant of conservation important species from the areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	Table 6-2: Pre-construction implementation plan – Protected and indigenous plant management
8.8	A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Refer to Section 6.1.3 – Planning of site remediation and post-construction rehabilitation
8.9	An open space management plan to be implemented during the construction and operation of the facility.	Refer to Table 6-19: Operational phase implementation plan – Alien invasive control
8.10	A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters, e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	Table 6-13: Construction phase implementation plan – Traffic

NO.	REQUIREMENTS	COMMENTS OR REFERENCE
8.11	A transportation plan for the transport of PV components, main assembly cranes and other large pieces of equipment.	Table 6-13: Construction phase implementation plan – Traffic
8.12	A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Refer to 6.1.4 – Planning and design of storm water management measures Refer to Table 6-3: Construction phase implementation plan – Surface water systems Refer to Table 6-17: Operational phase implementation plan – Surface water systems
8.13	An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Refer to Table 6-4: Construction phase implementation plan – Soil and agricultural potential Refer to Table 6-18: Operational phase implementation plan – Soils and agricultural potential
8.14	An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Refer to Table 6-3: Construction phase implementation plan – Surface water systems Refer to Table 6-17: Operational phase implementation plan – Surface water systems Refer to Table 6-9: Construction phase implementation plan – Waste
8.15	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Refer to Table 6-3: Construction phase implementation plan – Surface water systems Refer to Table 6-17: Operational phase implementation plan – Surface water systems Refer to Table 6-9: Construction phase implementation plan – Waste

B. INFORMATION REQUIREMENTS FOR AND ENVIRONMENTAL MANAGEMENT PLAN (EMP) IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998)

REQUIREMENTS	COMMENTS OR REFERENCE
IN TERMS OF SECTION 33 OF NEMA, AN EMP MUST COMPLY WITH SECTION 24N OF NEMA:	
(a) Details of – (i) the person who prepared the EMP; and (ii) the expertise of that person to prepare an EMP.	Section 1.3 – Details of the persons responsible for compiling the EMP
(b) Information on any proposed management or mitigation measures that will be taken to address the environmental impacts identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of: (i) planning and design; (ii) pre-construction and construction activities; (iii) operation or undertaking of the activity; (iv) rehabilitation of the environment; and (v) closure, where relevant.	Chapter 6 – Environmental Management Programme Section 6.1 – Planning and design phase Section 6.2 – Construction phase Section 6.3 – Operational phase Section 6.4 – Decommissioning phase
(c) A detailed description of the aspects of the activity that are covered by the draft EMP	Chapter 2 – Project activities
(d) An identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b)	Chapter 4 – Responsibility of implementing the EMP Chapter 6 – Environmental Management Programme
(e) Proposed mechanisms for monitoring compliance with and performance assessment against the EMP and reporting thereon	Chapter 6 – Environmental Management Programme
(f) As far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures	Chapter 6 – Environmental Management Programme Section 6.4 – Decommissioning phase
(g) A description of the manner in which it intends to— (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; (iii) comply with any prescribed environmental management standards or practices; (iv) comply with any applicable provisions of the Act regarding closure, where applicable; (v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	Table 3-1: Legislative and permitting requirements for the proposed project Chapter 6 – Environmental Management Programme
(h) Time periods within which the measures contemplated in the EMP must be implemented.	Chapter 6 – Environmental Management Programme

REQUIREMENTS	COMMENTS OR REFERENCE
(i) The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity.	Chapter 6 – Environmental Management Programme
(j) An environmental awareness plan describing the manner in which— (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment	Chapter 5 – Environmental Training and Awareness Plan
(k) Where appropriate, closure plans, including closure objectives.	Chapter 5 – Environmental Management Programme Section 5.4 – Decommissioning phase

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Loeriesfontein Solar Photovoltaic (PV) Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

The proposed site for development of the Loeriesfontein Solar PV Power Plants is located on Portion 5 of the farm Kleine Rooiberg 227 RD, approximately 40 km north of the town of Loeriesfontein in the Namakwa District Municipality of the Northern Cape Province. A study area of 1 040.04 ha was considered throughout the EIA process, although the actual development footprint of the proposed project, based on the avoidance of environmentally sensitive and other problematic areas, was defined as 334.5 ha in extent. The optimal generation capacity of the power plant based on an estimated requirement of 4 ha surface area per MW generation capacity was determined to be 84 MW.

Site development plans were prepared for a 70 MW project, which is well within the available surface area delineated as suitable for development.

This draft Environmental Management Programme (EMP) was based on the outcomes of the EIA process that was undertaken for the proposed development of the Loeriesfontein Solar PV Power Plant.

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The management and mitigation measures that were recommended to mitigate impacts to the environmental, socio-economic and heritage environment to an acceptable level are described systematically in this EMP.

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ABBREVIATIONS

AIA	Archaeological Impact Assessment
BSGR	BSG Resources Limited
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEANC	Northern Cape Department of Environmental Affairs and Nature Conservation
Digby Wells	Digby Wells Environmental
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIA Regulations	GN Regulations 543 to 546 (18 June 2010)
EMP	Environmental Management Programme
ESTA	Extension of Security of Tenure Act (Act 62 of 1997)
ETAP	Environmental Training and Awareness Plan
FEPA	Freshwater Ecological Priority Area
GIS	Geographic Information System
LED	Local Economic Development
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act, 2008 (Act 59 of 2008)
NFA	National Forests Act, 1998 (Act 84 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
Orlight SA	Orlight SA (Pty) Ltd
PPP	Public Participation Process
PV	Photovoltaic
SAHRA	South African Heritage Resources Agency
SKEP	Succulent Karoo Ecosystem Programme
SMME	Small, Medium and Micro Enterprise
VIA	Visual Impact Assessment

WMA	Water Management Area
WULA	Water Use License Application

1 INTRODUCTION

In line with the growing need for electricity supply and cleaner energy production in South Africa, the Orlight SA (Pty) Ltd (Orlight SA) Solar Photovoltaic (PV) Project was initiated by its holding company, BSG Resources Limited (BSGR). BSGR is an international natural resources company that operates in the fields of mining, and energy. BSGR established a new company, Orlight SA, for the construction and operation of five new Solar PV Power Plants in the Western Cape and Northern Cape Provinces.

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Loeriesfontein Solar PV Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

1.1 Project overview

The proposed site for development of the Loeriesfontein Solar PV Power Plant is located on Portion 5 of the farm Klein Rooiberg 227 RD [SG Code C015-000-000-000-227-00005][1], approximately 40 km north of the town of Loeriesfontein in the Namakwa District Municipality of the Northern Cape Province.

A study area of 1 040.04 ha was considered throughout the EIA process, although the actual development footprint of the proposed project, based on the avoidance of environmentally sensitive and other problematic areas, was defined as 334.5 ha in extent. The optimal generation capacity of the power plant based on a conservative estimate of the required surface area for solar PV infrastructure development (4 ha surface area per MW generation capacity) was determined to be 84 MW.

Site development plans were prepared for a 70 MW project, which is well within the available surface area delineated as suitable for development. The site layout is illustrated in Plan 1c.

The proposed power plant will make used of Solar PV technology and will be comprised of the following infrastructure:

- Solar PV panels;
- Support structures;
- Foundations;
- Electrical cabling;
- On-site substation;
- Transmission line;
- Access roads and river crossings;
- Temporary construction lay-down yard; and
- Access control and fencing of the site.

The layout of the proposed project infrastructure within the project site and greater study areas is illustrated in Plan 1c.

[1] During the application and scoping phase of the project, an error was made in the property description of the proposed study area. It was previously thought that the affected property was Portion 1 of the farm Kleine Rooiberg 227 RD, however, a land surveyor has since confirmed that the correct property description is Portion 5 of the farm Kleine Rooiberg 227 RD. The DEA and all stakeholders have been notified of the amendment to the property description.

1.2 Purpose of this report

An Environmental Management Programme (EMP) is an environmental management tool that is implemented with the objective of mitigating the undue or reasonably avoidable adverse impacts associated with the development of a project and to enhance any potential positive impacts that could be realised due to the development of a project.

This draft EMP was based on the outcomes of the EIA process that was undertaken for the proposed development of the Loeriesfontein Solar PV Power Plant. Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. A number of potentially problematic issues have been avoided by the choice of the site on which to place the project and also the placement of infrastructure on the chosen site has minimised a number of the environmental impacts. The management and mitigation measures that were recommended to mitigate impacts to the environmental, socio-economic and heritage environment to an acceptable level are thus systematically addressed in the EMP.

The specific objectives of this report are to:

- Define environmental management objectives to achieve an acceptable environmental standard and long-term sustainability of the proposed project;
- Outline mitigation measures and environmental specifications that will be required to be implemented during the construction, operational and decommissioning phases of the proposed project to realise the environmental management objectives;
- Formulate plans to manage specific environmental features that are known to be significantly affected during project implementation as a precautionary measure;
- Propose mechanisms to monitor the implementation of the mitigation measures; and
- Formulate plans that can be implemented in response to unforeseen or emergency events during project implementation.

1.3 Details of the persons responsible for compiling the EMP

Digby Wells is a South African company with international expertise in delivering comprehensive environmental and social solutions for clients in diverse sectors including the energy, minerals and mining industries. The names and expertise of the project team responsible for compilation of this report are provided in Table 1-1.

Table 1-1: Names and expertise of the report compilers

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Project manager	Mia Ackermann	2008: MSc Geography – UJ 2006: BSc (Honours) Geography and Environmental Management (*Cum Laude*) – UJ 2003 – 2005: BSc Geography and Environmental Management – UJ
Project administrator	Marike de Klerk	2005 – 2006: MA Sustainable Development – UJ 2000 – 2002: BhcS (*Cum Laude*) – UP 2003 – 2004: BhcS (Honours) (*Cum Laude*) – UP

1.4 Approach to environmental management

The approach to this EMP has been based on two primary internationally recognised principles for environmental management:

- *Precautionary principle* – States that wherever there is doubt regarding the impacts that an activity may have on the environment, precautionary measures should be taken to prevent such impacts; and
- *Polluter pays principle* – The project applicant should be committed to preventing pollution and will make resources available to ensure that all reasonable safeguards are in place to do so. Full accountability and financial liability for any pollution that may occur lies with the project applicant.

This EMP should be made binding and enforceable on all the parties involved in the development of the proposed project, including the project applicant and contractors at the different operational management levels.

1.5 Report structure

The structure of this EMP and the respective objectives for each section is outlined as follows:

- *Chapter 2 – Project activities* provides an overview of the project activities that will be undertaken during the construction, operational and decommissioning phases of the project and that will result in environmental impacts. These activities will be managed in terms the various mitigation measures that have been included in this report;
- *Chapter 3 – Legislative requirements* is a summary of the legislative context in which the project will be implemented. Requirements and guidelines that must be adhered to during the undertaking of all activities and according to which the environmental and social performance of the project are described;
- *Chapter 4 – Responsibility of implementation* outlines the various levels of responsibility for implementing the supporting management plans, respective mitigation measures and this EMP;
- *Chapter 5 – Environmental Training and Awareness Plan* outlining the methodology that will be used to inform employees of any environmental impacts which may result from their work and the manner in which the impacts must be dealt with in order to avoid pollution to or the degradation of the environment;
- *Chapter 6 – Environmental Management Programme* includes the management objectives for each phase of the proposed project and a plan for the implementation of mitigation measures to mitigate negative impacts and enhance positive impacts associated with the proposed project; and
- *Chapter 7 – Conclusion* which includes a statement from the EAP regarding the level to which potential impacts can be mitigated by implementing the measures outlined in this report.

2 PROJECT ACTIVITIES

The proposed Solar PV Power Plant will be comprised of the following infrastructure:

- *Solar PV panels* – An array of solar PV panels with a generating capacity of up to 70 MW will be installed over an area of 328.52 ha;
- *Support structures* – The solar PV panels will be mounted on steel support structures. The solar PV panels will be mounted to a maximum height of 7 m and tilted approximately 25° from the horizontal plane, facing to the north and may be on tracking systems to adjust the angle of the panels to the summer or winter solar radiation characteristics;
- *Foundations* – The panel foundations will be either hammered into the ground or have concrete foundations excavated to a depth of approximately 1.5 m, depending on the terrain characteristics determined through geotechnical studies;
- *Electric cabling* – The solar PV arrays will be connected via electric cabling which will be laid underground in trenches of approximately 1 m deep and 0.6 m wide. These cable will cross drainage lines at five points;
- *On-site substation* – The substation will occupy a surface area of approximately 0.79 ha and will include invertors to convert the electricity generated by the solar PV arrays from direct current to alternating current;
- *Transmission line* – The proposed power plant will be connected to the Eskom Helios substation which is located approximately 11 km to the north with 22 kV overhead transmission lines;
- *Access roads* – Access to the proposed project site will be from the Granaatboskolk/Zout Dwaggas gravel road which runs through the site. An internal network of roads will be required to access the different components of the proposed project. These roads will cross drainage lines at four points;
- *Temporary construction lay-down yard* – The construction lay-down yard will occupy a surface area of 8.1 ha and will include a site office, mobile toilets and bathroom facilities, a car parking yard and the hydrocarbon management facility; and
- *Access control and fencing of the site* – The site must be secured against theft from outside and for this purpose, fencing will be installed.

The physical area that will be disturbed by the proposed project activities and components are summarised in Table 2-1 below. The layout of the proposed project infrastructure within the project site and greater study area is illustrated in Plan 1c.

In order to establish and operate the infrastructure described above, numerous activities will be undertaken during the pre-construction, construction, operational and decommissioning phases of the proposed project. These activities were described in the EIA Report and formed the basis according to which potential impacts were identified and assessed. Table 2-2 provides a summary of these activities.

Table 2-1: Scale of physical disturbances associated with the proposed project

COMPONENT	PHYSICAL DISTURBANCE
Solar panels, roads and cables (ha)	328.52
Area of laydown yard (ha)	8.14
Area of substation (ha)	0.79
Total (ha)	**337.45**
Area suitable for development (ha)	340.00
Portion of area suitable for development (%)	*99%*
Study area (ha)	1040.04
Portion of study area (%)	*32%*

Table 2-2: Project phases and associated activities

ACTIVITY	DESCRIPTION
PHASE: PRE-CONSTRUCTION ***The duration of the pre-construction phase is approximately 4 months prior to the construction phase.***	
Environmental awareness and training	All contractors, sub-contractors and service providers will be made aware of the contents of the EMP. The effective implementation of this EMP will form part of their contractual agreement for this project.
Undertake pre-construction surveys	Areas delineated as no-go areas during the EIA phase will be surveys and demarcated to ensure that no construction activities are allowed in these areas. Other surveys that will be undertaken include a geotechnical survey to determine foundation requirements and degree of levelling that will be required, as well as a wet-season flora survey to identify Red Data and protected plant species that might not have been identified during the dry-season survey.
Archaeological mitigation	Prior to the commencement of the construction phase, a Phase 2 AIA must be undertaken to mitigate significant Late Stone Age (LSA) archaeological sites that were identified in the project development footprint.
PHASE: CONSTRUCTION ***The duration of the construction phase of the proposed 70 MW solar PV power plant is approximately 16 months.***	
Employment opportunities and accommodation	In the event that a 70 MW power plant is developed, approximately 490 direct job opportunities will be created during the construction phase. Construction workers will be sourced from local areas and therefore, minimal additional housing will be required. Accommodation of workers from outside the local area will be provided in the town of Loeriesfontein. Only security will be allowed to stay on site overnight. No commercial activities such, as food stalls, will be allowed on the site and adjacent to the national road.
Establishment of access and internal	The site will be accessed from the existing Granaatboskolk/Zout Dwagga gravel road. Sight distances along the road are adequate to allow safe use of the access to the site. Conflicting

ACTIVITY	DESCRIPTION
roads	traffic flows on the road at the access are low, and there are no noteworthy safety concerns. Two-track gravel roads of approximately 6 m in width will be established to access the construction lay-down yard and development footprint. The pattern of the drainage lines that were identified on the project site poses a number of restrictions to the project site layout design in terms of totally avoiding the drainage lines and delineated buffer zones. The internal roads required to connect the different areas with each other could not be located away from the drainage lines. Four road crossings of the drainage lines would therefore be constructed.
Site preparation	Site preparation will consist of the clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure. Topsoil will be removed for the construction of foundations of the substation and the car parking yard. Where the terrain is undulating, the terrain may be levelled. Large boulders and rocks will be removed. No protected tree species will be removed.
Construction lay-down yard	The construction lay-down yard will provide a storage area for construction material and will be used for assembly purposes.
Vehicle hard park and hydrocarbon storage	A vehicle hard park will be established where all construction vehicles and equipment will be parked overnight, serviced and refuelled. The hydrocarbon management area will be bunded for the safe storage of fuel, lubricants and waste oils.
Access control and fencing of site	Adequate systems and procedures will be put in place to minimise the risk of unauthorised access to the site. Carefully consideration will also be given to the plant layout to ensure access for day-to-day operations, emergency escape routes and maintenance of the plant and equipment.
Anchoring and installation of solar PV panels	The foundation types used for the solar PV mounting structures will depend on the terrain characteristics defined by the geotechnical studies. The mounting structure will either be hammered into the earth surface, or a shallow concrete foundation will be cast.
Installation of underground cables	Trenches will be excavated wherein underground electrical transmission cables will be laid. The pattern of the drainage lines that were identified on the project site poses a number of restrictions to the project site layout design in terms of totally avoiding the drainage lines and delineated buffer zones. Five underground cable crossings of the drainage lines would therefore be required.
Construction of facility substation	An on-site facility substation will be constructed which will include the casting of foundations, installation of the transformer and inverters and connecting of the conductors.
Construction of transmission lines	In the event that a 40 MW power plant is constructed, 2 x 22 kV transmission lines will be constructed from the facility substation along existing Eskom transmission lines to the Helios Substation. For a 70 MW power plant, 4 x 22 kV transmission lines will be required. **Management of the activities required for construction of the 22 kV transmission lines to the Helios substation is not included in this EMP, but will be addressed in the EMP that supports the Basic Assessment process that is being undertaken for the proposed transmission lines.*
Water use	Water will be used for domestic use and possibly for dust suppression during the construction phase. The total water requirements for the construction phase are estimated at 350 m^3 per month. An application for water service provision has been made to the local municipality.
Construction waste management	All construction phase waste will be collected and stored in a temporary waste storage area, where it will be collected by a waste removal contractor for disposal at a licensed waste disposal facility. No on-site burying or burning of wastes will be allowed.

ACTIVITY	DESCRIPTION
	The only chemical toxins on site will be the gas used in welding, the concrete, sulphur hexafluoride housed inside the switchgears and the diesel for the power generators used during the construction. These will be handled with care according to regulatory requirements. Wherever possible, waste materials shall be recycled.
Sewage management	Temporary ablution facilities will be provided and a contractor employed to safely remove sewage from the site to a licensed disposal facility.
Site remediation	Upon completion of the construction phase, the site will be remediated by removing all temporary construction infrastructure, construction waste and construction materials. Vegetation will be re-established in areas where sufficient and suitable substrate remains.
PHASE: OPERATION ***The typical lifecycle of a PV power plant is generally 20 years, where after it can be considered for upgrade and renewal or decommissioning, depending on the prevalent socio-economic conditions.***	
Employment opportunities and accommodation	In the event that a 70 MW power plant is developed, approximately 84 direct job opportunities will be created during the operational phase. Employees will be accommodated in the town of Loeriesfontein and daily transport to the site will be provided in buses.
Generation and transmission of electricity	The electricity generated by the solar PV panels will be stepped up through the inverters and transformers in the facility substation. The electricity will be evacuated from the facility substation via the overhead transmission lines described above.
Access control and fencing of the facility	The perimeter fence established during the construction phase will be maintained and access to the facility will be through a controlled access point.
Facility maintenance	Facility maintenance will include the replacement of damaged solar PV panels and cleaning of the panels using small amounts of water. Approximately 3 992 m^3 water will be required per month for cleaning purposes of a 70 MW power plant. An application for water service provision has been made to the local municipality.
PHASE: DECOMMISSIONING AND REHABILITATION ***Typical decommissioning and rehabilitation activities should take approximately 24 months.***	
Removal of infrastructure	Depending on the economic situation at the end-of-life of the solar PV panels, the facility will either be decommissioned or its operational phase extended past the planned life. Even if extended the facility will have to be decommissioned and closed.
Site rehabilitation	If and where applicable, sites will be rehabilitated. Rehabilitation is the process of returning the land in a given area to some degree of its former state, after some construction or operation activities may have resulted in its damage. This will involve shaping the surface and establishing vegetation to prevent erosion and to blend in with the surrounding landscape.

3 LEGISLATIVE REQUIREMENTS

The scope and content of this EMP has been informed by the following key legislation and guidelines:

- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- Succulent Karoo Ecosystem Programme;
- Critical Biodiversity Areas;
- Freshwater Ecological Priority Area (FEPA) Programme;
- National Water Act, 1998 (Act No. 36 of 1998);
- Environment Conservation Act, 1989 (Act No. 73 of 1989);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- National Heritage Resources Act, 1999 (Act No. 25 of 1999);
- Land Use Planning Ordinance, Ordinance 15 of 1985; and
- Local Economic Development (LED) Strategy for the Namakwa District Municipality.

A summary of the legislative and permitting requirements that are applicable to this EMP is provided in Table 3-1.

Table 3-1: Legislative and permitting requirements for the proposed project

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	Section 24 This section of the Bill of Rights stipulates that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that - i. Prevent pollution and ecological degradation; ii. Promotes conservation; and iii. Secures ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.	Parliament Constitutional Court	The constitutional rights from the basis of the environmental management objectives for the proposed project, namely to protect ecologically sensitive areas and support sustainable development and the use of natural resources, whilst promoting justifiable socio-economic development in the town nearest to the project site.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	Section 2 This section defines the principles of integrated environmental management. According to these principles, developments must take the following factors into consideration: • *Section 2(3)* – Development must be socially, environmentally and economically sustainable; • *Section 4(1)* – Sustainable development requires the consideration of all relevant factors including the following: o That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; o That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;	Department of Environmental Affairs (DEA) Northern Cape Department of Environment Affairs and Nature Conservation (DEANC)	The principles of integrated environmental management have been taken into consideration throughout the EIA process that was undertaken for the proposed project. This EMP contains an implementation plan that is aimed at achieving the objectives for sustainable development as specified in Section 4 of the Act. Specific objectives included in this EMP are: • To minimise disturbance of ecosystems and loss of biological diversity in the study area; • To minimise the disturbance of sites and landscapes that are considered important in terms of their heritage value; • To minimise the generation of waste, promote recycling of wastes and ensure safe

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	○ That the disturbance of landscapes and sites that constitute the nation´s cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied; ○ That waste is avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner; ○ That the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource; ○ That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; ○ That a risk averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and ○ That negative impacts on the environment and on people´s environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.		management and disposal of wastes; • To prevent pollution and degradation of the environment; • To implement remediation measures in the event that pollution and degradation occur; • To prevent impacts on renewable resources, such as soil and water.
	Section 24 In terms of this section, a list of activities that will require environmental authorisation prior to their commencement can be identified by the minister. These activities have been identified in GNR 543 to 546 (18 June 2010) promulgated in terms of the Act.	DEA DEANC	A full Scoping & EIA process was required for the proposed project for activities listed in terms of GNR 543 to 546. The EIA Report forms part of this process and will be submitted to the DEA for review and consideration. The DEANC has been included as a commenting authority on the application.
	Section 28(1)	DEA	A plan for the implementation of mitigation measures is

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	This section of the Act stipulates a Duty of Care which requires the project applicant to ensure that reasonable measures are taken throughout the project life cycle to ensure that any pollution or degradation of the environment associated with project implementation is avoided.		included in this EMP.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) Succulent Karoo Ecosystem Programme (SKEP) Critical Biodiversity Areas (CBA)	The Act provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. Within the regional conservation context there are two conservation programmes which are underlain by NEMBA, namely the SKEP and the CBA. The aim of these programmes are to identify and conserve areas of high biodiversity and areas that are in support of these areas through defining conservation outcomes and working towards these.	DEA	A specialist fauna and flora assessment was undertaken during the EIA process as part of a characterisation of the ecological baseline of the study area and to manage potential impacts on biodiversity resources. SKEP and the CBA have been referred to as the basis for conservation planning for the project.
	Section 57 This section of the Act states that person may not carry out a restricted activity (i.e. removal or destruction) of a specimen of a listed threatened or protected species without a permit issue by the relevant competent authority. A list of threatened and protected species was issued in GNR 151, 152 and 1187 promulgated in terms of the Act.	DEA	During the site layout design process, areas where threatened and protected species listed in terms of the Act occur were designated as no-go areas. No destruction of protected species will be required and therefore, no permitting requirements apply. Should any threatened or protected plant species that were not identified to occur in the project development footprint be identified during the pre-construction wet-season survey, the necessary permits for the removal of the specimens will have to be obtained.
	Section 75 This section of the Act controls activities relating to the control and eradication of invasive species. The requirements that must be adhered to are:	DEA	An alien invasive control eradication programme will be implemented as part of this EMP. The control programme has been formulated based on the requirements listed in terms of Section 75 of the Act.

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	• *Section 75(1)* – The control and eradication of invasive or weed species must be undertake by means of a method that are appropriate for the species and the environment in which it occurs; • *Section 75(2)* – Actions taken to control and eradicate listed invasive species must be executed with caution and in a manner that may cause least possible harm to biodiversity and the environment; and • *Section 75(3)* – Methods must be directed at the offspring, propagating material and re-growth of the invasive species.		
National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA)	Chapter 5 This chapter of the Act provides for the licensing of waste management activities, as listed in GNR 718 of the Act. Waste management activities require a Waste Management License and undertaking of an EIA prior to its commencement.	DEA NCDEANC	No waste management activities will be triggered by the proposed project and therefore no permitting requirements have been identified.
	Chapter 4 This chapter of the Act defines the principles of waste management to avoid negative impacts on the environment. In terms of the Act, any person who stores waste must take the appropriate steps to ensure that: • *Section 21(a)* – The containers in which waste is stored are intact or rendered unfit for safe storage of waste; • *Section 21(b)* – Adequate measures are taken to prevent accidental spillage or leaking; • *Section 21(c)* – Waste is not blown away by wind; • *Section 21(d)* – Nuisances such as odour, visual impacts and	DEA NCDEANC	The handling, storage and disposal of waste will have to be undertaken in accordance with a waste management plan that is based on the principles and requirements of this Act.

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	vectors do not arise; • *Section 21(e)* – Pollution of the environment and harm to health are prevented; and • *Section 22(2)* – Waste that is reusable, recyclable or recoverable must be separated and stored apart from other general waste.		
National Water Act, 1998 (Act No. 36 of 1998) (NWA) Freshwater Ecological Priority Area Programme	Section 19 In terms of this section of the Act, the project applicant must ensure that reasonable measures are taken to prevent and remedy any potential impacts of pollution to water resources.	Department of Water Affairs (DWA)	Mitigation measures to prevent impacts to water resources have been included in this EMP.
	Section 21 Water uses listed in terms of this section of the Act requires a Water Use License Application (WULA) to be made, unless such water use falls into one of the categories listed in Section 22 of the Act or falls under a general authorisation.	DWA	A WULA for identified water uses, including the establishment of road crossings and trenches for underground electric cables over dry drainage lines will have to be submitted to the DWA prior to the commencement of this project.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)	The Act provides for control and conservation of the utilisation of the natural agricultural resources of South Africa in order to promote the conservation of the soil, water sources and vegetation and the combating of weeds and invader plants; and for matters connected therewith. Category 1 plant in terms of the Act and needs to be eradicated using the control methods stipulated in Regulation 15D.	Department of Agriculture, Forestry and Fisheries (DAFF)	The destruction of Category 1 plants that occur in the study area, as well as control of other alien invasive species is provided for in the alien invasive control programme, which is also guided by NEMBA.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	Section 38 This section of the act state that Heritage Impact Assessments (HIAs) are required for certain types of development, including activities which result in changes to the character of a site exceeding 0.5 ha in extent. The relevant heritage authority must be notified of the development and will	South African National Heritage Resources Agency (SAHRA)	Heritage impacts have been considered during the EIA process and included a Phase 1 Archaeological Impact Assessment (AIA), Palaeontological Impact Statement and Visual Impact Assessment (VIA). A permit for the excavation and destruction of significant

LEGISLATION	LEGAL REQUIREMENTS	COMPETENT AUTHORITY	PROJECT REQUIREMENTS
	advise on the scope of the heritage assessments that need to be undertaken. Sand alone HIAs are not required where an EIA is undertaken and heritage considerations are integrated into the report.		LSA archaeological sites will be required prior to the commencement of the construction phase to ensure that impacts to the heritage resources are minimised.
Land Use Planning Ordinance, Ordinance 15 of 1985 Subdivision of Agricultural Land Act (Act No. 70 of 1970)	In terms of the provisions of these Acts, the property on which the proposed project is to be developed will require rezoning to land use for renewable energy generation.	Local Municipality	A rezoning application is being prepared for the proposed project. The subdivision of land can only be undertaken following the granting of the environmental authorisation for the proposed project and forms part of the rezoning process.
National Forests Act, 1998 (Act 84 of 1998) (NFA)	Section 5 In terms of this section of the Act, no person may cut, disturb, damage or destroy or remove any protected tree listed in terms of GNR 1042 of the Act without a licence granted by the minister.	DAFF	During the site layout design process, areas where threatened and protected species listed in terms of the Act occur were designated as no-go areas. No destruction of protected species will be required and therefore, no permitting requirements apply. Should any threatened or protected plant species that were not identified to occur in the project development footprint be identified during the pre-construction wet-season survey, the necessary permits for the removal of the specimens will have to be obtained.

4 RESPONSIBILITY OF IMPLEMENTING THE EMP

4.1 Organisational commitment

The success of an EMP is dependent upon the commitment of the organisation, at all levels, to environmental excellence (Environmental Protection Agency, 1995). Commitment to structured and effective EMPs will benefit both the organisations' business success and the community in which it operates. This commitment requires that the organisation provide the necessary resources for employee training, reference material and reporting and response procedures.

The manager of the company shall be held responsible and accountable for health and safety of personnel while on duty as well as the environmental impacts caused by project activities. The competence of the work force will be ensured through selection, training and awareness in health, safety and environmental matters. Continual evaluation measures must be implemented to ensure that performances with regard to social, health and well-being are improved and environmental management is effectively implemented throughout the lifespan of the proposed projects. Regular reviews of the company's performance are necessary during and after operations to ensure that procedures are appropriate and to ensure the desired environmental outcomes are being achieved.

4.2 Management areas and responsibility

The overall management responsibility for the implementation of the EMP will rest with the Environmental Manager of Orlight SA during construction, operation and closure. The Environmental Manager will be responsible for ensuring that all stakeholders understand and implement the plan. The Environmental Manager will also be responsible for ensuring that the plan remains effective and relevant through measurement and monitoring and adapting the plan where necessary to achieve its objectives. Although Orlight SA will ultimately be responsible for environmental management, it will also be the responsibility of all contractors to adhere to the plan. Specific requirements for environmental management relevant to their areas of operation should be detailed in their respective contracts. The management actions that will be the responsibility of the Environmental Manager include:

- Overview of EMP implementation;
- Ensure that environmental monitoring, recording and reporting are conducted;
- Adapting the EMP where required;
- Develop and implement environmental training and awareness plans, including protected species awareness; and
- Conduct internal Environmental Audits.

EMPs provide an essential tool for ensuring that the mitigation of negative impacts and enhancement of positive impacts is carried out effectively during the project life-cycle. The following tables therefore provides a summary of the potential mitigation measures that would be required for the potential impacts anticipated in the construction, operational and decommissioning phases for the Solar PV Power Plant project.

4.3 Contractors

The competence of the construction and operational workforce will be ensured through Orlight SA's tender process, as well as efficient selection, training, awareness and the effective implementation of applicable health and safety policies. The tendering requirements for potential contractors should be read in conjunction with the

EMP. Continual evaluation measures must be implemented to ensure that performances with regard to social, health and well-being are improved and environmental management is effectively implemented throughout the lifespan of the development. Regular reviews of the contractors' performance and Environmental Audits are necessary during and after the construction phase to ensure that procedures are appropriate and to ensure the desired environmental outcomes are being achieved.

4.4 Environmental Control Officers

An Environmental Control Officers (ECO) will be employed for the proposed project. The ECO would be responsible for ensuring that all stakeholders understand and implement the EMP. The ECO will also be responsible for ensuring that the plan remains effective and relevant. Specific requirements for environmental management relative to their areas of construction and subsequent operation will be detailed in their respective contracts. The management actions that will be the responsibility of the ECO are summarised below:

- Overview of EMP implementation;
- Ensure that environmental monitoring, recording and reporting are conducted;
- Develop and implement environmental training and awareness plans; and
- Conduct internal Environmental Audits.

5 ENVIRONMENTAL TRAINING AND AWARENESS PLAN

The purpose of an Environmental Training and Awareness Plan (ETAP) is to outline the methodology that will be used to inform employees of any environmental impacts which may result from their work and the manner in which the impacts must be dealt with in order to avoid pollution to or the degradation of the environment.

5.1 Responsibilities

Local contractors will be used during the construction and operational phases, where possible. People receiving contracts as a result of this project will be responsible for training and skills transfer to local labour and will be expected to present training plans to management and the ECO. Management will be responsible for ensuring that the plans are adequate and for the monitoring of the effectiveness of the training.

5.2 Timeframe

All construction workers and their supervisors will undergo environmental awareness training prior to working at the proposed project site. Refresher courses will be held at suitable intervals. New contract staff and new employees on site will also be required to undergo training.

5.3 Training requirements

The ETAP will incorporate training on the following components:

- The social and environmental context within which the Solar PV Power Plants will be constructed;
- The risks associated with the activities which workers and supervisors will be responsible for and the associated mitigation measures;
- The relevant procedures and protocols to be followed; and
- The roles and responsibilities for implementing mitigation measures.

5.4 Performance management

The effectiveness of the environmental management training and awareness building interventions will be evaluated by:

- The performance as recorded by the environmental audits (conducted by the ECO) aimed at evaluating the environmental awareness of employees directly, and
- Analysing the root causes of environmental incidents, including non-conformance to legal requirements, to determine which incidents were caused by a lack of environmental awareness and training.

6 ENVIRONMENTAL MANAGEMENT PROGRAMME

The purpose of this section is to define the environmental objectives for each phase of the proposed project. The action plans that are required to achieve these objectives were compiled within the context of activities that could result in potential impacts to the biophysical, socio-economic and heritage environment.

These action plans are presented in tabular format to easily present the requirement for implementation of mitigation measures, as shown in Table 6-1.

Table 6-1: Structure of environmental management implementation plans

ENVIRONMENTAL ASPECT	
PHASE OF PROJECT	
Context	The context refers to the environmental, socio-economic and heritage conditions of the surrounding environment).
Objective	The management objective refers to the desired outcome of management measures for mitigating negative impacts and enhancing positive impacts related to project activities.
Risk sources	The risks sources refer to activities that will result in a potential impact.
Potential impacts	The potential impact refers to the changes or effects anticipated on the environment resulting from an environmental aspect, whether desirable or undesirable (i.e. positive or negative impact on the receiving environment).
Management and mitigation actions	The management actions refer to the practical actions aimed at achieving management objectives and targets.
Performance indicators	The performance indicator refers to probably key success factors according to which the implementation success of the management measures and objectives should be evaluated.
Monitoring and evaluation	Monitoring refers to the actions, tools or methods that should be implemented to evaluate whether management actions are being implementing and whether the desired objective is being achieved.

The tables and action plans were also compiled to assess the potential impacts associated with the construction phase (red), operational phase (yellow) and decommissioning or closure phase (green) of the project activities on the receiving environment.

CONSTRUCTION PHASE
OPERATIONAL PHASE
DECOMMISSIONING AND CLOSURE PHASE

It should be noted that, as detailed in the main EIA Report, the most significant impacts are anticipated during the construction phase.

6.1 Planning and design phase

The objectives of the planning and design phase for the proposed project are to:

- Ensure that the design of proposed project and associated infrastructure is undertaken in such a way that it does not directly impact on sensitive topographical, ecological, visual and socio-cultural areas;
- Ensure that a site remediation plan is prepared to ensure that impacts during the construction phase does not limit the success of site remediation efforts;
- Ensure that stakeholder concerns and recommendations have been integrated in the planning and design of the project, where appropriate; and
- Enable the continuation of some of the existing land uses throughout project development and operation.

6.1.1 Design considerations

The project design for the proposed project was finalised after suitable alternatives and necessary assessments were conducted. This was part of an integrated and dynamic process to ensure the most financially viable and environmentally sensitive designs were considered for the project.

Upon completion of the environmental and cultural assessments undertaken for the study area, including important feedback received from stakeholders during the Public Participation Process (PPP), sensitivity maps were created using a Geographic Information System (GIS) (Plan 2c).

The following sensitive and no-go areas were delineated:

- *Drainage lines* – It is recommended that the main drainage line and associated system be avoided during construction and operation, owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems. A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around all of its tributaries. Establishment of internal roads and trenches for underground cabling could be allowed, pending approval of WULA for associated water uses;
- *Ecologically sensitive areas* –The no-go area generally describes the drainage lines running through the project area. Other areas of high ecological sensitivity include the northern part of the site where *Aloe falcata* (Vanrhynsdorp Aloe) and the protected plant species, *Hoodia gordonii*, was encountered. Least sensitive and favourable areas exist in southern parts of the study area;
- *Areas with heritage value* – It is recommended that LSA sites that have been rated as significant in terms of local and provincial archaeological context that are found on the outskirts of the study area and within other delineated no-go areas (e.g. drainage lines) should be avoided to ensure they are conserved (Site LO57, Site 122, Site 143 and Site 086); and
- *Eskom transmission line servitudes* – The existing 66 kV transmission lines that runs through the project site has a servitude width of 22 m. No construction will take place within these servitudes.

The implementation plans for the construction, operational and decommissioning phases of the proposed project will make reference to the above mentioned no-go and sensitive areas that were delineated for the project area.

6.1.2 Protected and indigenous plant management

During the pre-construction phase, a protected plant management programme must be implemented to allow for the maximum transplant of conservation important species from the areas to be transformed. The management plan for protected and indigenous plant species is shown in Table 6-2.

6.1.3 Planning of site remediation and post-construction rehabilitation

Site remediation and rehabilitation by definition means to replace that which was impacted by construction activities for the proposed project back to a sustainable and desirable condition. Thus the area of disturbance must be minimised to retain as much of the current land use capability as possible.

Important aspects to consider for rehabilitation are to minimise the area affected by the development, to minimise foreign material from entering the natural environment and to maximise the recovery and effective storage of material required for rehabilitation. Thus during construction of the relevant plants the following should be kept in mind:

- Construction activities must minimise their footprint of disturbance; and
- All infrastructure should be constructed with final closure in mind i.e. infrastructure should be designed with ease of deconstruction in mind.

A representative sample of rare and naturally occurring plant species that are present in the project development footprint should be conserved by removing and relocating them to another suitable section of the project area or these plants can be kept in a nursery so that the plants can then be replanted during rehabilitation of the disturbed areas.

Control and management of alien vegetation will contribute to the conservation of the natural vegetation. The alien species should therefore be removed from site and control measures must be implemented to ensure spreading of these species does not occur to other parts of the project area or the surrounding lands.

The areas not directly impacted upon by the project footprint but falling under the control of the project need to be managed for the duration of the time that the land is under project control.

6.1.4 Planning and design of storm water management measures

The proposed project site falls in an arid climatic region, but high rainfall events occur from time to time resulting in flash floods. Procedures for storm water flow through a project site need to take into consideration both normal operating practice and special circumstances. Special circumstances in this case typically include severe rainfall events.

The main factors influencing the planning of storm water management measures and infrastructure are:

- Annual average rainfall;
- Rainfall intensities;
- Soil and vegetation cover;
- Topography and slope gradients; and
- Placing of infrastructure and infrastructure design.

Table 6-2: Pre-construction phase implementation plan – Protected and indigenous plant species

PROTECTED AND INDIGENOUS PLANT SPECIES			
Context	The vegetation community present in the drainage lines was designated as a no-go area, due to the ecological importance of the benefiting ephemeral river system. The protected plant species, *Hoodia gordonii*, was also observed in this area. For this purpose, the northern part of the study area was classified as sensitive and should be avoided. Protected plant species management is a critical part of any new development, as the management of such species are enforced by law. The current study revealed one protected plant present within the study area, however, 13 protected plant species could possibly occur here.		
PRE-CONSTRUCTION PHASE			
Objectives	The environmental objectives for ecological components are: • To prevent direct impacts on the Protected plants present; • To prevent direct impacts on areas that were delineated as sensitive and could harbour more protected plants; • To minimise the footprint of disturbance during the construction phase; • To preserve as many natural plant species that can be used during site remediation; and • To eradicate alien invasive and weed species from the project area.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Removal of topsoil from the footprint of the substation site and car parking yard and stockpiling of topsoil for use during site rehabilitation; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and • Access control and fencing of the site.		
Potential impacts	The potential impacts on ecological components include: • During site preparation activities, protected plant species could be removed; • There is also a possibility that Red Data or protected plant species that have not been identified in areas within the project development footprint during dry-season surveys could be destroyed.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Orlight SA	Project planning

PROTECTED AND INDIGENOUS PLANT SPECIES			
	• A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species;	Flora specialist	Project planning
	• Application for permits to relocate or destroy protected plants must be applied for through the relevant provincial authority before any plant species are disturbed;	ECO Contractor	Pre-construction
	• All protected plants encountered should be relocated to an on-site nursery. During site remediation and rehabilitation, these species could be replanted as per the Protected plant species permit conditions;	ECO	Pre-construction
	• Clearing of vegetation should be supervised to ensure that no protected species are destroyed, and if encountered must be managed in accordance with provincial regulations; and	ECO	Pre-construction
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Contractor ECO	Pre-construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No destruction of vegetation outside designated areas; • Establishment of an on-site nursery; • Evidence of vegetation being relocated and re-established in other areas.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the possible relocation of protected species undertaken by the contractor; • Inspections should be undertaken by the contractor to identify protected plant species during any vegetation clearance.		

The objectives for storm water management in general include:

- Protection of life and property from flood hazards;
- Prevention of land and watercourse erosion;
- Ensuring continuous operation through different stages of the hydrological cycle; and
- Preservation of the natural environment (watercourses and their ecosystems).

Site description

Loeriesfontein has an annual average rainfall figure of 147 mm with the highest rainfall occurring during the winter months (27 mm in June). The topography is fairly flat with slope gradients varying between 3 – 6%. A major drainage line traverse the eastern portion of the study area from north to south with several smaller drainage lines joining it almost perpendicular from the west.

Solar panel and power substation infrastructure

A conceptual storm water management plan is illustrated in Plan 3c. The following principles should apply to the storm water management during the construction and operational phases of the proposed project:

- Infrastructure such as the substation should be constructed outside the 1:100 year flood line;
- Divert all surface water run-off away from the infrastructure areas through channels and berms via erosion protected chutes towards the drainage lines; and
- The drainage system need to be designed to specifications that can adequately deal with a 1:50 year intensity rainfall event or more to ensure sufficient capacity for carrying storm waters around and away from infrastructure.

Roads

- Controlled drainage from road surfaces is necessary for the maintenance of the road integrity;
- All roads should be constructed with a 3% slope so as to allow storm water to drain from their surface as soon as possible in order to avoid soaking and erosion of the road surface; and
- Roads will have side drains to collect and channel storm water run-off and direct it away from the road to a designated area via an erosion protected chute. All roads crossing water courses will have adequate bridges or culverts in order to prevent potential flood damage.

6.1.5 Phase 2 Archaeological Impact Assessment

It should be noted that avoidance of significant archaeological sites is not possible in all instances, as this would pose significant technical restrictions to the plant layout design and results in a significant loss of available development footprint. Even though these sites are of provincial and local significance were identified, they all occur on surface and are therefore likely to be destroyed due to natural and anthropogenic factors if not preserved. In these instances, systematic sampling of surface material may be the most expedient way of recording the sites and making the area available for development. It is not anticipated that the sites will have much deposit and a surface scrape of material may be sufficient, although some depth of archaeological deposit may occur at Site 149 and 150 (along the river).

The systematic excavation and/or collection of archaeological material will enhance the understanding of the regional LSA settlements and is therefore considered to be a positive impact in terms of archaeological research. Necessary permits must be obtained from SAHRA prior to any excavations or destruction of sites.

6.2 Construction phase

The environmental objectives for the construction phase of the proposed project are to:

- Ensure that construction activities are undertaken in accordance with the specifications and outcomes of the planning and design phase;
- Implement an environmental training and awareness plan to familiarise all parties with the contents of the EMP;
- Establish clear communication channels between parties responsible for implementing the EMP;
- Establish a grievance mechanism whereby the public are able to voice issues and concerns regarding the construction activities;
- Ensure that construction activities are managed in such a way as to reduce the risk of potential environmental impacts occurring;
- Prevent impacts on the ephemeral river system and associated drainage lines in the study area;
- Minimise degradation or loss of the soil resource;
- Minimise the impact of the project on indigenous vegetation, Red Data and protected plant species and other sensitive ecological areas;
- Ensure that site remediation is undertaken where necessary and within the stipulated timeframes;
- Minimise impacts to sites of heritage significance outside the project development footprint and unidentified archaeological and palaeontological sites, should they be identified during the construction phase;
- Minimise negative impacts associated with the presence of construction workers and migrant job-seekers; and
- Enhance the potential socio-economic benefits associated with the construction of the proposed project.

The implementation plans for the construction phase of the proposed Loeriesfontein Solar PV Power Plant are presented in the tables below.

Table 6-3: Construction phase implementation plan – Surface water systems

SURFACE WATER SYSTEMS	
Context	The project area is situated in the Olifants/Doring Water Management Area (WMA 17). The major rivers associated with this WMA are the Olifants, Doring, Krom, Sand and Sout Rivers. The project site is situated in the quaternary catchments E31B and E31C. A few ephemeral river systems and associated drainage lines were identified for the project area. These systems are associated with the Volstruisnesholte River catchment which is recognised by the FEPA as an upper management area in support of the downstream FEPAs (sub-catchment 5338). The catchment area is considered to be largely natural and as a result, any impacts to the systems may be severe.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for surface water systems are: • To prevent direct impacts on the ephemeral river system and associated drainage lines in the study area; • To prevent indirect impacts on surface water quality of the ephemeral river system due to sedimentation or contamination by hydrocarbons or waste products; and • To reduce the site's susceptibility to erosion.
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Levelling of the terrain where it is too undulating for installation of panels; • Establishment of access roads, including crossings over drainage lines and dry river beds; • Laying of underground cables, including crossings over drainage lines and dry river beds; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; • Storage of hydrocarbons and operation of equipment and vehicles; and • Generation and handling of domestic and industrial wastes.
Potential impacts	The potential impacts on surface water systems include: • The removal of natural vegetation from the project development footprint, levelling of undulating areas and creation of hard and compacted surfaces will alter the natural topography and drainage patterns of the project site;

SURFACE WATER SYSTEMS			
	• A significant impact would be the construction of road crossings over drainage lines and similarly, the laying of underground electric cables; • During rainfall events, disturbed surfaces would be susceptible to erosion and altered surface flow dynamics will accelerate the very slow, natural erosion process and sediment transport off-site; and • During surface flow events, increased sediment transported due to aggravated erosion from disturbed areas, as well as other contaminants (i.e. waste products, effluents, construction materials) stored on the construction site, may result in contamination of downstream water resources.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• All road crossings and underground trenches for electric cables that cross drainage lines in the project development footprint must be designed by a qualified road engineer in consultation with a surface water specialist;	Engineer/site specialist	Project planning
	• A WULA must be obtained for each crossing of drainage lines prior to the commencement of the construction phase. All mitigation measures specified in the WULA must be implemented;	Orlight SA	Project planning
	• The majority of site preparation activities be undertaken during the dry season;	Orlight SA	Project planning
	• A storm water management plan should be implemented during the construction phase;	Contractor	Construction
	• Delineated drainage lines and buffer zones should be clearly delineated;	ECO	Project planning
	• With the exception of the construction of road crossings and lying of underground cables, no other activities may be allowed with the delineated drainage lines and buffer zones;	Contractor	Construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Construction
	• All waste products must be managed according to a waste management plan;	Contractor	Construction
	• All construction materials should be stored in bunded areas to ensure that material loss during	Contractor	Pre-construction

SURFACE WATER SYSTEMS			
	surface flow events are prevented;		
	• Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Construction
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels;	Contractor	Construction
	• Spillage should be managed through an emergency spill response plan. A hydrocarbon spill kit should be kept on site.	Contractor	Construction
Performance indicators	The performance indicators are: • Approved WULA for all identified water uses; • Detailed engineering designs of river crossings; • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • Vegetation is restored after site remediation; • Hydrocarbon storage areas and vehicle hard parks are bunded; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, water quality in the drainage line should be monitored to identify potential sources of contamination.		

Table 6-4: Construction phase implementation plan – Soil and agricultural potential

SOIL AND AGRICULTURAL POTENTIAL			
Context	The vast presence of the shale rock type gave rise to fragment infested shallow soils (<30 cm) for the majority of the site, with the exception of the watercourses/drainage lines where alluvial deposits were dominating. Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed, is considered to be moderate. This will be partly due to the little cohesion between particles on the one hand, while the mass of the coarser fragments will reduce the susceptibility, depending on the force subjected to.		
CONSTRUCTION PHASE			
Objectives	The environmental objectives for soils and agricultural potential are: • To minimise loss of the soil resources to support existing land use and land capability; • To minimise soil erosion by wind and water; • To reduce the site's susceptibility to erosion; • To minimise compaction of soils during site preparation activities; and • To prevent soil contamination due to spillage of hydrocarbons or wastes.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Levelling of the terrain where it is too undulating for the installation of panels; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; • Storage of hydrocarbons and operation of equipment and vehicles; and • Generation and handling of domestic and industrial wastes.		
Potential impacts	The potential impacts on soils and agricultural potential include: • The coarse graded soils that occur on the project site have little cohesion between particles and consequently, these soils are highly susceptible to water erosion, depending on the force applied at the time of impact; • Soil compaction of well sorted fine-graded sand and silty soils; and • The potential for contaminating the soil due to spillage of hydrocarbons from vehicles and machinery, or improper waste management.		
Management and	**Actions**	**Responsibility**	**Timeframe**

SOIL AND AGRICULTURAL POTENTIAL			
mitigation actions	• The majority of site preparation activities to be undertaken during the dry season;	Orlight SA	Project planning
	• Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• Minimise the period of exposure of soil surfaces through planning;	Contractor ECO	Project planning Construction
	• Where feasible, activities that are usually undertaken by machinery (such as vegetation removal), should be replaced with manual labour;	Contractor	Construction
	• Topsoil should be stripped from the footprint of the substation and car hard park prior to activities being undertaken and the soils stockpiled for use during site remediation;	Contractor	Construction
	• A storm water management plan should be implemented during the construction phase;	Contractor	Construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Construction
	• Where topsoil is compacted, the soil surface can be loosened via tillage/ripping;	Contractor	Construction
	• All waste products must be managed according to a waste management plan;	Contractor	Construction
	• All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented;	Contractor	Pre-construction
	• Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Construction
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated	Contractor	Construction

SOIL AND AGRICULTURAL POTENTIAL			
	from clean water areas with berms or channels;		
	• Spillage should be managed through an emergency spill response plan. A hydrocarbon spill kit should be kept on site.	Contractor	Construction
Performance indicators	The performance indicators are: • No visible signs of erosion (i.e. bare patches, rills and gullies); • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • Construction vehicles are restricted to designated areas; • Vegetation is successfully restored during site remediation; • Hydrocarbon storage areas and vehicle hard parks are bunded; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, monitoring is required to identify potential erosional problems.		

Table 6-5: Construction phase implementation plan – Ecological components

ECOLOGICAL COMPONENTS	
Context	In relation to CBA, the study area falls outside any CBA (BGIS, 2010). In terms of the SKEP, the study area is not a geographic priority area, but has an irreplaceability value of 0.28. The irreplaceability value of a planning unit indicates how important that planning unit is for achieving conservation targets for the biodiversity features it contains. An irreplaceability value of 0.28 translates to flexibility in terms of which sites can be chosen to achieve the conservation target. The vegetation community present in the drainage lines was designated as a no-go area, due to the ecological importance of the benefiting ephemeral river system. The protected plant species, *Hoodia gordonii*, was also observed in this area. For this purpose, the northern part of the study area was classified as sensitive and should be avoided.

ECOLOGICAL COMPONENTS			
CONSTRUCTION PHASE			
Objectives	The environmental objectives for ecological components are: • To prevent direct impacts on the ephemeral river system and associated drainage lines in the study area; • To prevent direct impacts on other areas that were delineated as highly sensitive and unsuitable for development; • To minimise the footprint of disturbance during the construction phase; • To preserve as many natural plant species that can be used during site remediation; and • To eradicate alien invasive and weed species from the project area.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and • Access control and fencing of the site.		
Potential impacts	The potential impacts on ecological components include: • During site preparation activities, some of the naturally occurring vegetation will be removed; • There is also a possibility that Red Data or protected plant species that have not been identified in areas within the project development footprint during dry-season surveys, could be destroyed; • Decrease in effective photosynthesis as result of elevated ambient dust; • During site clearance, it is also likely that alien invasive and weed species will propagate on disturbed areas; • Alien invasive species could out-compete indigenous vegetation, due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches; and • Loss of habitat for grazing animals due to removal of vegetation and fencing of the site.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Orlight SA	Project planning
	• A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or	Flora specialist	Project planning

ECOLOGICAL COMPONENTS			
	destruction of these species;		
	• No vegetation removal should be allowed outside the designated project development footprint;	ECO Contractor	Construction
	• A representative sample of indigenous plant species should be selected for use during site remediation and rehabilitation as per the rehabilitation plan;	ECO	Pre-construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	ECO	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas;	Contractor ECO	Construction
	• An alien invasive and weed control programme should be implemented.	Contractor ECO	Construction
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Contractor ECO	Pre-construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No destruction of vegetation outside designated areas; • No visible evidence of alien invasive species.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Daily inspections should be undertaken by the contractor to identify area where alien invasive species could establish.		

Table 6-6: Construction phase implementation plan – Alien invasive control

ALIEN INVASIVE CONTROL			
Context	Preservation of natural habitat is of prime importance within this study area, mainly because of the SKEP data that indicates the site as important because it has an irreplaceability value of 0.28. The irreplaceability value of a planning unit indicates how important that planning unit is for achieving conservation targets for the biodiversity features it contains. An irreplaceability value of 0.28 translates to flexibility in terms of which sites can be chosen to achieve the conservation target. For these reasons the management of alien invasive species, that will be detrimental to these aspects, is essential.		
CONSTRUCTION PHASE			
Objectives	The environmental objectives for ecological components are: • To prevent the spread of alien invasive plant species present on the study area; • To remove the plant species *Prosopis glandulosa, Tamarisk ramosissima and Argemone ochroleuca*; • To avoid the introduction of additional alien invasive plant species; and • To preserve as many natural plant species that can be used during site remediation.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure, will create favourable habitat for alien invasive plant species to colonise; • Stockpiling of topsoil for use during site rehabilitation will create favourable habitat for alien invasive plant species; • Open areas along roadsides will create favourable habitat for alien invasive plant species.		
Potential impacts	The potential impacts on ecological components include: • Potentially viable habitat for naturally occurring plant species could become undesirable with the spread of *Prosopis glandulosa, Tamarisk ramosissima and Argemone ochroleuca*; • There is also a possibility that Red Data or protected plant species habitat could be destroyed as all three problem plants encountered here could potentially colonise these areas; • Loss of habitat for grazing animals due to alien invasive colonisation.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Orlight SA	Project planning

ALIEN INVASIVE CONTROL			
	• A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species;	Flora specialist	Project planning
	• No vegetation removal should be allowed outside the designated project development footprint;	ECO Contractor	Construction
	• A representative sample of indigenous plant species should be selected for use during site remediation and rehabilitation as per the rehabilitation plan;	ECO	Pre-construction
	• Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared;	ECO	Construction
	• *Removal of Prosopis glandulosa:* Cut stump foliar and soil applied herbicide can be successful, follow ups are always needed.	ECO	Pre-construction
	• *Removal of Tamarisk ramosissima:* Must be physically cut down removed and stumps treated with herbicide.	ECO	Pre-construction
	• *Removal of Argemone ochroleuca:* Controlled by shallow cultivation, when small poet emergence herbicides are succesfull.	ECO	Pre-construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas;	Contractor ECO	Construction
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Contractor ECO	Pre-construction
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No destruction of vegetation outside designated areas;		

ALIEN INVASIVE CONTROL	
	• No visible evidence of alien invasive species.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Daily inspections should be undertaken by the contractor to identify area where alien invasive species could establish.

Table 6-7: Construction phase implementation plan – Air quality

AIR QUALITY	
Context	The Granaatboskolk/Zout Dwaggas gravel road will be used during the construction and operational phases of the project and will be the major source of dust during the construction phase.
CONSTRUCTION PHASE	
Objectives	The environmental objective for air quality is to minimise creation of dust.
Risk sources	The following risk sources have been identified: • Vehicle movement on unsurfaced roads; and • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure.
Potential impacts	The potential impacts on air quality include: • The coarse graded soils that occur on the project site have little cohesion between particles and consequently, these soils are highly susceptible to water erosion, depending on the force applied at the time of impact. The very fine material in-between the fragments will be subjected to wind erosion where exposed and stockpiled; • Increased levels of ambient dust may cause respiratory ailments to the receiving environment; • Vehicles driving along unsurfaced roads at speeds which allow for the generation of dust; • Increase health and safety risks as result of increased dust and traffic; and • Decrease of plant productivity as result of dust on plants that limits photosynthesis.

AIR QUALITY			
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Minimise construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• Minimise the period of exposure of bare surfaces through planning;	Contractor ECO	Project planning Construction
	• Where feasible, activities that are usually undertaken by machinery (such as vegetation removal), should be replaced with manual labour;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation;	Contractor ECO	Construction
	• Dust suppression techniques such as applying water or non-toxic chemicals to minimise dust should be used, where feasible.	Contractor ECO	Construction
Performance indicators	The performance indicators are: • No visible signs of wind erosion; and • Topsoil in areas that are not to be further disturbed is replaced and vegetation successfully restored.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, monitoring is required to identify potential erosional problems.		

Table 6-8: Construction phase implementation plan – Waste

WASTE	
Context	The construction of the power plants will generate solid, liquid and non-hazardous waste. The municipal waste management site may not have the capacity to

WASTE			
	accommodate waste generated by the project and therefore, a waste management contractor would have to be employed to remove waste to a registered landfill site.		
CONSTRUCTION PHASE			
Objectives	The environmental objectives for waste management are to: • Minimise waste; • Contain movement of heavy vehicles to designated areas; • Avoid spillages and contamination; • Reuse, reduce and recycle, where possible; • Recover material such as glass, aluminium, as well as a variety of semiconductor materials. Recycling benefits the environment by reducing the volume of waste and helps to reduce the amount of energy required to provide raw materials and therefore the costs and environmental impacts of producing PV modules.		
Risk sources	The following risk sources have been identified: • Spillage during handling of waste or damaged containers; • Non utilisation of waste containers; • Waste being blown away from waste containers; • Waste vectors (i.e. rodents and cockroaches); • Littering by construction workers.		
Potential impacts	The potential impacts from waste generation include: • Surface water contamination; • Soil contamination; • Ecological degradation; • Negative visual impacts; and • Nuisance, such as bad odours.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Ensure construction waste is effectively contained, stored and managed on site;	Contractor	Construction

WASTE			
	• Ensure waste bins (e.g. for organic waste) is sufficient vermin proof and weatherproof;	Contractor	Construction
	• Ensure all rubble and waste rock are disposed of at a registered disposal sites;	Contractor	Construction
	• Implement the "reduce, reuse and recycle" approach for all waste. This means that different bins need to be put in place to separate i.e. plastic, paper, glass and cans, where feasible;	Contractor	Construction
	• Ensure all solid and hazardous waste is disposed of at a registered disposal sites; and	Contractor	Construction
	• The ablution contractor needs to ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site.	Contractor	Construction
Performance indicators	The performance indicators are: • Evidence that waste is effectively contained, stored and managed on site; • No littering is visible on site or from the site; • Waste bins (e.g. for organic waste) has lids and is sufficient vermin proof and weatherproof; • Evidence that all solid waste, including rubble and waste rock, are removed and disposed of at a registered sites; • The "reduce, reuse and recycle" approach for all waste are being implemented by means of establishing separate bins for i.e. plastic, paper, glass and cans; and • There is no evidence of uncontrolled spillages or waste on site.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

Table 6-9: Construction phase implementation plan – Visual Environment

VISUAL ENVIRONMENT	
Context	The Loeriesfontein study area is positioned on the farm Kleine Rooiberg, which was named after the landscape which displays outcropping areas that are reddish in colour and dominate the west and north of the study area. These unusual "rooiberge" definitely add to the aesthetic value of the study area. The

VISUAL ENVIRONMENT			
	landscape is dominated by vegetation that is comprised of low-lying shrubs and succulents and rocky areas. The study area is situated approximately 40 km outside of the town of Loeriesfontein and there are no residences in close proximity.		
CONSTRUCTION PHASE			
Objectives	The environmental objective for the visual environment are to: • Mitigate visual impacts to motorists on the Granaatboskolk/Zout Dwaggas gravel road; • Manage complaints and grievances regarding visual impacts; and • Minimise dust impacts and visual pollution.		
Risk sources	The following risk sources have been identified: • Increase in vehicular and other activity levels during the construction phase; • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; • Fencing of the project site; and • Installation of the solar PV panels and construction of all related project infrastructure.		
Potential impacts	The potential impacts on the visual environment include: • The largest visual impact will be experience due to the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur; • The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Complaints and grievances related to visual impacts must be managed and addressed through a grievance mechanism;	Orlight SA	Construction
	• No vegetation removal should be allowed outside the designated project development footprint;	Contractor	Construction
	• Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network);	Contractor	Construction

VISUAL ENVIRONMENT			
	• Minimise soil removal and construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods;	Contractor	Construction
	• The possible tourism aspect of the solar PV power plant should be explored and promoted;	Orlight SA	Pre-construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will minimise the potential for dust generation.	Contractor ECO	Construction
Performance indicators	The performance indicators are: • Construction activities are restricted to designated project development footprint areas; • No visible signs of wind erosion and dust generation; and • Vegetation successfully restored during site remediation.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

Table 6-10: Construction phase implementation plan – Employment creation

EMPLOYMENT CREATION	
Context	During the construction phase, the proposed project will create an estimated seven direct job opportunities per MW generation capacity, translating to a construction workforce of 490 people. Some of these job opportunities will be for unskilled labourers, which will be sourced from the town of Loeriesfontein. The majority of residents in this town have low educational and skills levels, thus many are unemployed and well suited to unskilled labour. It is likely that there are existing entrepreneurs, local businesses and Small, Medium and Micro Enterprises (SMMEs) in or around Loeriesfontein that render services that the proposed project will require. The social benefits associated with the proposed project will be enhanced if the proponent makes use of these businesses and SMMEs.
CONSTRUCTION PHASE	
Objectives	The environmental objective for employment creation are to:

EMPLOYMENT CREATION			
	• Employ as many labourers from the immediate and larger study area as possible; and • Utilise local businesses and SMMEs as much as is feasible.		
Risk sources	The following risk sources have been identified: • Contractors making use of their own labour force, reducing the opportunity for locals to be temporarily gainfully employed; • Sub-contracting large companies operating primarily outside the study area to provide support services such as catering; and • Sourcing labour (un-, semi- and skilled) from outside the larger study area if the required skills are available within that area.		
Potential impacts	The potential impacts of employment creation include: • Socio-economic benefits associated with creating local employment and business opportunities.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Ensure that a minimum of 80% of the unskilled workers are sourced from Loeriesfontein (surrounding towns, if insufficient labourers are available in Loeriesfontein);	Orlight SA Contractor	Pre-construction
	• Ensure that a minimum of 20% of the unskilled employment opportunities are awarded to women and previously disadvantaged individuals residing in the local and surrounding areas;	Orlight SA Contractor	Pre-construction
	• In conjunction with the local municipality and other local organisations and companies, identify suitable individuals in the local and regional areas to fill the available job opportunities;	Orlight SA Contractor	Pre-construction
	• Set-up a local labour and enterprise desk in Loeriesfontein to allow local labourers, entrepreneurs, SMMEs and companies to register their details and skills/ service to facilitate the employment and contracting of local labourers and entrepreneurs, SMMEs and companies;	Orlight SA	Pre-construction Construction
	• Relevant information regarding employment opportunities (including job descriptions, skills required, and number of opportunities), as well as contracting of entrepreneurs, SMMEs and other local companies (including the type and scale of service required) will be made available at the local labour and enterprise desk;	Orlight SA	Pre-construction Construction
	• Create conditions conducive to the involvement of local companies, SMMEs and entrepreneurs	Orlight SA	Pre-construction

EMPLOYMENT CREATION			
	during the construction phase;		
	• Provide guidelines in tender documentation regarding the employment of locals and use of local enterprises; and	Orlight SA	Pre-construction
	• Skills training will be provided for the construction workforce and entrepreneurs, SMMEs and local businesses as relevant and required.	Orlight SA Contractor	Pre-construction Construction
Performance indicators	The performance indicators are: • The majority of unskilled job opportunities are awarded to local individuals (at least 80% from Loeriesfontein or surrounding towns); • A fifth of unskilled job opportunities are filled by women and previously disadvantaged individuals; • The proponent/contractor has a list of candidates (including contact details, age, sex, skills level, educational levels and resident town) that may be able to fulfil unskilled job openings; • The proponent/contractor has a list of entrepreneurs, SMMEs and companies operating in the local area (including company name, services provided, number of employees and location) that could be used to provided services required during construction; • A labour and enterprise desk is operational and visible in Loeriesfontein; • Some services are provided by local entrepreneurs, SMMEs and businesses; • Tender documentation stipulates guidelines pertaining to the employment of locals, women and previously disadvantaged individuals, as well as the subcontracting of local entrepreneurs, SMMEs and businesses; and • The proponent/ contractor are able to provide records of training provided for local employees and entrepreneurs, SMMEs and businesses, including the nature of training, number of individuals/ entrepreneurs/ SMMEs/ businesses who received training, and the training provider.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-11: Construction phase implementation plan – Influx of job seekers

INFLUX OF JOB-SEEKERS	
Context	News of the proposed project and employment opportunities may result in an influx of job-seekers into Loeriesfontein and surrounding towns. Due to the limited housing available in these areas, such an influx may result in the development of informal settlements. Although it is unlikely that this will happen, the potential

INFLUX OF JOB-SEEKERS			
	adverse impacts associated with it should not be underestimated. Influx of job-seekers must thus be prevented as far as possible. It is likely that the rate of influx will be highest during pre-construction and the early stages of construction, and that the unsuccessful job-seekers will leave Loeriesfontein and surrounding towns shortly after their arrival in search of other opportunities.		
CONSTRUCTION PHASE			
Objectives	The environmental objective to minimise influx of job-seekers are: • Proactively discouraging the influx of migrant job-seekers; and • Actively preventing the establishment of informal housing and settlements.		
Risk sources	The following risk sources have been identified: • Some unsuccessful job-seekers may establish temporary informal housing without adequate services. This poses a health hazard for the migrants and the local population; • Some unsuccessful job-seekers may rent accommodation from locals, contributing to increased pressure on local service delivery; and • The local population may reject the unemployed migrants and their lifestyles, possibly resulting in social conflict and violence.		
Potential impacts	The potential impacts of influx of job seekers include: • The development of informal settlements due to the limited housing available in the area; • Congregation at the construction site; • Social conflict between the incumbent and migrant populations, due to the incumbent population feeling that the migrants are taking opportunities away from them; • An increase in social pathologies (prostitution, conflict and violence, alcohol abuse, drug use and crime). • Petty crimes and stock theft; • Risks to the security of the project site and equipment or goods.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Establish and communicate an effective grievance mechanism through which the surrounding land owners and local population can lay grievances and have it resolved prior to the grievance becoming contentious;	Orlight SA	Pre-construction Construction

INFLUX OF JOB-SEEKERS			
	• Transparently communicate the available job opportunities and emphasise that preference will be given to local labourers for these positions (by means of the labour and enterprise desk in Loeriesfontein);	Orlight SA Contractor	Pre-construction Construction
	• The recruitment process and use of subcontractors will be clearly communicated to the residents of Loeriesfontein and surrounding towns;	Orlight SA Contractor	Pre-construction Construction
	• Employ as many local labourers as possible in un- and semi-skilled positions as feasible, and encourage these labourers to remain at their existing residences;	Orlight SA Contractor	Pre-construction Construction
	• In collaboration with the local residents and local municipality, devise a strategy to report the establishment of any informal housing and settlements and a procedure to dismantle such housing as soon as possible, without contravening the Extension of Security of Tenure Act (Act 62 of 1997) (ESTA); and	Orlight SA	Pre-construction Construction
	• Local residents will be discouraged from renting accommodation to unsuccessful job-seekers. Such residents should rather be encouraged to reserve their available accommodation for the construction workforce.	Orlight SA	Pre-construction Construction
Performance indicators	The performance indicators are: • Residents in Loeriesfontein and surrounding towns are aware of the grievance mechanism; • Grievances that have been lodged were dealt with in accordance with the grievance mechanism's protocol; • Residents in Loeriesfontein and surrounding towns are aware of the number and type of job opportunities available to local residents, as well as the recruitment procedure; • Local labourers live in their own residences where feasible; • Labourers not from Loeriesfontein or surrounding towns are accommodated in formal (albeit temporary) housing with adequate services; • The proponent/ contractor becomes immediately aware of the erection of informal housing and is able to dismantle such housing without contravening the ESTA; and • Few or no local residents are renting accommodation to unemployed job-seekers.		
Monitoring and	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be		

INFLUX OF JOB-SEEKERS	
evaluation	undertaken by an independent social and labour specialist.

Table 6-12: Construction phase implementation plan – Traffic

TRAFFIC			
Context	The construction phase of the proposed project will necessarily increase the volume of traffic in the vicinity of the project site, as well as change the nature of the traffic (there will be an increased number of heavy motor vehicles). By imposing traffic and transportation rules, carefully planning access to the site, maintaining the access roads and ensuring that construction vehicles are roadworthy, the risk of traffic-related incidents involving construction traffic is reduced.		
CONSTRUCTION PHASE			
Objectives	The environmental objective to minimise impacts on traffic are: • To minimise the impact of traffic associated with construction activities on the quality of roads, local traffic flow, local residents, land owners and livestock; • To minimise the probability of traffic accidents involving construction vehicles, public road users and livestock; and • To ensure that all construction vehicles are roadworthy and have the appropriate permits or licenses.		
Risk sources	The following risk sources have been identified: • Construction vehicle movement; • Speeding on local roads; • Degradation of local road conditions; and • Transport of materials required for the construction phase.		
Potential impacts	The potential impacts on traffic include: • An increase in traffic (including heavy vehicle traffic) increases the risk of traffic accidents involving non-project personnel and livestock; and • An increase in traffic could have a negative impact on the quality of the roads in the vicinity of the proposed project, especially the gravel (farm) roads, further increasing the risk for traffic accidents.		
Management and	**Actions**	**Responsibility**	**Timeframe**

TRAFFIC			
mitigation actions	• The contractors preferred access road(s) to the site, procedures, schedules and traffic volumes will be communicated with the affected parties prior to the commencement of construction. The affected parties will be given the opportunity to suggest changes in cases where the impact on the local community and land owners will be significantly adverse;	Contractor	Pre-construction Construction
	• Appropriate signage should be erected outside the project footprint adjacent to the Granaatboskolk/Zout Dwaggas gravel road to inform motorists driving past of the construction activities that are being undertaken;	Orlight SA	Pre-construction
	• The gravel access road(s) to the site will be maintained to its original (or better) state and an appropriate dust suppressant measure will be employed if required;	Contractor	Construction
	• Construction vehicles will be inspected regularly to confirm that they are roadworthy, have the required license/ permit to transport their load and are not overloaded. Additionally, vehicles will be adequately maintained;	Contractor	Construction
	• Construction vehicles will be limited to travelling 40 km/h on gravel roads. This limitation will be strictly enforced;	Contractor	Construction
	• Drivers' shifts will be limited to 8 hours per day to prevent driver fatigue;	Contractor	Construction
	• Access from the national road to the gravel road leading to the site will be clearly marked and appropriate road signs will be used to warn public road users of the presence of heavy motor vehicles;	Contractor	Construction
	• Any traffic delays that may be caused by construction traffic will be coordinated with the relevant local authorities prior to the delay occurring;	Contractor	Pre-construction Construction
	• All drivers of construction vehicles will be in possession of the appropriate drivers' license for that vehicle;	Contractor	Construction
	• Drivers of construction vehicles will not be allowed to transport any passengers; and	Contractor	Construction

TRAFFIC			
	• Any traffic-related accident (including accidents involving just the construction vehicle, or the construction vehicle and a member of the public and/ or livestock) will be reported to the contractor immediately.	Contractor	Construction
Performance indicators	The performance indicators are: • Affected parties (including surrounding land owners) are aware and satisfied with the contractor's traffic-related logistics; • The access road is in the same or better state than what it was at the outset of construction; • Dust generation from traffic on the access road(s) is of an acceptable level; • The construction vehicles are not involved in any traffic-related incidents; • Access to the site is clearly marked with appropriate road signs; and • The project-affected and surrounding communities do not lay any traffic-related complaints (such as reckless driving or speeding).		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-13: Construction phase implementation plan – Safety and security

SAFETY AND SECURITY	
Context	The influx of job-seekers, the presence of a construction workforce as well as construction activities pose a potential safety and security risk for the residents of Loeriesfontein and surrounding towns. The presence of unemployed job-seekers as well as 'outsiders' (whether employed or not) could lead to petty crimes and stock theft. The safety of the construction workforce is also a concern (both while 'on-the-job' and at their accommodation), as well as that of the project-affected communities when in the vicinity of construction activities. Additionally, the security of the project site should also be considered.
CONSTRUCTION PHASE	
Objectives	The environmental objective to minimise impacts on safety and security are: • Maximise the employment of locals, thereby minimising the number of 'outsiders' to enter the project-affected community; and • Implement strict security measures in the vicinity of the construction site and other project infrastructure.
Risk sources	The following risk sources have been identified:

SAFETY AND SECURITY			
	• The safety of construction workers, job-seekers, local communities and livestock may be at risk; • Livestock theft and petty crime; • Theft of construction material; • Vandalism of project infrastructure; and • Project-related accidents (including accidents on site).		
Potential impacts	The potential impacts on safety and security include: • The presence of 'outsiders' create conditions conducive to petty crime and stock theft; • Construction activities (including construction traffic and the actual site) pose a safety risk; and • Potential vandalism of the site or other project infrastructure.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The number of non-local employees will be minimised;	Orlight SA Contractor	Pre-construction
	• Construction workers will be easily identifiable through their uniforms and name tags;	Contractor	Construction
	• Local law enforcement officials will be kept appraised of the project plans;	Orlight SA	Pre-construction
	• If any of the construction workers will be required to move outside the construction site or designated access road(s), the surrounding land owners will be notified prior to the occurrence;	Contractor	Construction
	• The contractor will cooperate fully with the local law enforcing agencies (police and any community-based committee, if present) should a construction worker be suspected of committing a crime;	Contractor	Construction
	• The construction site and laydown yard will be completely fenced off and access into the sites will be controlled by a 24-hour security service;	Contractor	Construction
	• The fence surrounding the construction site and laydown yard will be inspected daily for damage, and any damage will be repaired as soon as possible;	Contractor	Construction

SAFETY AND SECURITY			
	• Security personnel will be briefed about possible stock theft and poaching and taught to identify criminal elements/ activities in this regard;	Contractor	Construction
	• Contact details of emergency services will be prominently displayed at the construction site and laydown yard;	Contractor	Construction
	• Appropriate fire-fighting equipment will be made available on site and at the laydown yard, and representatives from the construction workforce will be trained as fire marshals; and	Contractor	Construction
	• Open fires made by the construction workforce will be strictly forbidden.	Contractor	Construction
Performance indicators	The performance indicators are: • Crime rates do not increase as a result of the proposed project; • The construction site and laydown areas are not vandalised; • No on-site or construction related accidents reported; • No veld fires started by open fires by the construction workforce are reported; and • Residents do not report any cases of trespassing by construction workers.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-14: Construction phase implementation plan – Social conflict

SOCIAL CONFLICT	
Context	The proposed project will employ a construction workforce of 490 people. Although some of these workers will be from the local and surrounding towns, many will come from outside the study area. Minimising the adverse impact these workers may have on the local communities is important for the successful completion of the construction of the proposed project, as is the well-being of the construction workforce. It is not anticipated that social conflict or an increase in social pathologies will materialise as a result of the presence of the construction workforce. Nevertheless, measures need to be taken to further minimise this risk. The well-being of the migrant workforce also requires attention.
CONSTRUCTION PHASE	

SOCIAL CONFLICT			
Objectives	The environmental objective to minimise social conflict are to: • Ensure adequate living and working conditions for the construction workforce; and • Avoid social conflict between migrant workers and the local residents.		
Risk sources	The following risk sources have been identified: • Construction accommodation and ablution facilities; and • Interaction between migrant construction workers and local residents.		
Potential impacts	The potential impacts of social conflict include: • Potential social conflict with local residents; • Potential spread of social pathologies as a result of the presence of the construction workforce; • Mobilisation against the proposed project by surrounding communities; and • Strikes if the working and living conditions of the construction workforce is not of an acceptable standard.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Local construction workers will remain resident at their current residences as far as it feasible;	Contractor	Pre-construction Construction
	• If required, temporary accommodation and ablution facilities for construction workers will be of an acceptable standard in terms of cleanliness and comfort;	Contractor	Pre-construction Construction
	• Construction workers will be granted one long weekend per month (coinciding with their remuneration date) during which they will be encouraged to travel home if feasible;	Contractor	Construction
	• All construction workers will receive a contract at the outset of their employment stipulating their conditions and duration of employment, remuneration and job description;	Contractor	Pre-construction
	• Waste removal facilities will be maintained, emptied and cleaned once a week. Such facilities will be the only designated area for waste removal will be clearly marked, closed off and animal-proof;	Contractor	Construction
	• Cooking of meals will take place in designated areas only and meals will be provided to staff;	Contractor	Construction

SOCIAL CONFLICT			
	• Fire-fighting equipment will be provided at the temporary accommodation and relevant training will be provided prior to the commencement of construction;	Contractor	Construction
	• A Code of Conduct for the construction workforce will be established prior to the commencement of construction, the workers will be informed and familiarised with this code and will be contractually bound to it;	Contractor	Pre-construction
	• Only construction workers will be allowed at the temporary accommodation and ablution facilities;	Contractor	Construction
	• The construction accommodation and ablution facilities will be under 24 hour security;	Contractor	Construction
	• Personal hygiene practices may only take place in the designated ablution facilities. No construction worker will be allowed to discard of water used for personal hygiene purposes anywhere other than at the ablution facilities provided;	Contractor	Construction
	• Upon completion of the construction phase, all workers residing in temporary accommodation will be required to vacate within one week, after which the accommodation and ablution facilities will be dismantled unless earmarked for use during the operational phase of the project;	Contractor	Post-construction
	• A recreational room will be established in the vicinity of the temporary accommodation facilities. This room will have a television and pool table, as well as a kiosk. No alcohol will be sold at the kiosk.	Contractor	Construction
	• The excessive use of alcohol and/ or illicit drugs will be strictly prohibited in the construction camp. Possession of illicit drugs and excessive alcohol use will be deemed as grounds for dismissal; and	Contractor	Construction
	• Any negative interaction between the migrant workforce and members of the local community will be reported to the contractor and ECO immediately.	Contractor	Construction
Performance indicators	The performance indicators are: • Not incidences of social conflict between the local communities and construction workforce are reported; • No strikes by the construction workforce take place; • None of the construction workers fall ill due to unhygienic conditions at the construction accommodation or ablution facilities;		

SOCIAL CONFLICT	
	• No rodents are found at the waste management site used by the construction workforce; and • No incidents of excessive alcohol or illicit drug use are reported.
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.

Table 6-15: Construction phase implementation plan – Palaeontological environment

PALAEONTOLOGICAL ENVIRONMENT			
Context	According to the palaeontological specialist, the scale of subsurface disturbance and exposure is quite limited, comprising mainly "post holes" to support the PV panel frames. These holes will mainly affect the stony regolith and variously weathered Prince Albert shales.		
CONSTRUCTION PHASE			
Objectives	The environmental objectives are to minimise impacts on the palaeontological environmental and potential finds.		
Risk sources	The following risk sources have been identified: • The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; ; and • The installation of solar PV panels and all associated infrastructure.		
Potential impacts	However, it is conceivable that eroded-out fossils could be found in places on the surface of the property. In view of the moderate fossil potential it is proposed that only a basic degree of mitigation is required. In the process of digging the excavations, isolated bones may be spotted in the hole sides or bottom, or as they appear on the spoil heap. By this is meant bones that occur singly, in different parts of the excavation. Bones clusters may be identified which are several bones in close proximity or bones resembling part of a skeleton. These bones will likely be seen in broken sections of the sides of the hole and as bones appearing in the bottom of the hole and on the spoil heap.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The field supervisor/foreman and workers involved in digging excavations must be encouraged and informed of the need to watch for potential fossil and buried archaeological material;	Contractor	Construction

PALAEONTOLOGICAL ENVIRONMENT			
	• Construction workers seeing potential objects are to report to the field supervisor who, in turn, will report to the ECO. The ECO will inform the archaeologist and/or palaeontologist contracted to be on standby in the case of fossil finds;	ECO	Construction
	• Temporary pause in activity at a limited locale may be required;	Contractor	Construction
	• The following actions should be taken in the event of isolated bone finds: - Action 1: An isolated bone exposed in an excavation or spoil heap must be retrieved before it is covered by further spoil from the excavation and set aside; - Action 2: The site foreman and ECO must be informed; - Action 3: The responsible field person (site foreman or ECO) must take custody of the fossil; - Action 4: The position (excavation position), depth of find in hole, digital image of hole showing vertical section (side) and a digital image of fossil must be recorded; - Action 5: The fossil should be placed in a bag (e.g. a Ziplock bag), along with any detached fragments. A label must be included with the date of the find, position info and depth; - Action 6: ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images as soon as possible by email.	Contractor ECO Palaeontologist	Construction
	• The following actions should be taken by the personnel in the event of a bone cluster find: - Action 1: Immediately stop excavation in the vicinity of the potential material. Mark (flag) the position and also spoil that may contain fossils; - Action 2: Inform the site foreman and the ECO; - Action 3: ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images as soon as possible by email; and - The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. It is likely that a Field Assessment by the palaeontologist will be carried out.	Contractor ECO Palaeontologist	Construction
	• In consultation with developer/owner and the environmental consultant, the following options	Contractor	Construction

PALAEONTOLOGICAL ENVIRONMENT			
	should be considered when deciding on how to proceed in the event of a Major Find: - Option 1: Avoidance of the major find through project redesign or relocation; - Option 2: Emergency excavation.	ECO Palaeontologist	
Performance indicators	The performance indicators are: • Notify palaeontologist and SAHRA in the event of any palaeontological find; • Undertake all actions noted above.		
Monitoring and evaluation	After any find has been reported, a palaeontologist should evaluate the actions taken by the contractor and ECO to determine whether the emergency find procedure is being implemented correctly and to plan improvements, if required.		

Table 6-16: Construction phase implementation plan – Archaeology

HERITAGE	
Context	The MSA artefact scatters recorded during the survey are widespread in the western part of Bushmanland and are of low significance as there are scatters of MSA artefacts across thousands of square kilometres of Bushmanland. The lack of in situ MSA open sites or indications of stratified archaeological deposits means that the archaeological material on site has limited scientific value. During the Phase 1 AIA, photographs were taken and small collections of material that is considered representative of the material as a whole were collected. Further mitigation is unlikely to result in a greater understanding of the material and as a result we do not believe further intervention from an archaeological point of view is necessary. The LSA sites located on low koppies and near the river exhibit a pattern of formal stone artefacts and raw material, as well as pottery and ostrich eggshell, which have not been recorded in combination in Western Bushmanland before.
CONSTRUCTION PHASE	
Objectives	The environmental objectives for the heritage environment are: • To minimise impacts on the archaeological sites of significance; and • To prevent impacts on archaeological sites that has not been identified during the AIA.
Risk sources	The following risk sources have been identified:

HERITAGE			
	• The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; and • The installation of solar PV panels and all associated infrastructure.		
Potential impacts	The potential impacts on heritage resources include: • The destruction of LSA artefact scatters recorded in the project development footprint during site establishment; and • There is a risk that LSA sites located outside the project development footprint might be damaged due to construction workers wondering into the no-go areas.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• A Phase 2 AIA should be undertaken for all significant LSA sites that have been identified in the project development footprint;	Archaeologist	Pre-construction
	• In the event that new archaeological sites or graves present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation;	ECO	Construction
	• No-go areas where other sites of archaeological significance are located should be clearly demarcated and no construction worker will be allowed to enter these area; and	ECO	Pre-construction
	• No archaeological sites of significance outside the project development footprint may be removed, disturbed or damaged.	Contractor	Construction
Performance indicators	The performance indicators are: • Complete Phase 2 mitigation of all archaeological sites; • Clearly demarcate no-go areas; and • Notify SAHRA and an archaeologist in the event that new sites or unmarked graves are identified during construction.		
Monitoring and evaluation	The Phase 2 AIA report must be submitted to SAHRA upon completion of the mitigation.		

6.3 Operational phase

The objectives for the operational phase of the proposed project are to:

- Establish a grievance mechanism whereby the public are able to voice issues and concerns regarding the operation of the proposed project;
- Prevent impacts on the ephemeral river system and associated drainage lines in the study area and further degradation or loss of the soil resource; and
- Control and prevent the propagation of alien invasive species.

The implementation plans for the operational phase of the proposed Loeriesfontein Solar PV Power Plant are presented in the tables below.

Table 6-17: Operational phase implementation plan – Surface water systems

SURFACE WATER SYSTEMS			
Context	The project area is situated in the Olifants/Doring Water Management Area (WMA 17). The major rivers associated with this WMA are the Olifants, Doring, Krom, Sand and Sout Rivers. The project site is situated in the quaternary catchments E31B and E31C. A few ephemeral river systems and associated drainage lines were identified for the project area. These systems are associated with the Volstruisnesholte River catchment which is recognised by the FEPA as an upper management area in support of the downstream FEPAs (sub-catchment 5338). The catchment area is considered to be largely natural and as a result, any impacts to the systems may be severe.		
OPERATIONAL PHASE			
Objectives	The environmental objectives for surface water systems are: • To reduce the site's susceptibility to erosion during floods or rainfall events; and • To prevent indirect impacts on surface water quality of the ephemeral river system due to sedimentation or contamination by hydrocarbons or waste products.		
Risk sources	The following risk sources have been identified: • Internal access roads and river crossings; • Surfaces of solar PV panels and roofs of infrastructure; and • Maintenance of solar PV panels.		
Potential impacts	The potential impacts on surface water systems include: • During rainfall events, compacted surfaces and areas below the solar PV panels will be susceptible to erosion due to the altered surface flow dynamics. The natural erosion process and sediment transport on-site and off-site will be aggravated; • During surface flow events, increased sediment transported due to aggravated, as well as other contaminants (i.e. hydrocarbon spills, waste products and effluents), may result in contamination of downstream water resources.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The storm water management infrastructure should be maintained during the operational phase;	Operator	Operation

SURFACE WATER SYSTEMS			
	• All waste products must be managed according to a waste management plan; and	Operator	Operation
	• Spillage should be managed through an emergency spill response plan.	Operator	Operation
Performance indicators	The performance indicators are: • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The operator of the solar PV power plant must undertake quarterly site inspections; • An independent auditor will be responsible for auditing implementation of the EMP on an annual basis; and • During surface water flows, water quality in the drainage line should be monitored to identify potential sources of contamination.		

Table 6-18: Operational phase implementation plan – Soils and agricultural potential

SOILS AND AGRICULTURAL POTENTIAL	
Context	The vast presence of the shale rock type gave rise to fragment infested shallow soils (<30 cm) for the majority of the site, with the exception of the watercourses/drainage lines where alluvial deposits were dominating. Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed, is considered to be moderate. This will be partly due to the little cohesion between particles on the one hand, while the mass of the coarser fragments will reduce the susceptibility, depending on the force subjected to.
OPERATIONAL PHASE	
Objectives	The environmental objectives for soils and agricultural potential are: • To reduce the site's susceptibility to erosion; and • To minimise compaction of soils.
Risk sources	The following risk sources have been identified:

SOILS AND AGRICULTURAL POTENTIAL			
	• Internal access roads and river crossings; and • Surfaces of solar PV panels and roofs of infrastructure.		
Potential impacts	The potential impacts on surface water systems include: • During rainfall events, compacted surfaces and areas below the solar PV panels will be susceptible to erosion due to the altered surface flow dynamics. The natural erosion process and sediment transport on-site and off-site will be aggravated.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The storm water management infrastructure should be maintained during the operational phase.	Operator	Operation
Performance indicators	The performance indicators are: • No visible signs of erosion (i.e. bare patches, rills and gullies); • No visible evidence of damage to storm water management infrastructure; and • No visible evidence of sediment transport during surface flow events.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The operator of the solar PV power plant must undertake quarterly site inspections; • An independent auditor will be responsible for auditing implementation of the EMP on an annual basis; and • During and after surface water flows, the site must be expected to identify potential erosional problems.		

Table 6-19: Operational phase implementation plan – Alien invasive control

ALIEN INVASIVE CONTROL	
Context	Preservation of natural habitat is of prime importance within this study area, mainly because of the SKEP data that indicates the site as important because it has an irreplaceability value of 0.28. The irreplaceability value of a planning unit indicates how important that planning unit is for achieving conservation targets for the biodiversity features it contains. An irreplaceability value of 0.28 translates to flexibility in terms of which sites can be chosen to achieve the conservation target. For these reasons the management of alien invasive species, that will be detrimental to these aspects, is essential.
OPERATIONAL PHASE	

ALIEN INVASIVE CONTROL			
Objectives	The environmental objectives for ecological components are: • To prevent the spread of alien invasive plant species present on the study area; • To remove the plant species *Prosopis glandulosa, Tamarisk ramosissima and Argemone ochroleuca*; • To avoid the introduction of additional alien invasive plant species; and • To preserve as many natural plant species that can be used during site remediation.		
Risk sources	The following risk sources have been identified: • Open areas along roadsides, solar PV panels and substation will create favourable habitat for alien invasive plant species.		
Potential impacts	The potential impacts on ecological components include: • Potentially viable habitat for naturally occurring plant species could become undesirable with the spread of *Prosopis glandulosa, Tamarisk ramosissima and Argemone ochroleuca*; • There is also a possibility that Red Data or protected plant species habitat could be destroyed as all three problem plants encountered here could potentially colonise these areas; • Loss of habitat for grazing animals due to alien invasive colonisation.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and ecologically sensitive areas should be demarcated and avoided at all costs;	Operator	Operation
	• *Removal of Prosopis glandulosa:* Cut stump foliar and soil applied herbicide can be successful, follow ups are always needed;	Operator	Operation
	• *Removal of Tamarisk ramosissima:* Must be physically cut down removed and stumps treated with herbicide;	Operator	Operation
	• *Removal of Argemone ochroleuca:* Controlled by shallow cultivation, when small poet emergence herbicides are successful; and	Operator	Operation
	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.	Operator	Operation

ALIEN INVASIVE CONTROL	
Performance indicators	The performance indicators are: • No visible evidence of alien invasive species.
Monitoring and evaluation	The following monitoring and evaluation actions are required: • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • Quarterly inspections should be undertaken by the contractor to identify area where alien invasive species could establish.

Table 6-20: Operational phase implementation plan – Employment creation

EMPLOYMENT CREATION	
Context	The operational phase of the proposed project will require 70 permanent employees for an estimated period of 20 years. Some of these long-term job opportunities will be for un- and semiskilled workers, which can be filled by local residents. Given the low educational and skills levels in the local municipal area, as well as the high unemployment rate of particularly the youth, the small number of permanent long-term job opportunities constitutes a significant (albeit small scale) socio-economic benefit for the directly-affected communities. Additionally, the use of local entrepreneurs, SMMEs and businesses further enhance the socio-economic benefit associated with the proposed project. Possible opportunities for local service providers include security and cleaning services, maintenance of the construction camp and equipment, as well as the provision of chemical toilets for use on site. Both local employees and entrepreneurs, SMMEs and businesses will likely gain significantly from appropriate skills training and capacity building. The project also stands to benefit from such training and capacity building as it will enable the employees and local service providers to better perform their duties.
OPERATIONAL PHASE	
Objectives	The environmental objectives for employment creation are to: • Employ as many labourers from the immediate and larger study area as possible; • Utilise local entrepreneurs, businesses and SMMEs as much as is feasible; and • Provide the required training and capacity building to better enable the employees and service providers to perform their duties.
Risk sources	The following risk sources have been identified: • Locals not employed despite availability of skills; and

EMPLOYMENT CREATION			
	• Local service providers not subcontracted despite availability of service.		
Potential impacts	Socio-economic benefits associated with creating local employment and business opportunities, as well as training and capacity building.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• A skills development and capacity building plan will be developed in conjunction with the relevant employees and local service providers to ensure that the training opportunities are relevant and required by the target beneficiaries;	Orlight SA Operator	Operation
	• Ensure that a minimum of 20% of the unskilled employment opportunities are awarded to women and previously disadvantaged individuals residing in the local and surrounding areas;	Operator	Post-construction
	• Ensure that a minimum of 80% of the unskilled workers are sourced from Loeriesfontein (and surrounding towns if insufficient labourers are available in Loeriesfontein); and	Operator	Post-construction
	• The proponent/ contractor will retain the list of local job-seeking individuals and service providers as compiled during the construction phase and will allow for period updates of the list.	Contractor Operator	Post-construction
Performance indicators	The performance indicators are: • The majority of unskilled job opportunities are awarded to local individuals (at least 80% of individuals are from Loeriesfontein or surrounding towns); • A fifth of unskilled job opportunities are filled by women and previously disadvantaged individuals; • The proponent/ contractor has a list of candidates (including contact details, age, sex, skills level, educational levels and resident town) that may be able to fulfil unskilled job openings; • The proponent/ contractor has a list of entrepreneurs, SMMEs and companies operating in the local area (including company name, services provided, number of employees and location) that could be used to provided services required during the operational phase of the project. Some services are provided by local entrepreneurs, SMMEs and businesses; and • The proponent/ contractor are able to provide records of training provided for local employees and entrepreneurs, SMMEs and businesses, including the nature of training, number of individuals/ entrepreneurs/ SMMEs/ businesses who received training, and the training provider.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a quarterly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

Table 6-21: Operational phase implementation plan – Local economic development

LOCAL ECONOMIC DEVELOPMENT			
Context	In addition to the skills training and capacity building for the employees and service providers utilised by the proponent, the proponent has a social responsibility towards the communities in which it operates. Fulfilling this social responsibility will take place in conjunction with the Hantam Local Municipality and will be aligned with the municipality's LED Strategy.		
OPERATIONAL PHASE			
Objectives	The environmental objectives for LED are to: • Create and strengthen skills among the residents in Loeriesfontein and surrounding towns; and • Assist the municipality to fulfil their LED objectives.		
Risk sources	The following risk sources have been identified: • No social responsibility from Orlight SA; • No contribution towards the local municipality's LED initiatives; and • Insufficient training and capacity building among residents in Loeriesfontein and surrounding towns.		
Potential impacts	The potential impacts on LED include: • Capacity building and skills training continuously undertaken during the operational phase of the project; and • Positively contributing to the local municipality's LED initiatives.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Capacity building and skills training opportunities will be identified in conjunction with the local municipality and will be aligned with the municipality's LED initiatives;	Orlight SA	Operation
	• Once a year, local residents and entrepreneurs, SMMEs and businesses will be given an opportunity to express interest in receiving training by registering with the proponent;	Orlight SA	Operation
	• Records will be kept of the training or capacity building provided, including the service provider, description of the training/ capacity building, date of training, names, ages and sex of beneficiaries or the name of SMME or local business; and	Orlight SA	Operation

LOCAL ECONOMIC DEVELOPMENT			
	• The usefulness of the training and capacity building will be determined by means of a survey to be completed by as many of the beneficiaries as possible to establish how it has contributed to their income-generating ability. This survey will be administered twice; once six months after the completion of training, and once one year after the completion of training. The results of the surveys will inform decisions regarding future training.	Orlight SA	Operation
Performance indicators	The performance indicators are: • LED initiatives identified by the municipality are supported; • The proponent is able to provide records of training provided; and • Local residents are aware of training and capacity building embarked on by the proponent.		
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a quarterly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.		

6.4 Decommissioning phase

The overall objective of the decommissioning phase is to leave the project area in a condition that minimises adverse impacts on the socio-economic and biophysical environment, with a legacy that contributes to sustainable development.

6.4.1 Objectives

The objectives of the decommissioning phase of the proposed project are to:

- Follow a process of decommissioning that is progressive and integrated into the short- and long-term project plans that will assess the closure impacts proactively at regular intervals throughout project life;
- Implement progressive rehabilitation measures, beginning during the construction phase;
- After the lease has expired and the project is in decommissioning phase, leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Return rehabilitated land-use to a standard that can be useful to the post-project land user, such as grazing;
- Where applicable, prevent any further soil and surface water contamination by maintaining suitable storm water management systems;
- Comply with local regulatory requirements and international best practise;
- Maintain active partnerships with local communities; and
- Maintain and monitor all rehabilitated areas following re-vegetation, and if monitoring shows that the objectives have been met, apply for closure.

The implementation plan for the decommissioning phase of the proposed Loeriesfontein Solar PV Power Plant is presented in the tables below.

6.4.2 Approach to the decommissioning phase

It is recommended that planning of the decommissioning of the project and rehabilitation of the site take place at least two years prior to its decommissioning. Important factors that need to be taken into consideration are described below.

Identification of structures for post-closure use

All structures on site should be assessed in conjunction with the ultimate land users and authorities to determine which items could be used in future. Care should be taken when this assessment is undertaken to ensure that the infrastructure left behind will not become abandoned due to unsuccessful enterprises.

All infrastructure planned for removal and demolition will need to be assessed for their viable re-use or recycling opportunity. Structures destined for demolition or recycling need to be separated.

Removal of infrastructure

All infrastructure not destined for future use on the relevant property will be removed and/or demolished. Concrete and brick structures are to be demolished along with their associated concrete foundations. Inert demolished rubble must be removed from site and disposed of at a registered landfill site. All foundations must be removed to a depth of 1 m. Hard surfaced must be ripped to a depth of 1 m and vegetated.

Landform re-creation

Successful replacement of topsoil starts with planning the final landform prior to construction. This will ensure that final rehabilitation costs are minimised as well as ensuring that the final landform accounts for free-draining areas and minimal slopes thereby minimising risks of erosion.

Soil amelioration

The steps that should be taken during the amelioration of soils are as follows:

- The deposited soils must be ripped to ensure reduced compaction;
- An acceptable seed bed should be produced by surface tillage;
- Restore soil fertility;
- Incorporate the immobile fertilisers in to the plant rooting zone before ripping; and
- Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

Establishment of vegetation

The objective is to restore the project site to a self-sustaining cycle i.e. to realise the re-establishment of the natural nutrient cycle with ecological succession initiated.

The objectives for the re-vegetation of reshaped and top-soiled land are to:

- Prevent erosion;
- Restore the land to the agreed land capability;
- Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
- Restore the biodiversity of the area as far as possible.

Maintenance

Established vegetation requires regular maintenance. If the growth medium consists of low-fertility soils, then regular application of plant food will be required until the natural fertility cycle has been restored. Annual fertiliser application should continue for three to five years.

Monitoring

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the progress of establishment of desired final ecosystems.

The following items should be monitored continuously:

- Depth of topsoil stripped and placed;
- Chemical, physical and biological status of replaced soil;
- Erosion status;
- Surface drainage systems and surface water quality;
- Vegetation basal cover;
- Vegetation species diversity; and
- Faunal re-colonisation.

Table 6-22: Decommissioning phase implementation plan – Surface water systems

SURFACE WATER SYSTEMS			
Context	The project area is situated in the Olifants/Doring Water Management Area (WMA 17). The major rivers associated with this WMA are the Olifants, Doring, Krom, Sand and Sout Rivers. The project site is situated in the quaternary catchments E31B and E31C. A few ephemeral river systems and associated drainage lines were identified for the project area. These systems are associated with the Volstruisnesholte River catchment which is recognised by the FEPA as an upper management area in support of the downstream FEPAs (sub-catchment 5338). The catchment area is considered to be largely natural and as a result, any impacts to the systems may be severe.		
DECOMMISSIONING PHASE			
Objectives	The environmental objectives for surface water systems are: • To prevent direct impacts on the ephemeral river system and associated drainage lines in the study area; • To prevent indirect impacts on surface water quality of the ephemeral river system due to sedimentation or contamination by hydrocarbons or waste products; • To reduce the site's susceptibility to erosion during rainfall events; and • To restore a sustainable surface that will not be susceptible to erosion after project decommissioning.		
Risk sources	The following risk sources have been identified: • Removal of infrastructure and ripping of compacted surfaces; • Generation of demolitions wastes; and • Machinery and vehicles used for decommissioning activities.		
Potential impacts	The potential impacts on surface water systems include: • The removal of infrastructure will create bare surface which will be susceptible to erosion and could lead to increased sediment transport during surface flow events; and • During surface flow events contaminants (i.e. waste products, effluents, hydrocarbons) stored on the construction site, may result in contamination of downstream water resources.		
Management and	**Actions**	**Responsibility**	**Timeframe**

SURFACE WATER SYSTEMS			
mitigation actions	• The majority of decommissioning activities must be undertaken during the dry season;	Orlight SA	Pre-decommissioning
	• A storm water management plan should be implemented during the decommissioning phase and until such a point as rehabilitation has been successfully completed;	Contractor	Decommissioning and post-closure
	• Delineated drainage lines and buffer zones should be clearly delineated;	ECO	Pre-decommissioning
	• No activities may be allowed with the delineated drainage lines and buffer zones;	Contractor	Decommissioning
	• Site rehabilitation should be undertaken on a concurrent basis according to the rehabilitation plan to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Decommissioning
	• All waste products and demolition waste must be managed according to a waste management plan;	Contractor	Decommissioning
	• Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Decommissioning
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels;	Contractor	Decommissioning
	• Spillage should be managed through an emergency spill response plan.	Contractor	Decommissioning
Performance indicators	The performance indicators are: • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • No visible evidence of hydrocarbon spills on site; • Vegetation has been successfully re-established; and • Waste management system is in place.		
Monitoring and	The following monitoring and evaluation actions are required:		

SURFACE WATER SYSTEMS	
evaluation	• The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, water quality in the drainage line should be monitored to identify potential sources of contamination.

Table 6-23: Decommissioning phase implementation plan – Soils and agricultural potential

SOILS AND AGRICULTURAL POTENTIAL	
Context	The vast presence of the shale rock type gave rise to fragment infested shallow soils (<30 cm) for the majority of the site, with the exception of the watercourses/drainage lines where alluvial deposits were dominating. Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed, is considered to be moderate. This will be partly due to the little cohesion between particles on the one hand, while the mass of the coarser fragments will reduce the susceptibility, depending on the force subjected to.
DECOMMISSIONING PHASE	
Objectives	The environmental objectives for soils and agricultural potential are: • To minimise loss of the soil resources to support existing land use and land capability; • To minimise soil erosion by wind and water; • To reduce the site's susceptibility to erosion; • To minimise compaction of soils during site preparation activities, including soil handling, stockpiling and vehicle use; and • To prevent soil contamination due to spillage of hydrocarbons or wastes.
Risk sources	The following risk sources have been identified: • Removal of infrastructure and ripping of compacted surfaces; • Generation of demolitions wastes; and • Machinery and vehicles used for decommissioning activities.
Potential impacts	The potential impacts on soils and agricultural potential include: • The removal of infrastructure will create bare surface which will be susceptible to erosion and could lead to increased sediment transport during surface flow events ;

SOILS AND AGRICULTURAL POTENTIAL			
	• The very fine material in-between the fragments will be subjected to wind erosion where exposed; and • The potential for contaminating the soil due to spillage of hydrocarbons from vehicles and machinery, or improper waste management.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The majority of decommissioning activities should be undertaken during the dry season;	Orlight SA	Project planning
	• Minimise activities on windy days. Temporary cessation of activities could be required during very windy periods;	Contractor	Construction
	• Minimise the period of exposure of soil surfaces through planning and immediate rehabilitation;	Contractor ECO	Project planning Construction
	• Where feasible, activities that are usually undertaken by machinery (i.e. applying fertiliser and seeding), should be replaced with manual labour;	Contractor	Construction
	• A storm water management plan should be maintained during the decommissioning phase;	Contractor	Construction
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion;	Contractor ECO	Construction
	• Where topsoil is compacted, the soil surface can be loosened via tillage/ripping;	Contractor	Construction
	• Heavy vehicle movement over rehabilitated areas should be prevented;	Contractor	Construction
	• Traffic over project areas that have not been stripped of topsoil should be minimised;	Contractor	Construction
	• All waste products must be managed according to a waste management plan;	Contractor	Construction
	• Vehicles should be serviced and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase;	Contractor	Construction
	• The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated	Contractor	Construction

SOILS AND AGRICULTURAL POTENTIAL			
	from clean water areas with berms or channels;		
	• Spillage should be managed through an emergency spill response plan.	Contractor	Construction
Performance indicators	The performance indicators are: • No visible signs of erosion (i.e. bare patches, rills and gullies); • No visible evidence of damage to storm water management infrastructure; • No visible evidence of sediment transport during surface flow events; • Vehicles are restricted to designated areas; • Topsoil in disturbed areas have been replaced and vegetation successfully restored; • Hydrocarbon storage areas and vehicle hard parks are bunded; • No visible evidence of hydrocarbon spills on site; and • Waste management system is in place.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; and • During surface water flows, monitoring is required to identify potential erosional problems.		

Table 6-24: Decommissioning phase implementation plan – Ecological components

ECOLOGICAL COMPONENTS	
Context	In relation to CBA, the study area falls outside any CBA (BGIS, 2010). In terms of the SKEP, the study area is not a geographic priority area, but has an irreplaceability value of 0.28. The irreplaceability value of a planning unit indicates how important that planning unit is for achieving conservation targets for the biodiversity features it contains. An irreplaceability value of 0.28 translates to flexibility in terms of which sites can be chosen to achieve the conservation target. The vegetation community present in the drainage lines was designated as a no-go area, due to the ecological importance of the benefiting ephemeral river system. The protected plant species, *Hoodia gordonii*, was also observed in this area. For this purpose, the northern part of the study area was classified as sensitive and should be avoided.

ECOLOGICAL COMPONENTS			
DECOMMISSIONING PHASE			
Objectives	The environmental objectives for ecological components are: • To prevent direct impacts on the ephemeral river system and associated drainage lines; • To prevent direct impacts on other areas that were delineated as highly sensitive and unsuitable for development; • To minimise the footprint of disturbance during decommissioning; • To return as many as possible naturally occurring plant species to the site during rehabilitation; • To eradicate alien invasive and weed species from the project area; and • To achieve a sustainable land surface that can support ecological diversity and natural ecological succession during rehabilitation.		
Risk sources	The following risk sources have been identified: • Movement of vehicles outside the designated site into natural areas; • Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard; and • Soil erosion due to surface water flows from disturbed areas; • Alien invasive species.		
Potential impacts	The potential impacts on ecological components include: • Upon exposure of bare surface after demolition of infrastructure, it is likely that alien invasive and weed species will propagate on disturbed areas; and • Alien invasive species could out-compete indigenous vegetation, due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• The no-go and high ecologically sensitive areas should be demarcated and avoided at all costs;	Contractor	Decommissioning
	• No vegetation removal should be allowed outside the designated demolition footprint;	ECO Contractor	Decommissioning
	• Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan to ensure that vegetation is restored to disturbed areas;	Contractor ECO	Decommissioning

ECOLOGICAL COMPONENTS			
	• An alien invasive and weed control programme should be implemented.	Contractor ECO	Decommissioning
Performance indicators	The performance indicators are: • Demarcation of drainage lines and buffer zones with visible danger tape or temporary fences; • No destruction of vegetation outside designated areas; • Evidence of vegetation being re-established in disturbed areas; • No visible evidence of alien invasive species.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the activities undertaken by the contractor; • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis; • Daily inspections should be undertaken by the contractor to identify area where alien invasive species could establish; and • A flora survey of the project development footprint should be undertaken upon completion of rehabilitation to determine the success of rehabilitation efforts.		

Table 6-25: Decommissioning phase implementation plan – Waste

WASTE	
Context	The demolition of the power plants will generate solid, liquid and non-hazardous waste. The municipal waste management site may not have the capacity to accommodate waste generated by the project and therefore, a waste management contractor would have to be employed to remove waste to a registered landfill site. A large amount of recyclable materials will be produced upon decommissioning of the solar PV panels and infrastructure. The fixed structure is 100% made of galvanized steel and therefore it could be said that the 100% of the structure is recyclable. PV modules can be reused in either new PV modules or other new products. Industrial recycling processes exist for both thin-film and silicon modules. By recycling end-of-life modules, the PV industry enables the sustainable use of PV technology, furthering PVs ability to help meet the energy needs while protecting the environment.
DECOMMISSIONING PHASE	

WASTE			
Objectives	The environmental objectives for waste management are to: • Minimise waste generation; • Avoid spillages and contamination; • Reuse, reduce and recycle, where possible; • Recover material such as glass, aluminium, as well as a variety of semiconductor materials. Recycling benefits the environment by reducing the volume of waste and helps to reduce the amount of energy required to provide raw materials and therefore the costs and environmental impacts of producing PV modules.		
Risk sources	The following risk sources have been identified: • Spillage during handling of waste or damage containers; • Waste vectors (i.e. rodents and cockroaches); • Littering by construction workers.		
Potential impacts	The potential impacts from waste generation include: • Surface water contamination; • Soil contamination; • Ecological degradation; • Negative visual impacts; and • Nuisance, such as bad odours.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Ensure construction waste is effectively contained, stored and managed on site;	Contractor	Decommissioning
	• Ensure waste bins (e.g. for organic waste) is sufficient vermin proof and weatherproof;	Contractor	Decommissioning
	• Ensure all rubble and waste rock are disposed of at a registered disposal sites;	Contractor	Decommissioning
	• Implement the “reduce, reuse and recycle” approach for all waste. This means that different bins need to be put in place to separate i.e. plastic, paper, glass and cans, where feasible;	Contractor	Decommissioning
	• Ensure all solid and hazardous waste is disposed of at a registered disposal sites; and	Contractor	Decommissioning

WASTE			
	• The ablution contractor needs to ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site.	Contractor	Decommissioning
Performance indicators	The performance indicators are: • Evidence that waste is effectively contained, stored and managed on site; • No littering is visible on site; • Waste bins (e.g. for organic waste) has lids and is sufficient vermin proof and weatherproof; • Evidence that all solid waste, including rubble and waste rock, are removed and disposed of at a registered sites; • The "reduce, reuse and recycle" approach for all waste are being implemented by means of establishing separate bins for i.e. plastic, paper, glass and cans; and • There is no evidence of uncontrolled spillages or waste on site.		
Monitoring and evaluation	The following monitoring and evaluation actions are required: • The ECO must evaluate, approve, supervise and monitor the construction activities undertaken by the contractor; and • An independent ECO will be responsible for auditing implementation of the EMP on a quarterly basis.		

Table 6-26: Decommissioning phase implementation plan – Socio-economic environment

SOCIO-ECONOMIC ENVIRONMENT	
Context	It is likely that the proposed project will be decommissioned after an operational lifespan of 20 years, implying that 70 jobs will be lost at this time. Although this is an inevitable element of such projects, certain measures can be taken to minimise the adverse socio-economic impact this will have on surrounding towns, its residents, service providers and project employees. Another source of potential adverse socio-economic impacts is the project infrastructure used for operational purposes. Depending on the manner this infrastructure will be dealt with upon decommissioning, it may hold positive impacts for the local community and municipality. Additionally, as is the case with the construction phase, decommissioning will bring some temporary employment opportunities.
DECOMMISSIONING PHASE	
Objectives	The environmental objectives for socio-economic environment are: • Minimise the negative socio-economic impacts associated with decommissioning activities; and

SOCIO-ECONOMIC ENVIRONMENT			
	• Enhance positive socio-economic impacts associated with temporary job opportunities.		
Risk sources	The following risk sources have been identified: • Decommissioning of project; and • Inappropriate decommissioning of project infrastructure.		
Potential impacts	The potential impacts on the socio-economic environment include: • Job losses and associated adverse socio-economic impacts; • Invasion of operational infrastructure (offices) and associated negative socio-economic, health and safety impacts; and • Creation of temporary employment opportunities.		
Management and mitigation actions	**Actions**	**Responsibility**	**Timeframe**
	• Retrenchment of project employees will be in line with the requirements of the South African Labour Legislation;	Orlight SA	Decommissioning
	• If the local municipality has a use for, and is able to maintain the project infrastructure (office, technical service buildings and laydown yard), this infrastructure will be donated to the municipality. If not, it will be dismantled within two weeks after operation has ceased;	Orlight SA	Decommissioning
	• A retraining programme should be initiated for employees that will be retrenched at least one year before cessation of the project;	Orlight SA	Decommissioning
	• At least 80% of the unskilled labour required for decommissioning activities will be sourced from Loeriesfontein and the surrounding towns; and	Orlight SA	Decommissioning
	• At least 20% of the unskilled labour positions required for decommissioning activities will be filled by women and previously disadvantaged individuals.	Orlight SA	Decommissioning
Performance indicators	The performance indicators are: • All retrenchments were aligned with the requirements of South African labour legislation; • The majority of unskilled job opportunities are awarded to local individuals (at least 80% from Loeriesfontein or surrounding towns); • A fifth of unskilled job opportunities are filled by women and previously disadvantaged individuals; and		

SOCIO-ECONOMIC ENVIRONMENT	
	• Project infrastructure is not informally used for housing purposes.
Monitoring and evaluation	Monitoring on the performance according to all of the above performance indicators is required on a monthly basis by Orlight SA. Quarterly audits should be undertaken by an independent social and labour specialist.

7 CONCLUSION

This draft EMP was based on the outcomes of the EIA process that was undertaken for the proposed development of the Loeriesfontein Solar PV Power Plant.

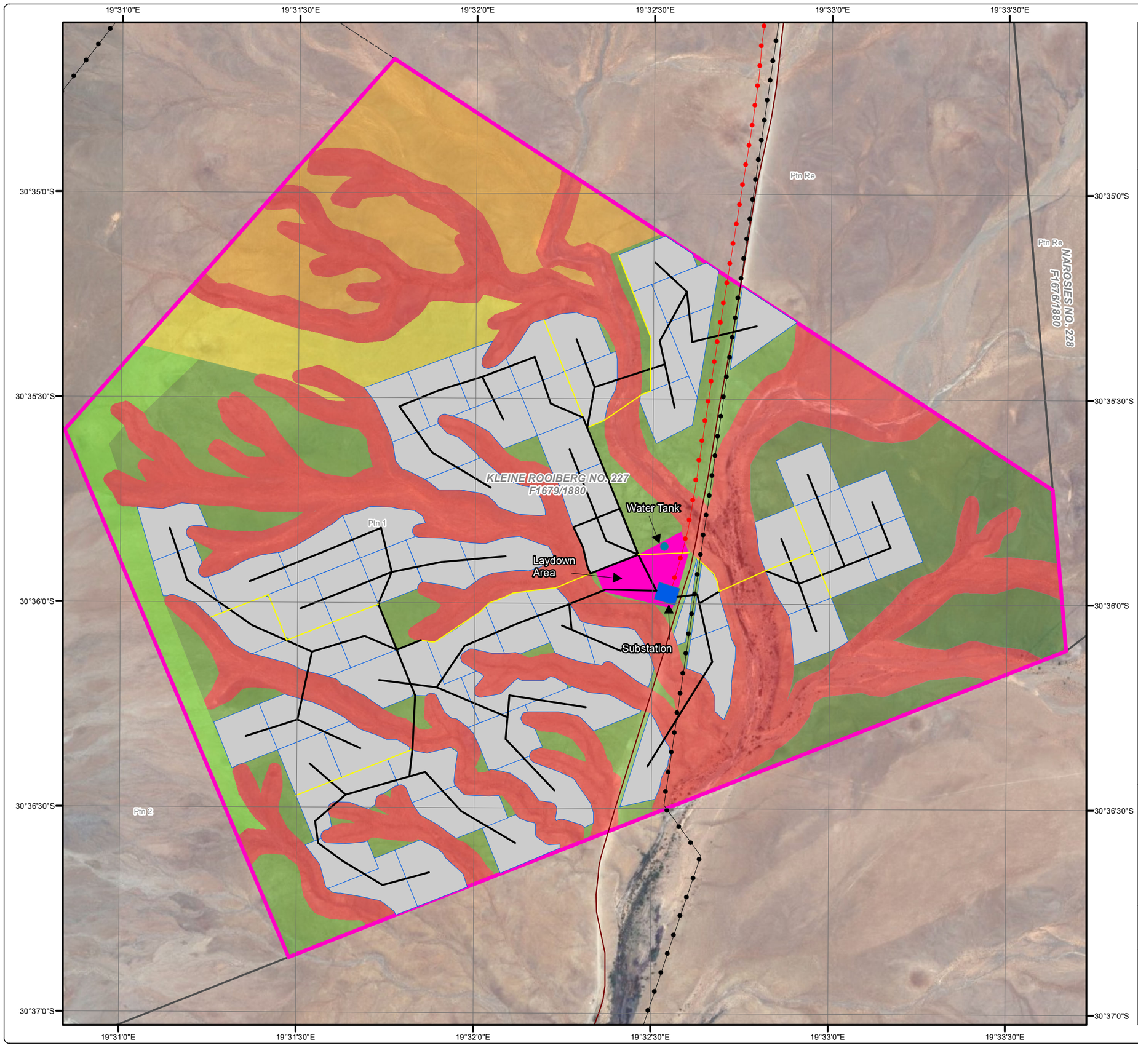
Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The management and mitigation measures that were recommended to mitigate impacts to the environmental, socio-economic and heritage environment to an acceptable level were systematically addressed in this EMP.

The EMP should be considered a dynamic document and will require updating and the inclusion of additional environmental specifications as and when required.

Plan 1c

Orlight SA (Pty) Ltd Solar PV Project

Site Layout: Loeriesfontein



Legend

- Study Area
- Substation
- 4 x New 22kV Lines with 88m Servitude
- Existing Transmission Lines
- Gravel Roads
- Internal Transmission lines
- Main Internal Rds
- Laydown Area
- Solar Panels
- Sub Station
- Water Tank
- Farm Boundaries
- Farm Portions

Sensitivity

- Least Sensitive Areas - First Option
- Favourable Areas
- Minimal Sensitivity
- Highly Sensitive Area
- Sensitive Area
- No-go

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E

Revision Number: 1
Date: 25/06/2012
Ref #:amc.BSGR1384.201206.153

N

0 0.25 0.5 1

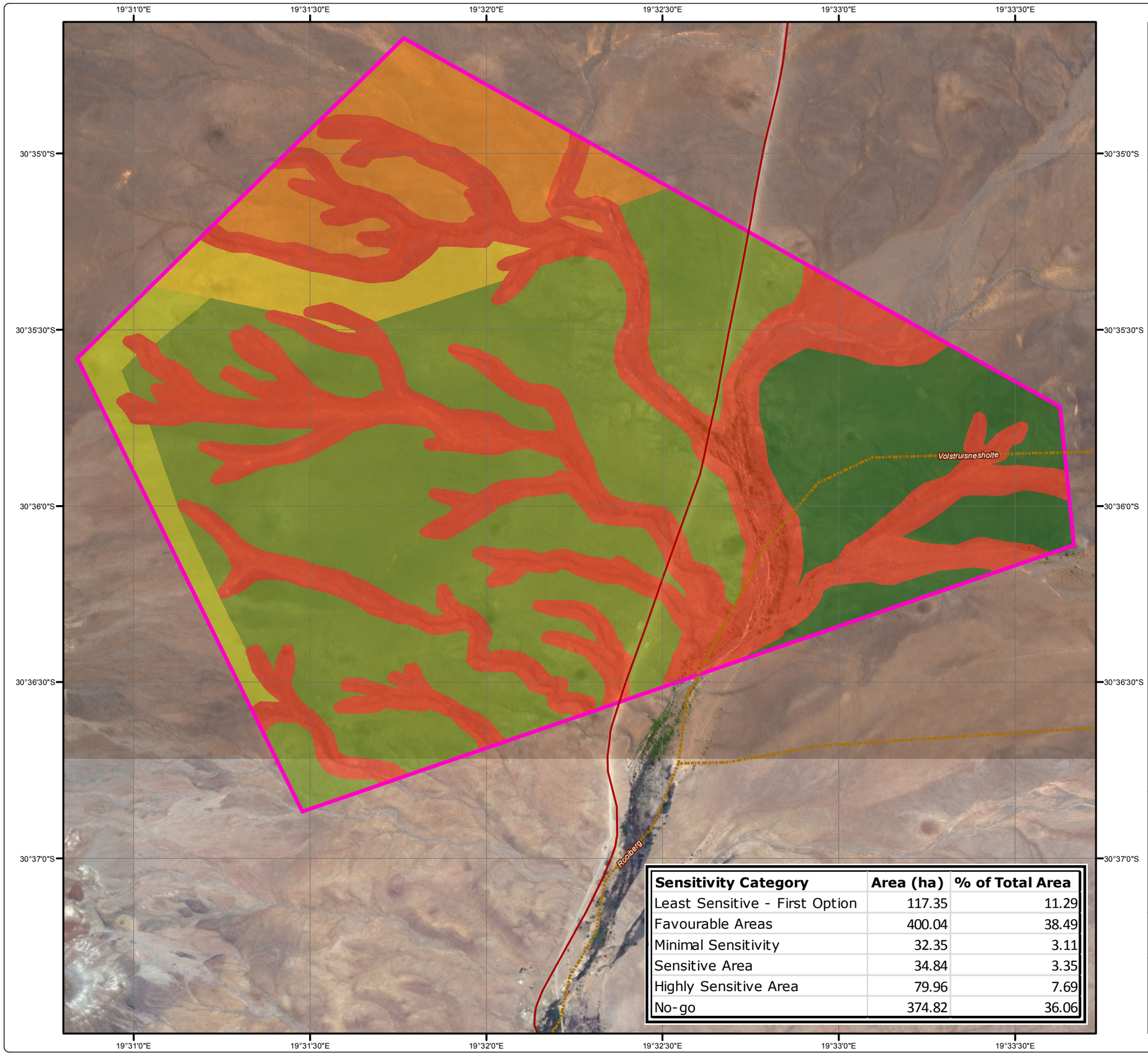
Kilometers

1:17 000

Plan 2c

Orlight SA (Pty) Ltd Solar PV Project

Integrated Sensitivity Map



Legend

- Study Area
- Minor Roads
- Dry river

Sensitivity Ratings

- Least Sensitive Areas - First Option
- Favourable Areas
- Minimal Sensitivity
- Sensitive Area
- Highly Sensitive Area
- No-go

Sensitivity Category	Area (ha)	% of Total Area
Least Sensitive - First Option	117.35	11.29
Favourable Areas	400.04	38.49
Minimal Sensitivity	32.35	3.11
Sensitive Area	34.84	3.35
Highly Sensitive Area	79.96	7.69
No-go	374.82	36.06

ORLIGHTSA RENEWABLE ENERGY

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Projection: Transverse Mercator
Datum: Hartebeesthoek WGS 1984
Central Meridian: 19°E

Ref #: amc.BSGR1384.201202.067
Revision Number: 2
Date: 13/02/2012

N

0 0.25 0.5 1

Kilometers
1:20 000

Plan 3c

Orlight SA (Pty) Ltd Solar PV Project

Storm Water Management: Loeriesfontein

Storm Water run-off will follow natural drainage. Where roads cross these drainage lines, culverts should be constructed to allow for drainage to flow towards the Rooiberg dry riverbed.

19°31'0"E | 19°31'30"E | 19°32'0"E | 19°32'30"E | 19°33'0"E | 19°33'30"E

30°34'30"S | 30°35'0"S | 30°35'30"S | 30°36'0"S | 30°36'30"S | 30°37'0"S

Ptn 3
Ptn 2
Ptn 1
Ptn Re
Ptn Re
NAROSIES NO. 228 F1676/1880
KLEINE ROOIBERG NO. 227 F1679/1880
Volstruisnesholte
Rooiberg

Legend

- Culvert
- Internal Transmission Lines
- Main Internal Roads
- New Transmission Lines
- Main Roads
- Study Area
- Solar Panels
- Drainage Lines
- Substation
- Laydown
- Dry river
- Farm Boundaries
- Farm Portions

Topography (m.a.m.s.l)

High : 1003

Low : 797

DIGBY WELLS ENVIRONMENTAL

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Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 19°E

Revision Number: 1
Date: 04/06/2012
Ref #:amc.BSGR1384.201206.012

N

0 0.25 0.5 1

Kilometers

1:20 000